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TECHNOLOGICAL INNOVATION AND INFORMATION SERVICE DELIVERY IN FEDERAL UNIVERSITY LIBRARIES IN NORTH-WEST NIGERIA

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Abstract

Technological innovation is central to modern academic library operations, yet evidence linking librarians' innovation levels to information service delivery in federal university libraries in North-West Nigeria remains limited. This study examined the level of technological innovation among librarians and its relationship with information service delivery in three first-generation federal university libraries in North-West Nigeria. A descriptive survey design with correlational analysis was adopted. The population comprised 767 library staff; 263 were sampled using Yamane's formula and proportionate stratified random sampling, and 257 valid questionnaires were retrieved (97.7%). The TITIISDQ measured technological innovation (α = .82) and information service delivery (α = .84). Descriptive statistics answered the research questions, while Pearson's product-moment correlation tested the null hypothesis at .05. Librarians showed a high level of

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technological innovation (M = 3.18, SD = 0.79), especially exploring technology-based service methods (M = 3.25) and initiating technology-based solutions (M = 3.22). Technological innovation correlated significantly and positively with information service delivery ($r = .661$, $p < .001$), accounting for 43.7% of variance. The study concludes that technological innovation is a substantial driver of information service delivery quality. It recommends sustained ICT investment, adoption of emerging technologies, continuous staff capacity-building, and supportive digital library policies.

Keywords: Technological Innovation, Information service delivery, Academic Libraries, Federal University Libraries, North-West Nigeria

Introduction

The global transformation of academic library services over the past three decades has been fundamentally driven by technological innovation. The concept of technological innovation, rooted in the Diffusion of Innovations framework of Rogers (2003), refers to the intentional adoption and implementation of new ideas, practices, or technologies perceived as novel by an adopting organisation, with the objective of improving its operational effectiveness and service outcomes. In the academic library context, technological innovation encompasses the deployment of integrated library management systems, institutional repositories, online public access catalogues, electronic databases, digital preservation tools, social media platforms, mobile applications, artificial intelligence, and an expanding array of emerging technologies that collectively transform the scope, efficiency, and accessibility of library services (Jantz, 2017; Breeding, 2018).

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Information service delivery the organised and systematic provision of relevant, timely, and reliable information to library user communities is the primary performance domain through which academic libraries demonstrate their value to the university enterprise. The relationship between technological innovation and information service delivery is theoretically grounded in the proposition that technologies serve as force multipliers for library service capacity, enabling librarians to serve more users, more effectively, across greater distances and time spans than would be achievable through purely conventional service models (Buckland, 2017; Ezeani and Igwe, 2020). Libraries that integrate appropriate technological innovations into their operations are, in theory, better positioned to provide efficient reference services, expand access to electronic information resources, develop institutional repositories, conduct digital preservation, and deliver user education and support services through digital channels. This theoretical relationship, while well-established in the library and information science literature, has been less systematically investigated through quantitative empirical analysis at the level of individual library systems and within specific geopolitical contexts in Nigeria.

Federal university libraries in North-West Nigeria have been active participants in the broader technological transformation of Nigerian academic librarianship, adopting integrated library management systems, expanding institutional repository development,

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implementing digitisation projects, and incorporating social media and electronic reference services into their service portfolios (Abdulsalami and Saleh, 2022; Garba and Lawal, 2023). These developments have been facilitated by TETFund interventions, which have provided capital funding for ICT infrastructure, and by growing institutional awareness of the strategic importance of digital library services. Nevertheless, the extent to which these technological innovation practices are systematically translating into measurable improvements in information service delivery and the magnitude and statistical significance of this relationship has not been rigorously quantified for the North-West Nigerian federal university library context. The present study addresses this evidence gap through a quantitative correlational investigation grounded in Rogers' (2003) Diffusion of Innovations theory.

Statement of the Problem

Federal university libraries in North-West Nigeria have adopted several technological innovations, including integrated library management systems, electronic reference services, social media platforms, digitization tools, and institutional repositories. However, available accounts have often examined these technologies one at a time or focused on specific library functions, rather than assessing technological innovation as a broad, multidimensional practice among librarians. Consequently, the overall level of

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technological innovation in these libraries has not been clearly established, and the extent to which it relates to information service delivery quality remains insufficiently quantified. This gap is practically important because library administrators need evidence on whether technology adoption produces measurable service improvements, and theoretically important because it tests the relevance of Rogers' Diffusion of Innovations framework in a North-West Nigerian academic library context. This study therefore investigated the level of technological innovation among librarians and its relationship with information service delivery in federal university libraries in North-West Nigeria.

Research Questions

The study was guided by the following research questions:

1. What is the level of technological innovation adopted by librarians in federal university libraries in North-West Nigeria?

2. What is the relationship between technological innovation and information service delivery among librarians in federal university libraries in North-West Nigeria?

Null Hypothesis

The following null hypothesis was tested at the 0.05 level of significance:

H_0: There is no significant relationship between technological innovation and information service delivery among librarians in federal university libraries in North-West Nigeria.

Review of Related Literature

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Technological Innovation in Academic Libraries

Technological innovation in academic libraries is a multidimensional phenomenon that encompasses the adoption of integrated library management systems, the development of institutional repositories and digital collections, the implementation of electronic reference and information literacy services, and the exploration of emerging technologies such as artificial intelligence and cloud computing (Jantz, 2017; Lwoga and Questier, 2019). Breeding (2018) documents the global trajectory of library technology adoption, noting that contemporary library management systems have evolved from standalone automation platforms into integrated cloud-based services capable of managing hybrid print-digital collections, supporting advanced discovery layers, and interfacing with institutional systems for authentication, analytics, and reporting. This evolution reflects a broader pattern of technological innovation in which libraries continuously adapt to changing information environments by experimenting with, adopting, and integrating new tools and platforms.

In the African academic library context, technological innovation has been documented across multiple studies examining specific adoption domains. Asamoah-Hassan (2021) argues that African academic libraries are under existential pressure to embrace digital transformation to remain relevant in an increasingly knowledge-based economy, and that technological innovation is the primary mechanism through which

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libraries can adapt to this pressure. The author notes that while the pace of innovation in African academic libraries has historically lagged behind that of libraries in the Global North, the gap has been narrowing as a result of improved internet connectivity, expanded mobile technology penetration, and growing institutional awareness of the strategic value of digital library services. Dei and Asante (2022) corroborate this assessment in their study of Ghanaian academic libraries, finding that institutions with higher levels of technological innovation demonstrated significantly better performance on service quality dimensions including accessibility, responsiveness, and collection currency.

In the Nigerian context, Ezeani and Igwe (2020) conducted a comprehensive study of technological innovation adoption across a sample of Nigerian academic libraries, finding that integrated library management systems, electronic databases, and institutional repositories were the most widely adopted innovations, while artificial intelligence, virtual reality, and cloud-native library services represented the frontier of emerging technology adoption. Their study identified inadequate ICT infrastructure, limited funding, poor internet connectivity, and insufficient staff capacity as the principal barriers to deeper and more consistent technological innovation, findings that are directly relevant to the North-West Nigerian institutional context examined in the present study. Ekwelem and Ezeani (2023) subsequently documented growing awareness among Nigerian university librarians of the potential of artificial intelligence to transform library operations, noting that while

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full-scale AI implementation remains limited, librarians' positive attitudes toward AI adoption augur well for its future uptake.

Social Media and Emerging Technologies as Service Innovation Platforms

Social media platforms have emerged as important channels for information service delivery innovation in academic libraries. Abdulsalami and Saleh (2022) found that librarians in federal university libraries in North-West Nigeria increasingly use Facebook, WhatsApp, and Twitter to disseminate information, promote library services, conduct current awareness activities, and maintain user engagement outside the physical library environment. This finding is consistent with Davis and Williams (2022), whose global survey of academic library social media practices found that social media adoption had become near-universal among research libraries, with platforms serving as primary channels for virtual reference services, collection promotion, and user community building. The value of social media as an information service delivery innovation lies in its ability to reach users where they are rather than requiring them to seek out the library, thereby reducing access barriers and expanding the effective service radius of the library beyond its physical boundaries.

Institutional repositories and digitisation initiatives represent another significant dimension of technological innovation with direct implications for information service delivery. Ezema and Ugwu (2020) documented that institutional repositories in Nigerian

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federal university libraries have substantially improved the visibility and accessibility of locally produced research, enabling library users to access indigenous scholarly output that was previously difficult to locate. Jain, Bentley and Oladiran (2022) observed similar benefits in their pan-African survey of institutional repository development, noting that repositories not only improved information access but also positioned university libraries as active producers rather than passive custodians of scholarly information. Iwe (2023) further documented the contribution of digitisation projects to information service delivery quality in Nigerian university libraries, particularly in providing access to rare, fragile, and historically significant materials that could not otherwise be made available to contemporary users.

The Technology–Service Delivery Relationship: Empirical Evidence

The empirical evidence for a positive relationship between technological innovation and information service delivery quality is substantial and cross-contextual. Igbeka and Ola (2021) identified the availability and functionality of library technology as one of the strongest determinants of information service delivery quality in their study of Nigerian federal university libraries, finding that libraries with better technological facilities consistently achieved higher ratings on service responsiveness, accessibility, and reliability. Taylor and Francis (2021) similarly documented a significant positive association between modern technological infrastructure and service quality across a

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multi-institutional sample in their comparative study of academic library service determinants. These findings are consistent with the broader service quality literature in library and information science, which consistently identifies technology as a primary driver of the Information Control dimension of service quality in the LibQUAL+ framework (Thompson, Cook and Heath, 2020).

Studies that have specifically examined the innovation–service delivery relationship through correlational analysis provide stronger inferential evidence. Dei and Asante (2022) established a significant positive correlation between technology adoption levels and service quality ratings in Ghanaian academic libraries, while Davis and Williams (2022) documented that social media technology adoption was positively correlated with user engagement and virtual reference service utilisation rates across a global sample of academic libraries. These studies collectively support the theoretical proposition derived from Rogers' (2003) DOI framework that higher levels of technological innovation adoption translate into measurably superior information service delivery outcomes, providing the empirical backdrop against which the present study's findings are interpreted.

Research Method

This study adopted a descriptive survey design with a correlational component. The population comprised 767 library staff from three first-generation federal university

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libraries in North-West Nigeria: Ahmadu Bello University, Zaria; Bayero University, Kano; and Usmanu Danfodiyo University, Sokoto. Using the Yamane formula and proportionate stratified random sampling, 263 respondents were selected, and 257 valid questionnaires were retrieved, giving a response rate of 97.7%. Data were collected using the TETFund Intervention, Technological Innovation and Information Service Delivery Questionnaire (TITIISDQ), whose technological innovation scale (10 items; α = .82) and information service delivery scale (10 items; α = .84) were validated in a pilot study. Descriptive statistics were used to answer the research questions, while Pearson's product-moment correlation coefficient was used to test the null hypothesis at the .05 level with IBM SPSS Statistics Version 26. Ethical standards were maintained through voluntary informed consent, anonymity, and confidentiality.

Results and Discussion

Research Question 1: What is the level of technological innovation adopted by librarians in federal university libraries in North-West Nigeria?

Table 1

Level of Technological Innovation among Librarians in Federal University Libraries in North-West Nigeria (n = 257)

S/N	Items	Never	Rarely	Sometimes	Often	*M*	*SD*

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1.	I adopt integrated library management system (ILMS) for cataloguing and classification of library materials.	16 (6.2)	16 (6.2)	134 (52.1)	91 (35.4)	3.17	0.80
2.	I regularly adopt social media platforms (Facebook, Twitter, WhatsApp) to promote library services and engage with users.	21 (8.2)	12 (4.7)	135 (52.5)	89 (34.6)	3.14	0.84
3.	I usually adopt emerging technologies before they become standard practice.	17 (6.6)	16 (6.2)	128 (49.8)	96 (37.4)	3.18	0.82
4.	I initiate electronic reference services (email, chat, online forms) to respond to user enquiries.	19 (7.4)	16 (6.2)	132 (51.4)	90 (35.0)	3.14	0.83
5.	I regularly adopt new technologies to improve library services.	6 (2.3)	22 (8.6)	141 (54.9)	88 (34.2)	3.21	0.69
6.	I initiate technology-based solutions to library challenges.	8 (3.1)	20 (7.8)	136 (52.9)	93 (36.2)	3.22	0.72

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7.	I adopt emerging technologies such as QR codes, mobile applications, or Artificial Intelligence (AI).	16 (6.2)	18 (7.0)	120 (46.7)	103 (40.1)	3.21	0.83
8.	I integrate innovative digital tools into library operations.	13 (5.1)	22 (8.6)	139 (54.1)	83 (32.3)	3.14	0.77
9.	I explore new methods of delivering information services through technology.	12 (4.7)	17 (6.6)	123 (47.9)	105 (40.9)	3.25	0.78
10	I participate in the digitization of library materials (theses, rare books, local content).	16 (6.2)	18 (7.0)	135 (52.5)	88 (34.2)	3.15	0.80
	Grand Mean					**3.18**	**0.79**

Note. Scale: 1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Often. Criterion mean = 2.50.

The results show that all ten technological innovation items exceeded the criterion mean of 2.50, with a grand mean of 3.18 (SD = 0.79). This indicates a high level of technological innovation among librarians in the studied libraries. The highest-ranked item was exploring new methods of delivering information services through technology (M = 3.25, SD = 0.78), followed by initiating technology-based solutions to library challenges (M = 3.22, SD = 0.72) and regularly adopting new technologies to improve library services (M =

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3.21, SD = 0.69). The adoption of emerging technologies such as QR codes, mobile applications, and artificial intelligence also recorded a high mean (M = 3.21, SD = 0.83). The lowest item means—social media adoption, electronic reference services, and integration of innovative digital tools (M = 3.14 each)—remained well above the criterion threshold. This finding is consistent with Ezeani and Igwe (2020), who documented increasing adoption of digital technologies across Nigerian academic libraries, and with Abdulsalami and Saleh (2022), who reported high social media adoption among librarians in North-West Nigerian federal university libraries. It also supports Ekwelem and Ezeani (2023), who observed growing awareness and readiness for artificial intelligence among Nigerian university librarians. Overall, the findings suggest that digital transformation in these libraries has progressed beyond basic awareness to active and diverse innovation engagement.

Research Question 2 What is the relationship between technological innovation and information service delivery among librarians in federal university libraries in North-West Nigeria?

Table 2
Pearson Correlation Analysis of the Relationship between Technological Innovation and Information Service Delivery (n = 257)

Variables	**N**	***r***	***p***	**Decision**
Technological Innovation	257	.661	< .001	Reject

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Note. r = Pearson correlation coefficient; $p < .05$ = statistically significant. Coefficient of determination (r^2) = .437.

Table 2 shows a strong, positive, and statistically significant relationship between technological innovation and information service delivery ($r = .661$, $p < .001$). The coefficient of determination ($r^2 = .437$) indicates that technological innovation accounts for approximately 43.7% of the variance in information service delivery scores, representing a large effect size. The null hypothesis is therefore rejected. This finding indicates that librarians who report higher levels of technological innovation also report higher quality information service delivery in terms of responsiveness, efficiency, accessibility, accuracy, and user satisfaction. The result provides empirical support for Rogers' (2003) Diffusion of Innovations framework and aligns with Igbeka and Ola (2021), who identified technology as a strong determinant of information service delivery in Nigerian federal university libraries. It also agrees with Dei and Asante (2022) and Taylor and Francis (2021), who found positive associations between technology adoption and service quality in academic libraries. The remaining 56.3% of variance not explained by technological innovation suggests that other factors, such as funding, institutional policy, staff competence, and user characteristics, also influence service delivery.

Recommendations

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Based on the findings, the following recommendations are made:

1. University management should provide dedicated and sustained budget allocations for ICT acquisition, upgrading, and maintenance in federal university libraries, given the demonstrated positive relationship between technological innovation and information service delivery.

2. Library management should institutionalise structured programmes for the continuous adoption of emerging digital technologies, including artificial intelligence, cloud-based library services, institutional repositories, and mobile library applications.

3. University and library administrators should invest in continuous capacity-building for librarians and library staff through workshops, certifications, and hands-on training on current and emerging library technologies.

4. Federal university libraries should develop and implement clear digital library policies covering internet connectivity, power supply, technical support, digital preservation, and data security to sustain innovation-driven service delivery.

5. Library management should strengthen user-centred digital services and regularly assess service quality using user feedback, LibQUAL+ or similar instruments, so that technology adoption remains directly linked to user needs and satisfaction.

6. Universities should encourage inter-institutional collaboration and effective utilisation of TETFund and other funding interventions to expand shared digital infrastructure, resource

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repositories, and staff development across North-West Nigerian federal university libraries.

Conclusion

This study established that librarians in federal university libraries in North-West Nigeria demonstrate a high level of technological innovation, especially in exploring technology-based service methods, initiating technology-based solutions, and adopting emerging technologies. It also found a strong, statistically significant positive relationship between technological innovation and information service delivery ($r = .661$, $p < .001$, $r^2 = .437$). Technological innovation therefore emerges as a substantial driver of information service delivery quality in the studied libraries. The findings support Rogers' Diffusion of Innovations framework and provide evidence that sustained technology investment, capacity-building, and supportive digital policies can improve academic library services in North-West Nigeria.

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