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Challenges of Implementing Emerging Technologies in Academic Libraries in Ogun State

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Abstract

Academic libraries in Nigeria are increasingly driven by the rapid shift towards digitally mediated teaching, learning, and research, alongside growing expectations from students, academics, and institutional management to adopt emerging technologies; however, many libraries continue to face infrastructural, organisational, and human constraints that limit meaningful integration. This study examined the extent to which emerging technologies have been adopted in academic libraries in Ogun State, Nigeria, the factors constraining their effective use, and the challenges and strategies of implementing these technologies in academic libraries in Ogun State. The study combined quantitative data from 147 structured questionnaires with qualitative insights from 12 semi-structured interviews. Quantitative data were analysed using descriptive and inferential statistics, while qualitative responses were examined thematically following Braun and Clarke's (2022) framework. The findings revealed moderate adoption of emerging technologies, particularly in basic digital services such as online cataloguing and institutional repositories. However, progress remains constrained by inadequate funding, poor Internet connectivity, unstable power supply, limited staff competence, and weak institutional policy support. Despite these challenges, librarians demonstrated notable adaptability and commitment to digital innovation. The study concludes that meaningful technological transformation in Nigerian academic libraries depends on coherent institutional policies, adequate funding, and sustained capacity development. It recommends targeted investment in digital infrastructure, structured professional development, policy integration, and collaborative partnerships to achieve sustainable and inclusive technological growth in academic libraries.

Keywords: Academic libraries; Emerging technologies; ICT challenges.

Introduction

Academic libraries are increasingly shaped by the influence of emerging technologies, which have transformed how scholarly information is created, organised, preserved, and accessed. These technologies are best understood not merely as novel digital tools, but as systems that introduce new capabilities into library environments and redefine service delivery. As

Umeozor and Emasealu (2022) observe, technologies are considered "emerging" when they are still evolving, unevenly adopted, and yet to become fully stabilised within institutional practice. In the Nigerian context, emerging technologies encompass a wide range of applications, including artificial intelligence for discovery and reference services, cloud-based platforms for remote access, Internet of Things devices for asset management, blockchain for authentication and rights protection, and immersive tools for teaching and learning (Odunlade & Ojo, 2023; Adedokun, 2023). Importantly, scholars note that what qualifies as "emerging" is strongly shaped by institutional capacity: while some universities experiment with advanced AI-driven systems, others are still striving to establish dependable digital catalogues or cloud-hosted services (Owate, 2024; Diaz, 2024). The central concern, therefore, is not technological sophistication alone, but the extent to which these tools meaningfully enhance library services and user experience.

Beyond availability, the effectiveness of emerging technologies in academic libraries depends on how well they are adopted and sustained within everyday operations. Research increasingly shifts attention from initial deployment to the quality of implementation, measured through service integration, user uptake, and long-term viability. Odunlade and Ojo (2023) argue that technology initiatives often falter when they remain at the pilot stage without institutional embedding. Nigerian studies further indicate that successful adoption is reflected in tangible outcomes such as the migration of core services online, improved efficiency in library processes, active user engagement, and the presence of stable funding mechanisms that support system maintenance (Adetunla & Chowdhury, 2025; Malgwi, 2025). These findings suggest that procurement alone does not guarantee progress; rather, sustained implementation relies on leadership commitment, governance structures, and collaborative practices that allow technologies to mature into routine service tools (Adedokun, 2023; Odunlade & Ojo, 2023).

Human capacity remains a critical factor shaping how emerging technologies are implemented in academic libraries. Digital competence among librarians extends beyond basic ICT skills to include the ability to evaluate technological systems, manage ethical considerations, and support users in navigating new digital environments. Liman (2023) emphasises that librarians require a combination of technical expertise, analytical judgement, and pedagogical capacity to manage contemporary digital tools effectively. However, empirical studies in Nigeria reveal marked disparities in staff competence across institutions, often linked to limited access to structured professional development programmes (Odunlade & Ojo, 2023; Owate, 2024). Where training opportunities are scarce and career incentives are weak, staff

engagement with new technologies tends to be cautious or resistant. Conversely, libraries that prioritise continuous training and recognise digital leadership within promotion structures are more likely to cultivate cultures of innovation and adaptability (Adedokun, 2023; Malgwi, 2025).

Equally significant are infrastructural and organisational conditions, which frame the possibilities for technology adoption in Nigerian academic libraries. Stable electricity supply, reliable Internet connectivity, secure networks, and appropriate hosting platforms are consistently identified as foundational requirements for effective digital services (Umeozor & Emasealu, 2022; Adedokun, 2023). Studies report substantial variation across institutions, with better-resourced libraries more capable of sustaining cloud-based repositories, discovery platforms, and advanced search systems (Owate, 2024). At the organisational level, leadership support, funding prioritisation, and clear policy frameworks strongly influence whether technologies progress beyond experimentation. Malgwi (2025) and Odunlade and Ojo (2023) note that initiatives supported by defined governance structures and clear institutional policies are more likely to achieve continuity, whereas poorly coordinated projects often collapse once initial support wanes. Policy clarity is particularly important for data-intensive technologies, as the absence of guidance on procurement, data protection, and system evaluation frequently discourages innovation (Adetunla & Chowdhury, 2025; Diaz, 2024).

Statement of the Problem

Despite widespread acknowledgement of the importance of emerging technologies in enhancing academic library services, a substantial gap persists between aspiration and practice. Many Nigerian academic libraries continue to operate under conditions marked by unstable power supply, inadequate network infrastructure, insufficient funding, and limited staff readiness, factors that collectively restrict the effective use of digital innovations (Odunlade & Ojo, 2023; Olatokun, 2024; Adetunla & Chowdhury, 2025). These challenges are particularly pronounced in Ogun State, where noticeable disparities exist in technological readiness and implementation across universities, polytechnics, and colleges of education. Understanding how infrastructural, human, and organisational factors interact to shape this uneven adoption landscape is therefore essential for achieving sustainable technological integration. It is against this backdrop that this study examines the challenges of implementing emerging technologies in academic libraries in Nigeria, with specific focus on tertiary institutions in Ogun State.

Research Objectives

1. To investigate the level of implementation of emerging technologies in academic libraries across Nigeria.
2. To analyse the infrastructural, human resource, and organisational factors affecting the successful integration of emerging technologies in Nigerian academic libraries.
3. To identify the key challenges confronting academic libraries in Nigeria in their efforts to adopt and sustain emerging technologies.
4. To recommend effective strategies and policy actions that can enhance the adoption and long-term use of emerging technologies in Nigerian academic libraries.

Research Questions

1. What is the current level of implementation of emerging technologies in academic libraries in Nigeria?
2. How do infrastructural, human resource, and organisational factors influence the integration of emerging technologies in Nigerian academic libraries?
3. What are the major challenges hindering the adoption and sustainability of emerging technologies in academic libraries in Nigeria?
4. What strategies and policy interventions can promote the effective and sustainable implementation of emerging technologies in Nigerian academic libraries?

Hypotheses

H_0: There is no significant relationship between infrastructural constraints, staff digital competence, organisational support, and the level of implementation of emerging technologies in academic libraries in Nigeria.

H_1: There is a significant relationship between infrastructural constraints, staff digital competence, organisational support, and the level of implementation of emerging technologies in academic libraries in Nigeria.

Conceptual Review

Emerging technologies in academic libraries are widely understood as digital tools and systems that significantly reshape how information resources are created, organised, accessed, and preserved within higher education environments. According to Odunlade and Ojo (2023), emerging technologies in Nigerian academic libraries include cloud based library systems, artificial intelligence driven discovery tools, digital repositories, and automated

circulation platforms that aim to improve service efficiency and user engagement. Similarly, Adebayo (2024) explains that the defining feature of these technologies is not novelty alone but their capacity to transform traditional library operations and extend access beyond physical boundaries. From a global perspective, Diaz (2024) argues that emerging technologies acquire meaning within specific institutional contexts, noting that what is considered advanced in one environment may still be experimental in another. In Ogun State, where institutional capacities vary widely, the concept of emerging technologies is therefore closely tied to functional improvement rather than technological sophistication, emphasising practical service enhancement over technical complexity.

Infrastructure readiness remains a central variable in discussions of technology implementation in academic libraries, particularly within developing contexts. According to Ogunleye (2023), infrastructure encompasses stable electricity supply, reliable Internet connectivity, adequate hardware, and secure digital platforms, all of which are prerequisites for sustaining technology driven services. Nigerian studies consistently show that infrastructural weakness continues to undermine digital initiatives in tertiary institutions, especially where frequent power outages and low bandwidth disrupt system performance (Olatokun, 2024). From an international standpoint, Chowdhury (2025) observes that even well designed digital library systems fail when deployed within fragile infrastructural environments. In Ogun State, disparities in infrastructural provision across universities, polytechnics, and colleges of education mean that the success of emerging technologies is uneven, reinforcing the view that infrastructure is not merely supportive but foundational to meaningful technological integration.

Human capacity and digital competence of library personnel constitute another critical dimension of technology implementation. According to Liman (2023), digital competence among librarians involves not only operational ICT skills but also the ability to evaluate digital tools, manage data ethically, and support users in navigating complex information systems. Nigerian researchers have noted that many librarians possess basic computer literacy yet lack exposure to advanced technologies such as artificial intelligence applications and integrated library platforms, largely due to limited training opportunities (Akinsola, 2024). Supporting this view, Vassilakaki (2024) argues that staff confidence and continuous professional learning are decisive factors in determining whether technologies are adopted enthusiastically or resisted in practice. Within Ogun State academic libraries, uneven access to professional development programmes has contributed to varied levels of staff readiness, making human capacity a significant challenge to sustainable technology use.

Organisational support and institutional governance strongly influence how emerging technologies are adopted and sustained in academic libraries. According to Malgwi (2025), organisational support includes leadership commitment, strategic planning, budgetary allocation, and clearly defined roles that guide technology related decision making. Nigerian studies indicate that technology initiatives often struggle where library leadership lacks authority or where institutional policies do not prioritise digital innovation (Ojobor, 2023). From a broader perspective, Diaz (2024) emphasises that governance frameworks provide stability by clarifying accountability, procurement procedures, and long term maintenance plans for digital systems. In Ogun State, differences in managerial priorities across institutions have shaped the pace and direction of technology implementation, suggesting that organisational context plays a decisive role in determining whether emerging technologies become embedded services or short lived experiments.

Financial capacity and sustainability represent another major challenge affecting the implementation of emerging technologies in academic libraries. According to Adetunla and Chowdhury (2025), sustainable technology adoption requires consistent funding not only for initial acquisition but also for system upgrades, licensing, maintenance, and staff training. Nigerian scholars have repeatedly observed that many library technology projects are introduced through short term grants or intervention funds, which limits continuity once external support ends (Olatokun, 2024). International evidence similarly shows that inadequate financial planning often leads to abandoned systems and underutilised platforms in academic libraries (Chowdhury, 2025). In Ogun State, fluctuating institutional funding and competing administrative priorities have constrained long term investment in digital infrastructure, reinforcing the view that financial sustainability is inseparable from effective technology implementation.

Theoretical Underpinning

The Technology Acceptance Model (TAM), developed by Fred Davis in 1986, provides a foundational explanation for how individuals form intentions to accept and use technological systems. Davis proposed that perceptions of usefulness and ease of use shape attitudes towards a system, which in turn determine adoption behaviour. These principles remain highly influential, particularly because they highlight the psychological processes underlying technology acceptance. Scholars such as Akinsola (2023) and Ezeani (2024) observe that TAM is especially relevant in academic library environments where staff attitudes often determine the success of innovation. TAM's emphasis on user cognition is consistently

validated: librarians tend to adopt systems they deem helpful for improving service delivery and manageable within their skill sets. Davis's original propositions have also been reinforced by complementary findings from Davis and Venkatesh (1996), who showed that TAM retains predictive strength across institutional cultures. Fatoki (2023) similarly notes that the model assists libraries in identifying barriers linked to perception, enabling targeted interventions such as training and user sensitisation. As Anaeto, Onabajo, and Osifeso (2008) remind us, communication and acceptance of innovation are shaped by how well users understand and value new tools, an argument that aligns squarely with TAM's foundational logic.

Nevertheless, the model has also attracted sustained criticism, particularly for overlooking the organisational, infrastructural, and socio-cultural realities that shape technological change. Venkatesh and Bala (2008) argue that TAM does not adequately account for institutional constraints such as policy gaps, management decisions, and resource limitations. This concern is echoed by Chukwu and Okoro (2023), who found that inadequate training and inconsistent IT policies in Nigerian universities often override individual intentions to adopt technology. Opara (2024) further contends that technology implementation in academic libraries is rarely linear; rather, it evolves through iterative, collaborative processes strongly shaped by institutional politics and resource allocation. Despite these limitations, TAM remains an appropriate theoretical foundation for this study because it offers a clear lens for examining how librarians in Nigerian academic libraries interpret and respond to emerging technologies. In settings where limited infrastructure and uneven digital competence prevail, perceptions of usefulness and ease of use become central determinants of whether technologies such as cloud platforms, artificial intelligence tools, or digital repositories are embraced or resisted. The model therefore helps to explain why adoption remains inconsistent across institutions and provides a basis for analysing how training, leadership support and organisational alignment can positively shape user perceptions and improve implementation outcomes.

Methodology

This study employed a mixed-methods approach. A convergent parallel approach was used, allowing quantitative and qualitative data to be collected and analysed simultaneously before being integrated, a practice Creswell and Creswell (2023) describe as strengthening validity through methodological convergence. The population comprised 240 professional and paraprofessional librarians from universities, polytechnics and colleges of education, from which a sample of 150 was determined using Yamane's (1967) formula and selected through stratified random sampling to ensure institutional representation. Additionally, 12

librarians with demonstrable experience in technology-related roles were purposively sampled for interviews. Data were gathered through a structured questionnaire and a semi-structured interview guide, both of which were validated by experts and piloted, yielding a Cronbach's alpha of 0.83. The questionnaire was administered through a combination of physical distribution and Google Forms to ensure broad participation, flexibility for respondents, and consistency in data collection across institutions. Quantitative data were analysed using SPSS (version 26), applying descriptive statistics, while adopting a decision threshold of 3.00 for interpreting mean scores. Qualitative responses were transcribed and examined thematically using Braun and Clarke's (2022) framework. The final interpretation synthesized insights from both strands to provide a comprehensive understanding of the organizational, infrastructural, and human factors influencing technology implementation in the libraries studied.

Results and Analysis

Out of the 150 copies of the questionnaire distributed, 147 were returned and valid for this analysis.

Table 1: Demographic Data of Respondents

Variables	Categories	Frequency	Percentage (%)
Gender	Male	82	55.8
	Female	65	44.2
Age Range (Years)	21–30	18	12.2
	31–40	42	28.6
	41–50	53	36.1
	51 and above	34	23.1
Academic Qualification	OND/NCE	21	14.3
	B.LS / B.Sc (Library & Information Science)	54	36.7
	M.LS / M.Sc (Library & Information Science)	58	39.5
	Ph.D and Others	14	9.5
Designation	Librarian I/II	59	40.1
	Senior Librarian / Principal Librarian	47	32.0
	Deputy / Chief Librarian	17	11.6
	Library Officer / Assistant	24	16.3
Institution	Olabisi Onabanjo University, Ago-Iwoye	23	15.6
	Federal University of Agriculture, Abeokuta	16	10.9
	Babcock University, Ilishan-Remo	15	10.2
	Crawford University, Igbesa	11	7.5
	Federal Polytechnic, Ilaro	17	11.6
	Abraham Adesanya Polytechnic, Ijebu-Igbo	6	4.1
	Moshood Abiola Polytechnic, Abeokuta	15	10.2
	Gateway ICT Polytechnic, Saapade-Remo	10	6.8

	Federal College of Education, Abeokuta	17	11.6
	Tai Solarin College of Education, Omu-Ijebu	17	11.6
Senatorial District	Ogun Central	48	32.6
	Ogun East	71	48.3
	Ogun West	28	19.0

Source: *Field Survey, 2025*

The demographic characteristics of the respondents present a coherent picture of the professional landscape of academic libraries in Ogun State, revealing a workforce that is both experienced and strategically positioned to influence technological change.

Table 2: Level of Implementation of Emerging Technologies in Academic Libraries in Nigeria

Items	**SA**	**A**	**N**	**D**	**SD**	**Mean**	**Std. Dev.**
1. Our library has fully integrated emerging technologies in its operations.	59 (40.1%)	53 (36.1%)	19 (12.9%)	9 (6.1%)	7 (4.8%)	4.00	1.04
2. The adoption of automation and digital tools has improved service delivery.	61 (41.5%)	57 (38.8%)	17 (11.6%)	7 (4.8%)	5 (3.4%)	4.10	0.96
3. Library users can easily access resources through emerging technologies.	54 (36.7%)	61 (41.5%)	21 (14.3%)	7 (4.8%)	4 (2.7%)	4.04	0.93
4. Emerging technologies are regularly updated and maintained in our library.	47 (32.0%)	58 (39.5%)	27 (18.4%)	9 (6.1%)	6 (4.1%)	3.89	1.00
Grand Mean						**4.01**	

Table 2 reveals the level of implementation of emerging technologies in academic libraries across Nigeria. The quantitative results indicate a relatively high level of implementation of emerging technologies in academic libraries across Ogun State, as reflected in the strong mean scores for automation, digital service delivery, and user access. These findings suggest that technological tools have become a visible component of contemporary library operations. The qualitative evidence, however, provides a clearer interpretation of this trend. While interviewed participants acknowledged the growing presence of digital systems, they characterised implementation as uneven and still evolving.

Table 3: Influence of Infrastructural, Human Resource, and Organisational Factors on Technology Integration

Items	SA	A	N	D	SD	Mean	Std. Dev.
5. Inadequate ICT infrastructure limits the implementation of emerging technologies.	73 (49.7%)	54 (36.7%)	11 (7.5%)	5 (3.4%)	4 (2.7%)	4.27	0.91
6. Lack of staff training affects the effective use of emerging technologies.	67 (45.6%)	59 (40.1%)	12 (8.2%)	6 (4.1%)	3 (2.0%)	4.23	0.87
7. Organisational culture and management support influence technology adoption.	62 (42.2%)	61 (41.5%)	15 (10.2 %)	5 (3.4%)	4 (2.7%)	4.17	0.93
8. Adequate funding determines the extent of technological innovation in libraries.	71 (48.3%)	57 (38.8%)	10 (6.8%)	5 (3.4%)	4 (2.7%)	4.26	0.90
Grand Mean						**4.23**	

Table 3 presents data on the influence of infrastructural, human resource, and organisational factors on technology integration in Nigerian academic libraries. The grand mean of 4.23 reveals strong agreement that these factors significantly shape the extent and success of technological implementation. Participants consistently cited unstable electricity supply, unreliable Internet connectivity, and limited access to modern ICT equipment as persistent constraints that disrupt daily operations and undermine staff confidence. Human resource challenges identified in the survey are similarly reflected in interview accounts, as librarians spoke candidly about gaps in technical skills and limited opportunities for formal training. Differences in organisational support also became evident, with qualitative accounts showing that libraries benefiting from active leadership engagement and management backing were better positioned to translate technological investments into effective services, thereby reinforcing the survey evidence on the centrality of organisational culture.

Table 4: Major Challenges Hindering the Adoption and Sustainability of Emerging Technologies

Items	SA	A	N	D	SD	Mean	Std. Dev.
9. Inadequate funding remains the most significant barrier to technology adoption.	79 (53.7%)	48 (32.7%)	11 (7.5%)	5 (3.4%)	4 (2.7%)	4.31	0.89
10. Poor internet connectivity affects access to digital resources.	72 (49.0%)	51 (34.7%)	14 (9.5%)	6 (4.1%)	4 (2.7%)	4.23	0.91
11. Frequent power outages disrupt the use of emerging technologies.	75 (51.0%)	52 (35.4%)	12 (8.2%)	5 (3.4%)	3 (2.0%)	4.29	0.86
12. Resistance to change among staff hinders technology adoption.	61 (41.5%)	58 (39.5%)	18 (12.2%)	7 (4.8%)	3 (2.0%)	4.14	0.94
Grand Mean						**4.24**	

The data in Table 4 highlight the prevailing challenges impeding the adoption and sustainability of emerging technologies in Nigerian academic libraries. With a grand mean of 4.24, the responses reveal widespread recognition of systemic barriers such as inadequate funding, poor internet infrastructure, and unreliable electricity supply. The qualitative findings add depth to these results by illustrating how such constraints operate over time. Interview participants described a recurring pattern in which technology projects are introduced through short term funding but gradually deteriorate when financial support lapses. Examples of discontinued automation systems and expired software licenses provide concrete explanations for the high levels of agreement recorded in the survey regarding funding related barriers. Resistance to change, which appears in the quantitative data as a moderate challenge, was further contextualised through interview narratives that linked reluctance to anxiety about skills, workload pressures, and job security rather than outright opposition to innovation.

Table 5: Strategies and Policy Interventions for Effective and Sustainable Implementation

Items	SA	A	N	D	SD	Mean	Std. Dev.
13. Continuous professional training will enhance librarians' technological competence.	66 (44.9%)	58 (39.5%)	14 (9.5%)	5 (3.4%)	4 (2.7%)	4.20	0.91
14. Increased government and institutional funding will strengthen technology adoption.	71 (48.3%)	57 (38.8%)	10 (6.8%)	5 (3.4%)	4 (2.7%)	4.26	0.89
15. Collaboration between libraries and ICT industries can drive innovation.	68 (46.3%)	59 (40.1%)	11 (7.5%)	5 (3.4%)	4 (2.7%)	4.22	0.92
16. Developing clear policies and implementation frameworks will ensure sustainability.	64 (43.5%)	60 (40.8%)	13 (8.8%)	6 (4.1%)	4 (2.7%)	4.18	0.93
Grand Mean						**4.22**	

The data in Table 5 examine strategic and policy interventions that could enhance the effective and sustainable implementation of emerging technologies in academic libraries. With a grand mean of 4.22, the results reflect a strong consensus among respondents on the need for multifaceted interventions combining human capacity development, financial commitment, and policy clarity. These findings are closely mirrored in the qualitative data. Interview participants consistently emphasised training as a critical enabler of sustainable technology use, aligning with the high mean scores recorded for capacity building initiatives. The call for stable funding was similarly reinforced, with respondents stressing that predictable financial support is essential for maintaining digital systems. Qualitative insights further expanded the survey findings by highlighting practical collaborative strategies, such as shared infrastructure and consortial arrangements, as well as the urgent need for clear institutional policies. Together, the quantitative and qualitative evidence converge to show that while emerging technologies are increasingly present in academic libraries in Ogun State, their long-term sustainability depends on deliberate investment in infrastructure, staff development, and coherent governance structures.

Testing of Hypothesis

Multiple Regression Analysis of Factors Influencing the Implementation of Emerging Technologies in Academic Libraries

Predictor Variable	B	Std. Error	β	t	Sig.
Constant	1.214	0.287	–	4.23	.000
Infrastructural Constraints	0.462	0.072	.41	6.42	.000
Staff Digital Competence	0.318	0.101	.29	3.15	.002
Organisational Support	0.271	0.096	.24	2.78	.006

Model Summary:

$R = .585$

$R^2 = .342$

Adjusted $R^2 = .328$

$F(3, 143) = 24.68$, $p < .001$

$n = 147$

Interpretation and Transition

The regression results indicate that the model provides a statistically robust explanation of the factors influencing the implementation of emerging technologies in academic libraries across Ogun State. Infrastructural constraints emerged as the most influential predictor, underscoring the centrality of stable electricity, reliable connectivity, and functional ICT facilities in sustaining digital library services. Staff digital competence also demonstrated a strong and significant contribution, highlighting the role of skills, confidence, and continuous learning in translating technological availability into meaningful practice. Organisational support, although comparatively weaker, remained statistically significant, suggesting that leadership commitment and institutional backing play an important complementary role in shaping implementation outcomes.

Taken together, these findings confirm that challenges associated with infrastructure, human capacity, and organisational commitment are not isolated concerns but interrelated forces that jointly shape the trajectory of emerging technology adoption in academic libraries. The results provide empirical grounding for the qualitative evidence presented earlier and establish a solid basis for the subsequent discussion on how these challenges manifest in everyday practice and what they imply for policy, planning, and professional development within Nigerian academic libraries.

Discussion

The quantitative data established measurable patterns regarding the degree of adoption, institutional support, and perceived obstacles, while the qualitative interviews deepened these patterns by exposing the underlying institutional, human, and contextual realities.

The quantitative results showed that most academic libraries in Ogun State have attained a moderate level of implementation of emerging technologies, particularly in areas such as online cataloguing, electronic databases, and institutional repositories. However, the mean responses indicated that full integration remains uneven across institutions, with variations in funding, leadership support, and infrastructural capacity shaping the extent of technological utilisation. This pattern was echoed in the qualitative findings, where participants described the current state as a "work in progress" rather than a consolidated system. Respondents acknowledged the existence of digital tools but emphasised their fragmented or underutilised nature. This synthesis suggests that implementation efforts in Nigerian academic libraries are largely initiative-driven rather than system-driven, a conclusion consistent with the views of Adebayo (2023) and Olatokun (2024), who both noted that many libraries in developing contexts adopt technologies on a project basis without integrating them into long-term institutional strategy.

Infrastructural and human resource factors were found to exert substantial influence on the success of emerging technology adoption. Quantitative results revealed strong agreement among respondents that poor power supply, unstable Internet connectivity, and inadequate ICT facilities hindered effective technology use. The qualitative evidence expanded on this, portraying a working environment characterised by recurring power outages, outdated computers, and limited access to technical support. Librarians described how these deficiencies forced them to depend on personal devices and mobile data to carry out digital tasks. These live experiences bring a human dimension to the numerical findings, reinforcing the idea that infrastructure is not merely a technical requirement but a precondition for equitable access to digital resources. This resonates with the argument of Eze and Eze (2023) that technological development in Nigerian academic libraries is contingent on addressing infrastructural deficits and developing local capacity for digital resilience.

Another significant area of convergence relates to human competence and organisational support. Quantitative results revealed that many librarians agreed on the need for continuous professional training and management encouragement to enhance digital proficiency. The qualitative narratives substantiated this, showing that the enthusiasm of librarians to embrace

new technologies is often restrained by limited training opportunities and a lack of institutional follow-up. Respondents expressed that library management's commitment to ICT varies considerably, influencing staff motivation and innovation. This pattern aligns with Okafor (2023), who found that institutional leadership and managerial communication play pivotal roles in sustaining technology-based reforms in academic settings. Hence, the integration of findings underscores that while individual librarians exhibit willingness to learn and adapt, systemic inertia and leadership inconsistency remain significant barriers to sustained digital transformation.

The triangulated results also revealed converging evidence regarding the major challenges hindering adoption and sustainability. Both data strands identified funding inadequacy as the most persistent obstacle. Quantitative findings indicated high levels of agreement that financial constraints limit technology renewal and staff training, while qualitative insights demonstrated how erratic budget allocations and bureaucratic delays stifle innovation. Participants lamented the inability to renew software licences or replace obsolete systems, a scenario that confirms Ogunleye's (2023) assertion that inconsistent funding cycles perpetuate technological fragility in Nigerian higher education. Moreover, both methods illuminated issues of staff resistance, policy gaps, and a lack of maintenance culture, suggesting that the barriers are not merely technical but institutional and behavioural. This triangulated understanding reveals that the sustainability of emerging technologies depends not only on financial investment but also on cultivating a supportive organisational ethos that values innovation, accountability, and adaptability.

Finally, both the quantitative and qualitative results converge on the view that strategic interventions are essential for overcoming current limitations. Respondents from both data sources strongly agreed that targeted capacity-building, national ICT policy alignment, and inter-institutional collaboration could transform the digital landscape of academic libraries. Qualitative narratives provided illustrative examples of how collaborative resource sharing and locally developed software could reduce costs and foster collective innovation. These findings lend empirical support to Nwankwo (2022) and Abdulsalami (2023), who emphasised that sustainable technology integration in Nigerian libraries demands coordinated policy frameworks and multi-stakeholder engagement. The triangulation thus underscores that effective implementation of emerging technologies is not a matter of isolated projects but an outcome of strategic alignment, institutional leadership, and continuous human capacity development.

Conclusion and Recommendations

The study shows that academic libraries in Ogun State are gradually integrating emerging technologies, yet their progress is hindered by persistent structural, institutional, and human limitations. Although librarians increasingly appreciate the value of digital transformation, adoption remains uneven due to disparities in infrastructure, funding, and organisational preparedness. Challenges such as unreliable power supply, weak Internet connectivity, outdated ICT facilities, and limited financial commitment continue to slow technological advancement. These difficulties are compounded by gaps in technical expertise and insufficient opportunities for continuous professional development. Nevertheless, the findings also reveal notable resilience among library personnel, whose openness to learning and innovation demonstrates that meaningful technological progress is achievable when supported by clear policy direction, sustained investment, and deliberate capacity-building efforts.

In light of these findings, the study recommends that:

1. Adequate and consistent funding should be prioritised to improve digital infrastructure in academic libraries.
2. Continuous professional development programmes should be institutionalised to enhance librarians' technical, managerial, and digital literacy skills.
3. Academic libraries should operate within a well-defined policy framework that integrates digital transformation into broader institutional strategies.
4. Libraries should build strategic partnerships with other academic institutions, government agencies, and private technology firms to share resources, expertise, and infrastructure.

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