Mapping the Adoption Gradient of Emerging Technologies in Academic Libraries: A Survey of Kogi State Tertiary Institutions.

Imoisili O. Odigie
odigieimoisili@gmail.com
Federal University Lokoja

&

Esther Adebisi
estheridowu74@gmail.com
Kogi State Polytechnic

Abstract
The study evaluated the adoption rate of emerging technologies for service delivery and identified key operational challenges in tertiary institution libraries across Kogi State, Nigeria. Utilizing a descriptive survey research design, data were collected using the structured questionnaire from 92 librarians across seven institutions selected through sequential mixed sampling procedure. Data were analysed using descriptive statistics, results revealed a low overall adoption rate. Out of thirteen evaluated technologies, only five met the adoption threshold: Web 2.0/3.0 tools, institutional repositories, internet integration, artificial intelligence resources, and cloud computing. Conversely, complex innovations like big data analytics and virtual reality remained unadopted. These findings indicate that technological lag stems from structural and resource deficits rather than behavioral resistance. Library administrators and institutional policymakers must prioritize strategic ICT funding, phased technology implementation, and continuous technical capacity building to enhance service delivery.

Keywords: Emerging Technologies, Libraries, Challenges, Technology Adoption, Library Services, ICT Infrastructure, Kogi State, Nigeria

Introduction
The rapid advancement of Information and Communication Technology (ICT) has deeply reshaped how information is created, organized, stored, and disseminated across all sectors of society, and libraries are no exception to this transformation. University libraries, traditionally viewed as custodians of print based knowledge resources, are gradually being reimagined as dynamic information hubs that leverage

emerging technologies to enhance their service delivery, expand and improve access, and meet the ever changing expectations of a digitally oriented academic community. Emerging technologies such as artificial intelligence (AI), cloud computing, Radio Frequency Identification (RFID), the Internet of Things (IoT), mobile applications, institutional repositories, virtual and augmented reality, chatbots, and big data analytics have introduced unprecedented possibilities for improving the efficiency, accessibility, and responsiveness of library and information services (Bibliotheca, 2026; Xu et al., 2024).

Globally, libraries in developed and some developing nations have progressively integrated these technologies into their operations, resulting in improved cataloguing systems, self-service circulation, remote access to digital collections and services, personalized information retrieval, and enhanced user engagement (Asim & Arif, 2023; Idhris & Peter, 2024). In the Nigerian context, however, the adoption of emerging technologies in university libraries has been comparatively slow and uneven, often constrained by infrastructural deficits, inadequate funding, epileptic power supply, limited technical expertise, and institutional policy gaps (Odigie, 2024). These challenges are particularly pronounced in state-owned and lesser-resourced institutions, where the pace of technological adoption tends to lag that of federal or some well-funded private universities.

Kogi State, as an emerging educational hub in North-Central Nigeria, hosts several institutions of higher learning whose libraries are expected to serve as vital support systems for teaching, learning, and research. Yet, there remains limited empirical evidence on the extent to which the libraries of these institutions have embraced emerging technologies for service provision. Particularly the specific technologies in use, and the factors influencing their adoption or non adoption. Understanding the current state of technology adoption in these libraries is therefore essential, not only for benchmarking their performance against global standards but also for informing policy and investment decisions aimed at bridging the digital divide in library services within the state and the country at large.

It is against this backdrop that this study seeks to evaluate the adoption rate of emerging technologies for service provision in university libraries in Kogi State, with a view to identifying the specific technologies currently in use and the extent of their integration into library operations.

Statement of the Research Problem

Despite the growing global emphasis on technology-driven library services, many libraries in Nigeria, including those in Kogi State, continue to rely heavily on conventional, largely manual methods of service delivery. This persistence of traditional practices raises concerns about the readiness and capacity of these institutions to meet the information needs of a generation of students and researchers who are increasingly accustomed to fast, mobile, and technology-mediated access to information.

While subjective observations suggest that some university libraries in Kogi State have begun to introduce elements of automation and digital service delivery, there is a dearth of systematic, empirical data documenting exactly which emerging technologies have been adopted, the depth and consistency of their use, and how these compare across the different tertiary institutions of learning within the state. Without such data, it remains difficult for library administrators, university management, and policymakers to make informed decisions regarding technology investment, staff training, and infrastructural development.

Furthermore, the absence of a clear understanding of the current adoption landscape makes it challenging to identify gaps, assess whether existing efforts are yielding the intended improvements in service quality, and determine what barriers, be they financial, infrastructural, human capacity-related, or attitudinal, may be impeding fuller technology integration. This lack of documented insight constitutes a significant gap in the literature on library technology adoption in Nigeria, particularly within the specific context of Kogi State.

It is this gap that the present study seeks to address by systematically evaluating the adoption rate of emerging technologies for service provision in university libraries in Kogi State, with the specific aim of identifying the technologies that have been adopted and the extent of their utilization.

Objectives of the Study

1. To evaluate the emerging technologies currently adopted in libraries of Kogi state Nigeria.
2. To highlight the challenges hindering the effective adoption of emerging technologies in library service delivery.

Literature review

The research provides a systematic review of literature on emerging technologies adopted and the challenges hindering the adoption of these technologies in themes.

Adoption of AI in libraries

Libraries have transitioned from traditional repositories to intelligent service hubs driven by technologies. Within libraries there have been reports of progressive integration of AI, IoT, blockchain, augmented reality and robotics (Hotsonyame, 2025). As noted by Bibliotheca, (2026) these technologies have been used to influence user experience in libraries and impacted greatly on library operations and services. Amongst the emerging technologies dominating library operations AI and Big data analytics are some of the most influential with generative pre-training transformers (GPTs) being the most adopted and used. A study by Saunders & Rutherford, (2024) found that librarians in the USA used ChatGPT and LibChat generally for library tasks, furthermore Idhris & Peter, (2024) report the transformative capabilities of AI chatbots on libraries operational efficiency. Despite concerns of accuracy and hallucinations by Li & Coates, (2024), in the United Kingdom these chatbots are interactive, answering questions based on built frequently asked questions. This falls short of their full generative potential showing delayed adoption (Cox & Dixon, 2026).

Other emerging technologies identified are Internet of things (IoT) and radio frequency identifiers (RFID). These technologies allow libraries to harness the potential for automated circulation and inventory management and self-guided tours allowing libraries to greatly enhance their performance and save time which could otherwise be used in these manual tasks (Asim & Arif, 2023; Xu et al., 2024; Zhou, 2024). Blockchain has been reported to be used in data security, owing to its transparency feature. Literature reported use include digital preservation tracking, tracking for interlibrary loans, and library ledgers (Abid, 2021; Kanyika et al., 2025). Lastly reality has been extended with the use of technologies like; augmented and virtual reality. Libraries use these technologies to enhance user's learning process through virtual exhibitions and GIS navigation (Guo et al., 2024).

Challenges hindering the adoption of emerging technologies

While there has been much upshift in libraries and user services as a result of these technologies, there remain barriers to their full implementation. Bibliotheca (2026)

reports show budgetary constraints to be a huge barrier to the use of these emerging technologies in libraries. While another report by Gardella (2025) helps in understanding that these technologies pose potential risks for user privacy and other security concerns.

Research Methodology

This study adopted a descriptive survey research design. The survey design was considered appropriate because it allows the researcher to collect data from a cross-section of respondents at a particular point in time in order to describe, analyse, and interpret existing conditions (Creswell & Plano Clark, 2018). The population of this study comprised all librarians working in university libraries, polytechnics and colleges of education within Kogi state totalling one hundred and twenty-eight librarians (128) based on statistics obtained from the Nigerian Library Association Kogi state registry. The tertiary institutions covered under this study include; Federal University Lokoja, Confluence University of Science and Technology, Prince Abubakar Audu University and Salem University Federal Polytechnic Idah, Kogi State Polytechnic and College of Education Okene. The study made use of a sequential mixed sampling procedure due to the specificity of the research objective (Creswell, 2022); the first sampling procedure was purposive with an inclusion criterion that librarians were involved directly in the provision of services to users, meaning persons working within circulation, technical units, reserve and reference units equivalents in these libraries. This reduced the population of librarians to one hundred and ten (110) persons. Participants were selected using simple random sampling to ensure each eligible librarian had an equal chance of being included in the final sample from those whom met the criteria.

The primary instrument for data collection was a structured questionnaire designed by the researcher, titled "Emerging Technologies Adoption Questionnaire (ETAQ)." Face and content validity of the questionnaire was established through review by the researcher's supervisor in Library and Information Science department, who assessed the instrument for clarity, relevance, and appropriateness. for reliability the questionnaire demonstrated high internal consistency in the test sample, with a Cronbach's alpha of $\alpha = .87$. Copies of the questionnaire were administered directly to library staff in the selected institutions by the researcher, respondents were given two weeks to complete the questionnaire. The researcher retrieved ninety-two (92) questionnaires of the randomly selected 110 librarians distributed giving a response rate of eighty-three percent (83.6%). These responses were used in the study analysis.

Data Analysis

Table 1: Emerging Technologies Adopted in Kogi State Libraries (N = 92)

S/N	Emerging Technologies	HA	A	MA	NA	fx	Mean ($\bar{X}$)	Decision
1.	Library Tracker	4	6	40	42	156	1.70	Not Adopted
2.	Artificial Intelligence	36	40	14	2	294	3.20	Adopted
3.	Augmented Reality	12	11	40	29	190	2.07	Not Adopted
4.	Internet	41	39	2	10	295	3.21	Adopted
5.	Robots	10	20	40	22	202	2.20	Not Adopted
6.	Blockchain and Distributed Ledger Technology	2	4	36	50	142	1.54	Not Adopted
7.	Book Delivery Drone	0	4	28	60	128	1.39	Not Adopted
8.	Institutional Repository	48	30	12	2	308	3.35	Adopted
9.	Cloud Computing	38	42	0	12	290	3.15	Adopted
10.	Big Data Analytics	2	0	26	64	124	1.35	Not Adopted
11.	Virtual Reality	0	22	30	40	166	1.80	Not Adopted
12.	RFID/NFC	10	2	10	70	136	1.48	Not Adopted
13.	Web 2.0/3.0 Technologies	60	30	0	2	332	3.61	Adopted
	Grand Mean=						**2.31**	

Key: HA = Highly Adopted [4], A = Adopted [3], MA = Moderately Adopted [2], NA = Not Adopted [1]

The table shows the adoption pattern of thirteen (13) emerging technologies in libraries in Kogi State, based on responses from 92 library staff, using a criterion mean of 2.50. The results show that only five (5) of the thirteen technologies were adopted: Web 2.0/3.0 Technologies ($\bar{X}$ = 3.61), which ranked highest, followed by Institutional Repository ($\bar{X}$ = 3.35), Internet ($\bar{X}$ = 3.21), Artificial Intelligence ($\bar{X}$ = 3.20), and Cloud Computing ($\bar{X}$ = 3.15). These are largely internet-dependent, relatively low-cost, and easier-to-implement technologies, suggesting that libraries

in the state have concentrated their technology adoption efforts on basic connectivity and content-access tools rather than more sophisticated systems.

The remaining eight (8) technologies were found to be not adopted, with mean scores below the 2.50 criterion. These include Robots ($\bar{X}$ = 2.20), Augmented Reality ($\bar{X}$ = 2.07), Virtual Reality ($\bar{X}$ = 1.80), Library Tracker ($\bar{X}$ = 1.70), RFID/NFC ($\bar{X}$ = 1.48), Blockchain and Distributed Ledger Technology ($\bar{X}$ = 1.54), Book Delivery Drone ($\bar{X}$ = 1.39), and Big Data Analytics ($\bar{X}$ = 1.35, the lowest rated). Notably, Machine Learning and Big Data Analytics often assumed to accompany AI adoption recorded low means, indicating that while basic AI resources have been adopted, more advanced or specialized applications of AI and immersive technologies remain largely absent from library operations. The grand mean of 2.31, which falls below the criterion mean of 2.50, indicates an overall low level of adoption of emerging technologies among university libraries in Kogi State.

Table 2: Challenges hindering the effective adoption of emerging technologies in library service delivery

S/N	Items	SA	A	D	SD	TS	Mean	Decision
1.	Inadequate funding affects technology adoption	63	26	2	1	335	3.64	Agreed
2.	Poor internet connectivity is a major challenge	0	27	65	0	211	2.29	Disagreed
3.	Resistance to change affects technology use	0	33	3	56	161	1.75	Disagreed
4.	Inadequate infrastructure limits technology	68	20	2	2	338	3.67	Agreed
5.	Lack of technical support staff is also a problem	50	41	1	0	325	3.53	Agreed
	Grand Mean=						**2.98**	

Key: SA = Strongly Agreed [4], A = Agreed [3], D = Disagreed [2], SD = Strongly Disagreed [1]

The table presents respondents' views on the challenges affecting the adoption of emerging technologies in libraries in Kogi State, based on a criterion mean of 2.50. The results show that respondents agreed with three (3) of the five statements. Inadequate infrastructure limiting technology adoption recorded the highest mean ($\bar{X}$ = 3.67), closely followed by inadequate funding ($\bar{X}$ = 3.64) and lack of technical support staff ($\bar{X}$ = 3.53). These findings suggest that respondents perceive

infrastructural and financial constraints, alongside a shortage of skilled technical personnel, as the most significant barriers hindering the adoption of emerging technologies in their libraries.

Conversely, respondents disagreed with two (2) statements. Poor internet connectivity ($\bar{X} = 2.29$) and resistance to change ($\bar{X} = 1.75$, the lowest-rated item) were not perceived as major challenges, with resistance to change being particularly firmly rejected as a barrier. This indicates that, in the view of library staff, the primary obstacles to technology adoption are structural and resource-based (funding, infrastructure, and manpower) rather than behavioural or attitudinal (staff resistance) or connectivity-related. The grand mean of 2.98, which is above the criterion mean of 2.50, indicates that, overall, respondents agree that identifiable challenges exist that significantly hinder the adoption of emerging technologies in university libraries in Kogi State.

Discussion

Emerging Technologies Adopted

The findings demonstrate a selective, surface-level pattern of technology adoption among the evaluated libraries, culminating in an overall low adoption with the grand mean. Of the thirteen technologies evaluated, adoption was strictly concentrated in five internet-dependent, low-cost, or consumer-accessible applications. The notably lower grand mean reinforces a conclusion that university libraries in the state have adopted only the most basic, accessible technologies (internet access, cloud storage, institutional repositories, and general Web 2.0/3.0 tools). This concentration aligns with the observations of Hotsonyame (2025), who noted that modern academic libraries globally have transitioned toward cloud-hosted, web-based digital service hubs to maintain basic service continuity.

The study further showed that more advanced, capital-intensive, or technically demanding technologies (AR, VR, machine learning, blockchain, Book drones, big data analytics, and library trackers) remain largely unadopted. Guo et al. (2024) documented widespread implementation of Augmented and Virtual Reality across top university libraries in the United States for immersive learning, GIS navigation, and virtual exhibitions, libraries in Kogi State have yet to integrate extended reality environments into their user services. Similarly, whereas Abid (2021) and Kanyika et al. (2025) highlighted the rising utility of blockchain for decentralized data security, digital preservation tracking, and interlibrary loan ledgers globally, local

institutional awareness and adoption remain negligible. In the same vein Automated circulation systems powered by Internet of Things (IoT) architectures and Radio Frequency Identification (RFID) emphasized by Asim and Arif (2023), Xu et al. (2024), and Zhou (2024) as essential components for self-service inventory management remain unadopted in the state.

Challenges

The evaluation of operational challenges yielded an overall grand mean of 2.98, confirming that major systemic barriers impede technological advancement. The data reveal that these obstacles are strictly structural and resource-driven rather than behavioural. These findings directly validate industry surveys by Bibliotheca (2026), which identified severe budgetary constraints as the primary impediment to acquiring high-tier library technologies. Regionally, these results align with Odigie (2024), who highlighted that university libraries in North-Central Nigeria frequently experience operational bottlenecks caused by chronic underfunding, hardware deficits, and a dearth of specialized technical personnel required to deploy and maintain complex systems.

A crucial empirical insight from this study lies in the rejection of human-centred barriers. Respondents explicitly disagreed that staff resistance to change or poor internet connectivity constituted primary obstacles. This provides a vital contribution to technology adoption literature in developing nations. Which means library personnel exhibit strong behavioural intention and psychological readiness to adopt modern tools. The persistence of traditional, manual service delivery noted in the problem statement is not a consequence of staff apathy or hostility toward technological change, but rather a direct reflection of institutional under-investment, missing physical infrastructure, and inadequate skilled technical support.

Since the pattern of responses reveals that these challenges are concentrated around funding, infrastructure, and technical staffing rather than internet connectivity or staff attitudes toward change. This suggests that interventions aimed at improving technology adoption in these libraries should prioritize increased budgetary allocation, infrastructural development, and capacity building/recruitment of technically skilled personnel, as these appear to be the most pressing constraints according to library staff themselves.

Summary of the findings

1. The findings reveal that university libraries in Kogi State have adopted only a limited range of emerging technologies, favouring simpler, internet-based

tools over more sophisticated or resource-intensive innovations such as artificial intelligence applications, blockchain, virtual/augmented reality, big data analytics, and automated delivery systems.

2. This challenges to low level of adoption are largely attributable to inadequate funding, poor infrastructure, and insufficient technical staffing, rather than staff resistance to change or connectivity problems.

Conclusion

This study set out to evaluate the adoption rate of emerging technologies for service provision in university libraries in Kogi State, Nigeria. The findings revealed that while these libraries have made modest progress in embracing certain technologies, most notably Web 2.0/3.0 tools, institutional repositories, internet access, artificial intelligence resources, and cloud computing, their overall level of technology adoption remains low, as reflected in the grand mean of 2.31. More advanced and resource-intensive innovations, such as blockchain technology, big data analytics, virtual and augmented reality, machine learning applications, and automated systems like book delivery drones and library trackers, remain largely unadopted.

The study further established that this limited adoption is driven primarily by structural challenges, particularly inadequate funding, poor infrastructure, and a shortage of technical support staff, rather than by staff resistance to change or connectivity issues. This suggests that the barriers to technological advancement in these libraries are largely resource-based and therefore addressable through deliberate institutional and policy intervention.

In conclusion, university libraries in Kogi State are yet to fully harness the transformative potential of emerging technologies in service delivery. Bridging this gap will require sustained investment in ICT infrastructure, increased budgetary allocation, and capacity building for library staff, if these institutions are to remain competitive and responsive to the evolving information needs of their academic communities in the digital age.

Recommendation

This study has the following recommendations;

1. Given the low uptake of most examined emerging technologies libraries should consider a phased or pilot implementation approach, starting with cost-effective, high-impact technologies before scaling up to more complex systems. Also, University Librarians can develop clear ICT policies and strategic plans. These would outline specific goals, timelines, and

responsibilities for technology adoption in library services, ensuring accountability and continuity

2. Library management should organize regular training, workshops, and seminars to upskill existing staff in the use of emerging technologies, and the university management should recruit qualified ICT and technical support personnel to aid the management and maintenance of these new systems.

References

Abid, H. (2021). Uses of blockchain technologies in library services. *Library Hi Tech News*, *38*(8), 9–11. https://doi.org/10.1108/LHTN-08-2020-0079

Asim, M., & Arif, M. (2023). Internet of Things Adoption and Use in Academic Libraries: A Review and Directions for Future Research. *Journal of Information Science*. https://doi.org/10.1177/01655515231188338

Bibliotheca. (2026). *AI In Libraries: What's Changed, What's At Stake*. https://www.bibliotheca.com/ai-in-libraries/

Cox, A. M., & Dixon, N. (2026). UK librarians' Views of Chatbots: A Study Based on Fictional Scenarios. *The Journal of Academic Librarianship*, *52*(2), 103213. https://doi.org/10.1016/j.acalib.2026.103213

Creswell, J. (2022). Sampling and integration mixed methods. In *University of Michigan Family Medicine*. https://www.youtube.com/watch?v=LZDTQVOI9ZI

Creswell, J. W., & Plano Clark, V. L. (2018). Core Mixed Methods Design. *Designing and Conducting Mixed Methods Research Approach*, 77–84.

Gardella, G. (2025). Digital Transformation: How Libraries Are Implementing AI in 2025 - Liblime. In *Liblime*. https://liblime.com/2025/11/13/digital-transformation-how-libraries-are-implementing-ai-in-2025/

Guo, Y., Li, S., Zhang, X., Fu, Y., Yuan, Y., & Liu, Y. (2024). Embracing the Metaverse: A Survey of Virtual Reality and Augmented Reality Practices at the United States' Top One Hundred University Libraries. *College & Research Libraries*, *85*(7). https://doi.org/10.5860/crl.85.7.1006

Hotsonyame, G. N. (2025). *Integration of Emerging Technologies by Academic Libraries: A Literature Review*. https://doi.org/10.21203/rs.3.rs-6576779/v1

Idhris, M., & Peter, M. (2024). Investigating the Impact of AI Chatbots on Library Operations and Information Retrieval in Academic Libraries. *IP Indian Journal*

of Library Science and Information Technology, *9*(2), 132–134. https://doi.org/10.18231/j.ijlsit.2024.021

Kanyika, M. E., Raikhan Sadykova, Kalima Tuenbaeva, & Chuwa, L. (2025). Adapting to new technologies: A systematic literature review of blockchain implementation in academic libraries. *Information Development*. https://doi.org/10.1177/02666669241312153

Li, L., & Coates, K. (2024). Academic Library Online Chat Services Under the Impact of Artificial Intelligence. *Information Discovery and Delivery*. https://doi.org/10.1108/idd-11-2023-0143

Odigie, I. (2024). Exploring the awareness, use and challenges facing the integration of artificial intelligence in library services by librarians in university libraries in North-Central, Nigeria. *Communicate: Journal of Library and Information Science*, *26*(1), 222–229.

Saunders, L., & Rutherford, B. (2024). ChatGPT and Reference Success: Do Librarians Beat the Bot? *Public \& Access Services Quarterly*, *20*(4), 237–256. https://doi.org/10.1080/15228959.2024.2393850

Xu, H., Liu, W., Li, L., & Zhou, Q. (2024). An IoT-Based Low-Cost Architecture for Smart Libraries Using SDN. *Scientific Reports*, *14*(1), 7022. https://doi.org/10.1038/s41598-024-57484-2

Zhou, Q. (2024). Smart Library Architecture Based on Internet of Things (IoT) and Software Defined Networking (SDN). *Heliyon*, *10*(3), e25375–e25375. https://doi.org/10.1016/j.heliyon.2024.e25375