

HARNESSING INNOVATIVE TECHNOLOGIES TO TRANSFORM LIBRARIANSHIP AND INFORMATION SERVICES DELIVERY IN ACADEMIC LIBRARIES IN NIGERIA

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Abstract

The integration of innovative technologies has transformed many sectors, and librarianship is no exception. As libraries increasingly move towards digital platforms, the adoption of technologies such as artificial intelligence, cloud computing, and digital repositories is transforming how information services are delivered. Libraries are now challenged with improving service efficiency, accessibility, and user satisfaction in a fast changing technology environment. This study explores how innovative technologies are reshaping librarianship and enhancing information services delivery in academic libraries. The study adopted survey research method. The population of the study consisted of professional librarians from academic libraries, with 52 valid responses obtained through an online questionnaire. Structured questionnaire was used as instrument for data collection. The instrument was subjected to validity and reliability tests, after which data obtained were analyzed using descriptive statistics and presented in tables. The result of the study revealed that there is low adoption of innovative technologies across the institutions in Nigeria. Most of the academic libraries still struggle with integrating technologies beyond basic ICT tools. The study equally revealed that the full potential benefits of innovative technologies remain unrealized due to low adoption. The study identified the major constraints to effective implementation of these technologies as inadequate funding, inadequate infrastructure, erratic power supply, resistance to change among others. In line with the findings, recommendations were made. The study concludes that for academic libraries to remain relevant in the digital knowledge economy, they must transition from traditional services to more innovative, technology driven operations.

Keywords: Innovative technologies, Service delivery, Information, Librarianship, Academic library

Introduction

The digital revolution has significantly impacted various sectors, which includes librarianship and information service delivery. The emergence of innovative technologies such as Artificial Intelligence (AI), Big Data, Blockchain, Cloud Computing, and the Internet of Things (IoT) has

transformed traditional library operations into more dynamic and user centered services (Shinde, Seth, & Kadam, 2023). Today's libraries mostly have shifted from manual cataloging and physical storage to digital repositories, automated indexing, and personalized recommendation systems and the pace of adoption varies across different regions and institutions, influenced by factors such as funding, digital literacy, and infrastructure development (Brown, 2022).

According to Meesad and Mingkhwan (2024), digital revolution has profoundly influenced how knowledge is created, stored, and accessed across the globe. This indicates that 21st century libraries have shifted from traditional repositories of printed collections into dynamic knowledge hubs powered by technology. However, innovative technology such as artificial intelligence (AI), big data, blockchain, cloud computing, and the Internet of Things (IoT) have redefined information management, enabling personalized retrieval systems, automated cataloguing, and real time access to digital repositories (Ozioko & Okpara, 2022). Globally, libraries in developed regions have embraced these technologies to enhance accessibility, improve user engagement, and support advanced research needs. Moreover, Owens et al. (2018) stated that the pace of adoption remains unequal in developing countries. Some academic and public libraries have transitioned to digital platforms, many continue to wave with infrastructural deficits, insufficient funding, and limited technical expertise (Khalid, Malik, & Mahmood, 2021). This disparity raises concerns about equity in knowledge access and the ability of libraries in resource constrained environments to remain relevant in the digital knowledge economy.

In Nigeria, academic libraries are at a crossroads, users increasingly demand instant, technology enabled access to scholarly resources, while many libraries still rely on outdated systems and working heavily with manual processes. However, challenges such as inadequate ICT infrastructure, digital literacy gaps among librarians, and insufficient budgetary allocation hinder smooth adoption of advanced technologies (Khalid, Malik, & Mahmood, 2021). Despite these constraints, the integration of AI-powered chatbots, big data analytics, and IoT based tracking systems presents new opportunities to modernize Nigerian libraries and align them with global standards of service delivery (Patel et al., 2024). While a growing scholarly works in Nigeria have examined the adoption of information and communication technologies (ICTs) in libraries, much of this work has primarily concentrated on traditional digital tools such as online catalogues, e-resources, and automated circulation systems. These studies have been valuable in highlighting the progress of libraries towards digital transformation, but they often provide only a broad overview of ICT adoption. Meanwhile, what remains relatively underexplored is the extent to which emerging technologies such as artificial intelligence (AI), blockchain, big data, and the Internet of Things (IoT) are being implemented in Nigerian academic libraries, and how these tools specifically affect service delivery and user satisfaction. This gap underscores the need for focused research that not only documents the presence of such technologies but also evaluates their effectiveness in addressing contemporary challenges in librarianship.

This study arises from professional engagement in librarianship and a personal commitment to explore how Nigerian libraries can leverage innovative technologies to remain relevant in the digital era. Observing firsthand the struggles of academic libraries in Nigeria to meet rising user expectations with limited resources has motivated this investigation. The study is intended to contribute both to scholarly and to practical solutions that enhance library services in resource constrained contexts.

Statement of the Problem

Despite the rapid advancement and adoption of innovative technologies such as AI, Big Data, Blockchain, Cloud Computing, and IoT in global librarianship, Nigerian academic libraries largely rely on outdated manual processes and lack the infrastructure, expertise, and resources necessary for full technological integration. This disparity hinders their ability to provide modern, efficient, and user centered information services, thereby affecting user satisfaction and the libraries relevance in the digital knowledge economy. There is a significant gap in understanding the extent to which these emerging technologies are being implemented in Nigerian academic libraries and how effectively they improve service delivery and user experience. This study aims to address this gap by examining the adoption and impact of innovative technologies on Nigerian academic library services.

Research Objectives

The specific objectives of the study were to:

1. Identify the Innovative technologies adopted by academic libraries to transform library services
2. Determine the impact of emerging technologies in service delivery in academic library
1. Determine the extent of skill librarians have in using innovative technologies
2. Find the challenges encountered in implementing the innovative technologies

Research Questions

1. What are the innovative technologies adopted by academic libraries to transform library services
2. What is the impact of innovative technologies in service delivery in academic library
3. What is the extent of librarians skill in using innovative technologies
4. What are the challenges encountered in implementing innovative technologies

Literature Review

Adoption and Integration of Innovative Technologies in Academic Libraries

Globally, libraries have transitioned from traditional manual processes to technology driven environments in response to the digital revolution. Studies highlight that innovations such as Artificial Intelligence (AI), Big Data, Blockchain, Cloud Computing, and the Internet of Things (IoT) have been widely adopted in developed countries to enhance service delivery (Shinde, Seth, & Kadam, 2023). Libraries in the United States and Europe, for instance, have integrated AI-driven catalogues, blockchain secured digital lending, and IoT enabled smart circulation systems (Panda, 2025).

The adoption of the new technologies have improved operational efficiency and strengthened access to diverse digital resources. In the African region, the adoption is progressing at a slower pace. Meanwhile, some universities in South Africa and Kenya have implemented AI-enabled repositories and cloud based services, many others across sub-Saharan Africa continue to rely heavily on manual

processes due to infrastructural and financial constraints (Elisa et al., 2025). This uneven adoption reflects the continent's broader digital divide, which has implications for equitable access to knowledge.

However, in Nigeria the literature indicates that although academic libraries are increasingly aware of emerging technologies, adoption remains limited. Most of the libraries continue to face challenges in establishing a solid foundation in the use of these technologies (Tella, 2020). Studies by Aguboshim (2021), show that integration is hindered by inadequate ICT infrastructure, insufficient funding, and limited technical expertise. Furthermore, the adoption that does exist is often restricted to basic ICT tools such as online catalogues and e-resources, leaving advanced tools like AI, Blockchain, and IoT underutilized (Akintola, 2021).

Impact of Innovative Technologies on Service Delivery in Academic Libraries

The transformative potential of emerging technologies in improving the quality and efficiency of library service delivery has been widely acknowledged. Globally, AI-powered chatbots and virtual assistants have enhanced reference services by providing instant responses to user queries (Lee, Pan, & Hsieh, 2022). Similarly, Big Data analytics has allowed libraries to personalize services based on user behavior, while blockchain has strengthened digital rights management and authentication of scholarly materials (Ahmed, Chehri, & Jeon, 2023). However, African libraries adopting innovative technologies have reported improvements in service quality and service delivery. For instance, IoT enabled systems have improved resource tracking, while AI has facilitated automated cataloguing and indexing (Tshikoshi & Nwagwu, 2021). However, limited adoption and infrastructural challenges mean such benefits are irregular across institutions.

In Nigeria, the few libraries integrating emerging technologies report positive impacts on efficiency and accessibility. According to Mistry et al. (2024), cloud based repositories in Nigerian universities have improved digital resource sharing and access. Yet, the overall impact is constrained by the relatively low level of adoption, this indicates a need for systematic studies to measure and document the impact of these technologies on service delivery in Nigerian academic libraries.

Skills for Using Innovative Technological

Librarians ability to use emerging technologies has become a key determinant of how effectively academic libraries adapt to the digital age. Studies consistently show that while most librarians possess basic ICT skills, there remains a significant gap in advanced digital competencies such as artificial intelligence, data analytics, cloud computing, and digital preservation (Hamad, Al-Fadel, & Fakhouri, 2021). However, research across Nigerian academic libraries reveals that many librarians acquire their skills through informal self learning or short term workshops rather than structured professional training, resulting in unequal proficiency levels (Akintola, 2021). Furthermore, according to Sinha and Ugwulebo (2024) also has emphasis on the

limitation been compounded by inadequate infrastructure, lack of institutional support, and insufficient exposure to emerging technologies. Other studies have shown that librarians can perform routine ICT tasks efficiently but often struggle with implementing or maintaining advanced systems like integrated library automation tools, institutional repositories, and AI-driven library services (Ikwuanusi, Adepoju, & Odionu, 2023). Similarly, international projects such as the European BIBLIO initiative demonstrate that structured professional development and digital literacy programs can significantly improve librarians technological competence (Zignani et al., 2020). Factors influencing the extent of librarians digital skills include access to training, institutional motivation, and funding availability (Chen et al., 2025), while barriers such as outdated facilities and limited exposure to emerging technologies continue to hinder progress. The skill gap not only affects the integration of tools like blockchain, Big Data, and IoT but also undermines the efficiency and user satisfaction of academic library services (Lekan & Olufunke, 2023). Therefore, addressing this challenge requires systematic professional development, curriculum reform in library education, and sustained institutional investment to bridge the gap between awareness and practice. Overall, existing evidence suggests that while librarians are willing and motivated to embrace innovation, the extent of their technological skill remains moderate, requiring continuous learning and organizational support to fully harness the benefits of emerging technologies in academic libraries

Challenges to Effective Implementation of Innovative Technologies

Although emerging technologies promise to transform library services, their adoption is not without challenges. Globally, libraries report issues such as cybersecurity threats, data privacy concerns, and the high cost of implementation (Ogwo, Ibegbulem, & Nwachukwu, 2023). Moreover, staff resistance to technological change and the need for continuous training present additional barriers (Clark & Lischer-Katz, 2023). The most significant challenges include infrastructural deficits, inadequate funding, and insufficient government policy support for ICT integration (Bharti & Verma, 2021). This creates a situation where only a few elite institutions can afford advanced technological tools.

In Nigeria, academic libraries face persistent barriers such as inadequate ICT infrastructure, limited funding, poor internet connectivity, and a shortage of skilled personnel (Aderogba & Ajayi, 2020). Cybersecurity risks and digital literacy gaps further complicate adoption, while budgetary constraints prevent sustained investment in innovation (Adarkwah et al., 2024). These challenges underline the need for strategic policies and partnerships to support sustainable integration of innovative technologies in Nigerian academic libraries.

Research Methodology

Descriptive survey research design was adopted for this study. This was found appropriate because it is more ideal for studying a spread population of librarians across Nigeria. The librarians from the different WhatsApp platforms formed the

population. A self structured online survey was sent to Librarians WhatsApp groups, inviting them to fill it. The survey was open for 10 days to allow respondents sufficient time to participate. The survey was made up of two sections. **Section A** was demographic data while **Section B** was made up of research questions. The respondents were asked to tick their preferences. The responses were: Strongly agree, Agree, Undecided, Disagree and Strongly disagree. There were also: Very High Extent, High Extent, Moderate Extent, Low Extent and Very Low Extent. Fifty two respondents accurately filled the form. The data was analyzed using simple frequencies and percentages. The result was presented in tables.

Results of Analysis

Demographic Characteristics of Respondents

Table 1: Type of Institution

Responses	Frequency	Percentage (%)
University	25	48.1
Polytechnic	22	42.3
Research Institute	5	9.6
Total	52	100

Findings show that respondents were drawn from various academic and information institutions. The highest representation came from University (48.1%), followed by Polytechnic (42.3%), while research institutes is 9.65%. This distribution indicates that the adoption of emerging technologies is being observed across diverse institution types, though University formed the dominant sample in this study.

Table 2: Respondent Status

Responses	Frequency	Percentage(%)
Librarian	27	51.9
Library Officers	6	11.5
ICT Personnel	19	36.6
Total	52	100

The status distribution shows that librarians constituted 51.9%, library officers 11.5%, and ICT personnel 36.6%. This suggests that the feedback represents a diverse workforce, which strengthens the reliability of the findings regarding skill levels and adoption of emerging technologies.

Table 3: Innovative technologies for transforming services delivery in academic libraries

Innovative technologies	Frequency	Percentage (%)
Internet of Things (IOT)	10	19.2
Big Data Analytics	7	13.5
Blockchain Technology	0	0
Artificial Intelligence (AI)	5	9.6
None of the above	30	57.7
Others	0	0
Total	52	100

Table 4 shows the innovative technologies adopted to transform academic library services. 30(57.7%) of the respondents reveal no adoption of innovative technology,

10(19.2%) indicated the adoption of Internet of things (IOT), 5(9.6%) shows adoption of Artificial intelligence, 7(13.5%) also indicated the adoption of Big Data Analytics while no respondent indicated the adoption of Blockchain Technology. This result clearly indicates low adoption across the academic institutions. The dominance of “none of the above” validates the assertion by (Tshikoshi & Nwagwu, 2021), that Nigerian academic libraries still struggle with integrating modern technologies beyond basic ICT tools.

Table 4: The impact of innovative technologies on service delivery

Items	Strongly agree	Agree	Undecided	Disagree	Strongly Disagree
It reduces library staff workload	8(15.4%)	10(19.2%)	4(7.7%)	17(32.7%)	13(25%)
It encourages library patronage	9(17.3%)	10(19.2%)	6(11.5%)	15(28.8%)	12(23.1%)
Enhance users experience and engagement	8(15.4%)	11(21.1%)	8(15.4%)	9(17.3%)	16(30.7%)
Increase access to resources	10(19.2%)	7(13.5%)	9(17.3%)	15(28.8%)	11(21.1%)
Improves the retrieval of relevant information resources	14(26.9%)	12(23.1%)	4(7.7%)	12(23.1%)	10(19.2%)

Table 4 reveals the impact of innovative technologies in transformation of library services. Respondents strongly agree to improves the retrieval of relevant resources 14(26.9%), increase access to resources 10(19.2%), encourages library patronage 9(17.3%). However, 12(23.1%) of the respondents agree that innovative technologies improves the retrieval of relevant resources. The finding implies that due to low adoption in academic libraries, the full potential benefits of these technologies remain unrealized.

Table 5: Extent of skill librarians have in using innovative technologies

Skills	Very Extent	High Extent	Moderate Extent	Low Extent	Very Low Extent
Information retrieval skill	30(57.7%)	15(28.8%)	5(9.6%)	2(3.8%)	0
Data collection skill	24(46.2%)	11 (21.2%)	10(19.2%)	5(9.6%)	2(3.8%)
Data management skill	12(23.1%)	27(51.9%)	6(11.5%)	4(7.7%)	3(5.7%)
Digital content creation skill	4(7.7%)	8(15.4%)	9(17.3%)	15(28.8%)	16(30.7%)
Collaboration and Team work skill	24(46.2%)	16(30.8%)	8(15.4%)	2(3.8%)	2(3.8%)

Programming language skills (python, java, developing library software and tools)	6(11.5%)	7(13.5%)	8(15.3%)	12(23.1%)	19(36.5%)
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Table 5 shows librarians response regarding the extent of skills they have in utilizing innovative technologies. The table revealed that majority of the respondents indicated that the extent of information retrieval skill is very high 30(57.7%), followed by data collection skill and collaboration and team work skill 24(46.2%). However, on data management skill, majority of the respondents 27(51.9%) agreed to have high extent skill in utilizing innovative technologies, while on programming language skill, the extent of the skill of majority of the respondents 19(36.5%) is very low. The strongest decline is in digital content creation and programming language skills, indicating a limited ability to create engaging digital resources that can enhance users learning outcome.

Tables 6: Challenges limiting the effective implementation of innovative technologies

Responses	Frequency	Percentage (%)
Inadequate funding	18	34.6
Poor infrastructure	5	9.6
Limited technical skills	5	9.6
Resistance to change	8	15.4
Cybersecurity concern	3	5.8
Lack of awareness	5	9.6
Erratic power supply	8	15.4
Total	52	100

This table revealed that 18(34.6%) of the respondents indicated inadequate funding as a major challenge limiting the effective implementation of innovative technology in their library. Other challenges are resistance to change and erratic power supply 8(15.4%). However, 5(9.6%) of the respondents respectively indicated that poor infrastructure, limited technical skills and lack of awareness is a challenge to implementing innovative technology in their library. While, 3(5.8%) of the respondents also indicated that cybersecurity concern has been a challenge to implementing innovative technology in their library. This means that the major challenges faced by academic staff in their quest to adopt innovative technologies are inadequate funding; erratic power supply; resistance to change among others.

Discussion of Findings

This study examined the innovative technologies adopted by academic libraries to transform library services. The findings revealed that although librarians are aware of innovative technologies such as Artificial Intelligence (AI), Big Data analytics, Blockchain technology, Cloud Computing, and the Internet of Things (IoT), their actual adoption in academic libraries remains very low. Most academic libraries still rely

heavily on basic ICT tools such as computers, internet services, online public access catalogues (OPAC), and electronic resources, with minimal integration of advanced innovative technologies. This indicates a wide gap between awareness and practical implementation of emerging technologies in Nigerian academic libraries. This finding supports the view of (Akintola, 2021), that innovative technologies such as AI, Blockchain, and IoT are largely underutilized in academic libraries compared to conventional ICT tools like e-resources and online catalogues.

Secondary, the study determines the impact of innovative technologies on service delivery in academic libraries. The findings showed that innovative technologies have strong potential to enhance library services, particularly in information retrieval, improving access to information resources, providing efficient resource tracking and has capacity to enhanced user experience. However, due to the low level of adoption, their actual impact on service delivery remains limited in most academic libraries. This result aligns with (Bharti & Verma, 2021) who reported that while emerging technologies can significantly improve library service efficiency and user satisfaction, their benefits are often unrealized in developing countries due to low adoption levels. Thus, the transformative impact of these technologies in Nigerian academic libraries is yet to be fully achieved.

Also, the extent of skills librarians have in utilizing innovative technologies were studied, the findings revealed that most librarians possess high level of information retrieval skill and data collection skill which are sufficient for the use of basic ICT tools. However, advanced technical skills required for the effective adoption and use of innovative technologies such as AI, Big Data analytics, and Blockchain are largely inadequate. This skills gap limits librarians the ability to implement and manage emerging technologies effectively. This finding is consistent with earlier studies which reported that inadequate technical competencies among librarians hinder the successful deployment of innovative technologies in academic libraries (Bharti & Verma, 2021).

The study further identified several challenges hindering the effective adoption and implementation of innovative technologies in Nigerian academic libraries. The major challenges include inadequate funding, insufficient technological infrastructure, erratic power supply, limited training opportunities, resistance to change among library staff, and weak institutional and government policy support. These challenges collectively constrain the integration of innovative technologies into library operations. This finding agrees with Okwu and Opurum (2021), whose study on emerging technologies in university libraries revealed that inadequate funding, infrastructural deficits, lack of skilled manpower, and weak policy support are major barriers to effective technology adoption. The implication is that unless these challenges are adequately addressed, the adoption and implementation of innovative technologies in academic libraries will remain minimal.

Conclusion

Based on the findings, the study concluded that academic libraries in Nigeria are technologically aware but not technologically empowered. To remain relevant in the digital knowledge economy, libraries and librarians must transition from traditional services to more innovative, technology driven operations. Achieving this requires strategic investment, continuous staff capacity building, and institutional commitment toward digital transformation.

Recommendations

Based on the findings of the study, the study recommends as follows:

1. The academic libraries in Nigeria should expand beyond using basic ICT tools and integrate innovative technologies such as Artificial Intelligence, Big Data analytics, Blockchain, Cloud Computing, and the Internet of Things into library operations. This will enhance the modernization and transformation of library services.
2. Academic libraries should strategically apply emerging technologies to improve service areas such as information retrieval, access to information resources, resource tracking, and users experience and engagement.
3. Academic library management should organize regular training and hands-on workshops for librarians on emerging technologies to improve their competence on the application of these technologies for effective library services.
4. Academic library management should ensure adequate funding, reliable power supply, supportive policies, and improved ICT infrastructure are available to sustain adoption of innovative technologies in the libraries.

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