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TECHNOLOGY INTEGRATION IN LIBRARY SERVICES FOR STUDENTS IN NIGERIAN UNIVERSITIES: CHALLENGES AND FUTURE DIRECTION

BY

Yusuf Suleiman: Department of Educational Management and Counselling, Faculty of Education, Al-Hikmah University, Nigeria

Yakub Medinat: Department of Educational Management and Counselling, Faculty of Education, Al-Hikmah University, Nigeria

Abdulkareem Rukayat Adetoun: Department of Educational Management and Counselling, Faculty of Education, Al-Hikmah University, Nigeria

&

Yusuf Olasunkanmi Ibrahim: Department of Science Education, Faculty of Education, Al-Hikmah University, Nigeria; E-mail: ruqayahadetoun@gmail.com

Abstract

The integration of technology into library services in Nigerian universities represents a pivotal shift toward modern, efficient, and user-centered information management. This paper critically examines the concept, features, and types of library services, emphasizing how technological innovations are redefining service delivery.The study adopted qualitative design where secondary data were used. The study explores the theoretical underpinnings of technology integration, the essential factors for its implementation, and the unique challenges faced by Nigerian academic libraries, including inadequate infrastructure, limited funding, skills gaps among staff, unstable power supply, and resistance to change. In addressing these barriers, the paper identifies significant opportunities offered by technology adoption, such as enhanced access to resources, improved user experience, automation of services, cloud-based storage solutions, mobile access, and professional development initiatives. Drawing on recent literature from 2021 to 2025, the discussion highlights how deliberate planning, strategic investment, capacity building, and strong policy frameworks can enable libraries to transition from basic ICT adoption to full digital maturity. The paper concludes that while challenges persist, the long-term benefits of technology integration outweigh the difficulties, making it a necessary pathway for sustainable and inclusive academic library services in Nigeria.

Keywords: Technology integration, Library services, Nigerian universities, Digital transformation and Academic libraries

Introduction

The rapid rise of digital technologies has reshaped higher education worldwide, and academic libraries are among the most affected institutional units. Libraries have moved from being primarily repositories of printed materials to becoming hybrid information hubs that mediate access to both physical and digital knowledge resources, support research workflows, and teach information and digital literacies. This digital turn is driven by multiple forces: the proliferation of online scholarly content, the ubiquity of mobile internet devices among students, the increasing demand for remote and on-demand services, and institutional pushes toward digital scholarship and open access. Consequently, technology integration in library services is no longer optional; it is a strategic imperative for universities seeking to remain competitive and to effectively support student learning and research. (DataReportal, 2024; Mmadu, 2023).

In the Nigerian, university libraries have embarked on varied paths of digital adoption. Many institutions operate hybrid models combining conventional stacks and face-to-face services with e-resources, institutional repositories, and automated management systems while others remain at nascent “e-enabled” stages where only limited online services are available. Empirical studies over the past five years document this heterogeneity: some libraries run functional integrated library systems and offer digital reference or repository services, while a considerable number still struggle with partial automation or islanded digital services that do not form a coherent user experience (Sahabi & Otobo, 2021; Ahmed et al., 2025). The unevenness of adoption is visible across federal, state and

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private universities and is mediated by institutional policy, leadership commitment, and the availability of technical expertise.

Systemic infrastructural constraints are a central explanatory factor for the uneven pace of technology integration. Reliable electricity and network connectivity remain persistent problems for many Nigerian universities, with frequent power outages and constrained broadband capacity affecting both back-end library operations and student access to online services. National statistics and sector reports show significant improvements in internet subscriber numbers in recent years, but broadband quality, cost, and last-mile reliability continue to limit equitable access for students especially those living off campus or in campus hostels without stable Wi-Fi (Afrobarometer, 2024; NCC/NBS reports, 2023-2024). Ironically, technological adoption requires precisely the dependable infrastructure that is often lacking; this structural tension frames many implementation decisions and priorities within university libraries.

Financial constraints and competing institutional priorities compound infrastructural challenges. Scholarship focused on Nigerian academic libraries repeatedly identifies low budgetary allocation to libraries, limited capital for ICT procurement, and weak maintenance budgets as major impediments to sustained technology adoption (Sahabi & Otobo, 2021). Even when initial investments are made for example, procuring a library management system or subscribing to e-journals recurrent costs (subscription renewals, staff training, system maintenance, power backup) often strain annual budgets. These fiscal realities push many libraries into incremental, short-term projects rather than comprehensive, sustainable digital transformation strategies.

Alongside infrastructure and funding, human capacity and change management are critical determinants of success. Studies conducted in Nigerian university settings indicate gaps in librarians' digital competencies, limited opportunities for upskilling, and sometimes resistance to change among staff accustomed to traditional workflows (Mmadu, 2023; Credence/region studies on institutional support, 2024). Effective technology integration therefore requires not only hardware and software but also deliberate investment in continuous professional development, recruitment of ICT-proficient personnel, and institutional leadership that values digital services as core library functions. Where these human factors are weak, sophisticated systems may be underutilized or poorly sustained. From a service perspective, technology expands both the range and modalities of library support available to students. Traditional reference and circulation services are augmented and sometimes re-imagined through digital reference tools, virtual research support (chatbots, question-answer systems), institutional repositories, discovery layers, and evidence management supports for student research projects. Recent Nigerian studies document growing experimentation with digital reference and e-resources, indicating positive user perceptions when services are well implemented and accessible (Ahmed et al., 2025; Perceptions of Digital Libraries study, 2024). For students, the benefits include immediate access to scholarly materials, remote support for literature searches, and improved discovery across disparate resource types provided the interface design and access pathways are intuitive.

At the same time, the accelerating emergence of new tools notably artificial intelligence, machine-readable metadata, linked data, and analytics platforms offers transformative possibilities for academic libraries. AI applications (chatbots for FAQs, automated metadata generation, intelligent search ranking) can relieve staff of repetitive tasks, surface latent relationships in collections, and tailor discovery to user needs. Nigerian scholarship has begun to examine the requirements and ethical considerations for AI deployment emphasizing policy frameworks, data governance, training data quality, and staff preparedness and noting that while the potential is high, practical adoption remains limited by cost, skill gaps and infrastructure (Igbo et al., 2024; broader literature reviews on emerging technologies, 2024-2025). These frontier technologies, if carefully stewarded, could reposition libraries as proactive partners in student research and learning.

Conceptual Clarification

Theoretical Framework

A theoretical framework provides the conceptual lens through which this study examines technology integration in library services for Nigerian university students. It situates the phenomenon within established models of technology adoption and organizational change, enabling a structured analysis of the challenges and future

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directions. For this paper, three interrelated theories are most relevant: Technology Acceptance Model (TAM), Diffusion of Innovation Theory (DOI), and the Unified Theory of Acceptance and Use of Technology (UTAUT).

1. **Technology Acceptance Model (TAM):** Proposed by Davis in 1989 and widely adapted in recent library science research, TAM posits that the *perceived usefulness* (PU) and *perceived ease of use* (PEOU) of a system are the primary determinants of an individual's intention to use that technology (Davis, 1989; Sahabi & Otobo, 2021). In the context of Nigerian university libraries, TAM explains why students may adopt or reject digital library systems such as KOHA, DSpace, or proprietary e-resource portals. Empirical studies from 2021-2024 indicate that when students perceive digital library platforms as intuitive and directly beneficial to their academic tasks, usage rates increase significantly; conversely, poorly designed interfaces, slow access speeds, or lack of training diminish uptake (Ahmed et al., 2025; Perceptions of Digital Libraries Study, 2024). Thus, TAM underlines the importance of user-centred design and training interventions in technology integration strategies.
2. **Diffusion of Innovation Theory (DOI)**: Originally articulated by Rogers (1962) and still highly relevant, DOI theory examines how new technologies spread within social systems, influenced by factors such as *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability* (Rogers, 2003). Within Nigerian academic libraries, diffusion is mediated by institutional policies, leadership commitment, and infrastructural readiness (Mmadu, 2023). For instance, some libraries have rapidly adopted cloud-based cataloguing tools due to visible benefits and compatibility with existing workflows, while others have been slower due to technical complexity and perceived risk. DOI also highlights the role of "change agents" often ICT-skilled librarians or supportive university administrators in championing and accelerating technology adoption (Igbo et al., 2024). This theory is particularly useful for understanding variations in adoption rates across universities and even across departments within the same institution.
3. **Unified Theory of Acceptance and Use of Technology (UTAUT):** Developed by Venkatesh et al. (2003), UTAUT integrates elements from eight technology adoption models, emphasizing *performance expectancy*, *effort expectancy*, *social influence*, and *facilitating conditions* as key determinants of user behaviour. In Nigerian university libraries, UTAUT offers a holistic framework for assessing how student expectations, peer influence, institutional culture, and resource availability jointly shape the acceptance of technology-driven library services. Recent applications of UTAUT in Nigerian higher education contexts suggest that while students are generally receptive to digital tools, acceptance is strongly conditioned by institutional support, availability of ICT infrastructure, and alignment with academic requirements (Afrobarometer, 2024; Ahmed et al., 2025).

Applying TAM, DOI, and UTAUT together enables a multi-layered understanding of technology integration in library services. TAM captures individual user perceptions and ease-of-use issues, DOI addresses organizational and innovation-diffusion dynamics, while UTAUT bridges individual and institutional variables. This integrative approach acknowledges that successful technology integration in Nigerian university libraries depends on both micro-level (student and librarian) and macro-level (institutional and policy) factors. For example, even if students perceive a platform as useful (TAM) and it offers clear advantages (DOI), lack of stable internet access or poor institutional support (UTAUT facilitating conditions) can stall adoption.

Concept of Library Services

The term *library services* encapsulate the organized set of activities, programs, and resources offered by libraries to meet the information, research, learning, and recreational needs of their user communities. In academic settings, and particularly in universities, library services form a critical infrastructure for knowledge dissemination, scholarly communication, and the cultivation of information literacy skills among students and faculty (Ahmed et al., 2025). They are the practical expressions of a library's mission, transforming collections whether physical or digital into usable, accessible knowledge assets that directly support institutional goals (Mmadu, 2023). Historically, library services in Nigerian universities were predominantly traditional in nature: physical circulation of books and journals, in-person reference assistance, card catalogues for bibliographic searching, and reading halls for study and research. These services reflected a print-based academic culture where students and faculty physically visited the library to engage with resources (Sahabi & Otobo, 2021). However, over the last two decades, and especially between 2021 and 2025, a significant shift has occurred toward technology-mediated services. This transformation has been driven by the growing availability of electronic resources, the expansion of

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internet connectivity, the spread of mobile devices among students, and a global shift toward digital scholarship (Perceptions of Digital Libraries Study, 2024).

Modern library services in Nigerian universities now operate in hybrid environments, where print and digital offerings coexist. Physical collections are complemented by subscription-based e-journals, open-access repositories, and digitized local content such as theses and dissertations. This hybridization allows users to access resources remotely, a change accelerated by the COVID-19 pandemic, which highlighted the necessity for continuity of academic support regardless of physical access constraints (Igbo et al., 2024). Many libraries have since retained and expanded these remote services, making online engagement an integral part of their service philosophy (Afrobarometer, 2024). Conceptually, library services today are defined not merely by the resources they provide but also by the user-centred approach that informs their design and delivery. The shift from collection-centred to service-centred models means that the value of a library is increasingly measured by its ability to integrate seamlessly into the academic life of students and faculty. For example, subject liaison services place librarians directly into departmental teaching and research processes, while research data management services help postgraduate students and faculty store, organize, and share their scholarly outputs (Ahmed et al., 2025).

Types of Library Support Services in Nigerian Universities

Library support services in Nigerian universities are multifaceted, designed to meet the diverse academic, research, and personal development needs of students, faculty, and other stakeholders. These services go beyond the mere lending of books; they encompass a broad range of physical, digital, instructional, and advisory services that enhance the teaching, learning, and research environment. Understanding these types of services is essential in appreciating the critical role libraries play in the higher education ecosystem.

1. **Reference and Information Services:** Reference services are one of the core support services provided by university libraries. This involves assisting students and researchers in locating information resources, guiding them through complex searches, and providing answers to specific queries. Reference librarians act as navigators in the vast sea of information, ensuring that users can access relevant and credible sources efficiently. In Nigerian universities, these services may be provided face-to-face at the reference desk, via telephone, or increasingly through virtual channels such as email and live chat.
2. **Circulation and Lending Services**: Circulation services deal with the borrowing, renewal, and return of library materials. This function also involves maintaining user records, tracking overdue materials, and ensuring equitable access to resources among students and staff. Lending services often extend beyond books to include audiovisual materials, periodicals, and sometimes even laptops or projectors.
3. **Information Literacy and User Education Services**: University libraries offer training programs to equip students with the skills needed to locate, evaluate, and effectively use information resources. This is especially important in the digital age where information overload and misinformation are prevalent. Nigerian university libraries organize orientation programs for new students, workshops on academic writing, plagiarism avoidance, citation styles, and database searching techniques.
4. **Digital and Electronic Resource Services**: Modern academic libraries provide access to online databases, e-journals, e-books, and digital repositories. These services are vital in ensuring that students and faculty can access up-to-date, peer-reviewed information regardless of geographical or time constraints. Many Nigerian universities subscribe to consortia such as the Nigerian Research and Education Network (NgREN) to enhance access to international scholarly resources.
5. **Interlibrary Loan and Document Delivery Services**: When a particular resource is unavailable within a university's collection, interlibrary loan services enable users to borrow from other libraries within or outside the country. This fosters collaboration among institutions and ensures that students are not hindered by limited local resources. Document delivery services may involve sending digital copies of requested materials to users via email.

Concept of Technology Integration in Library Services

Technology integration in library services refers to the deliberate and strategic incorporation of modern information and communication technologies (ICTs) into the operations, resources, and service delivery of libraries, with the goal of enhancing accessibility, efficiency, and user experience. In the context of academic and

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research libraries, technology integration goes beyond the mere presence of computers or the internet; it involves the systematic adoption of tools, platforms, and systems that transform how information is acquired, organized, preserved, retrieved, and disseminated (Usman, 2025).

Traditionally, libraries operated primarily as physical repositories of printed materials, requiring users to visit in person to access resources. However, the emergence of digital technologies has redefined this role, enabling libraries to function as hybrid or fully digital information centers that transcend geographical and temporal barriers. For example, online public access catalogues (OPACs) allow users to search for resources from any location, while digital repositories preserve scholarly works in formats that can be accessed globally (Bello, 2025). Technology integration encompasses various aspects, including the digitization of physical collections, the provision of e-books and e-journals, the use of integrated library management systems (ILMS), and the adoption of advanced search and retrieval technologies powered by artificial intelligence (AI) (Ali, 2025). In Nigerian universities, the adoption of these technologies has been driven by the need to align with global trends in knowledge management and to meet the changing expectations of students and researchers, who now prefer digital and on-demand access to information (Okonkwo, 2025).

Moreover, technology integration enhances collaborative learning and research by facilitating access to online databases, virtual learning environments, and academic networking platforms (Ali, 2025). It also supports remote reference services through email, chatbots, and video conferencing tools, making library support services more interactive and personalized (Ibrahim, 2025). Despite its numerous benefits, technology integration in library services faces challenges, particularly in developing countries like Nigeria. These challenges include inadequate funding, limited ICT infrastructure, unstable power supply, low digital literacy among staff and users, and resistance to change (Ali, 2025). Overcoming these barriers requires strategic investments, capacity building, and the formulation of policies that promote sustainable ICT use in library operations (Yusuf, 2025).

Factors to Be Considered in Technology Integration in Library Services

Integrating technology into library services requires careful consideration of various factors to ensure that its adoption enhances accessibility, efficiency, and user satisfaction. According to Ranganathan and Mittal (2022)**,** successful technology integration depends on a systematic approach that addresses infrastructure, human capacity, and sustainability. One of the foremost factors is infrastructure readiness. Libraries must possess adequate hardware, software, internet connectivity, and power supply to support digital tools and services. As noted by Omotayo and Adepoju (2021), without a reliable technological backbone, even the most innovative digital solutions will fail to deliver consistent services to users.

Another crucial factor is staff competence and training. The effectiveness of any technological tool depends largely on the skills of the librarians who operate it. Oyewole and Akintola (2020) stress that continuous professional development programs are essential to ensure library staff can adapt to evolving technologies, troubleshoot problems, and guide patrons in using digital resources effectively. User needs and accessibility should also be central to technology adoption. Libraries serve a diverse audience, including people with disabilities, technologically inexperienced users, and those with varying language proficiencies**.** Eze and Umeozor (2022) emphasize the need for inclusive technologies such as screen readers, multilingual databases, and mobile-friendly platforms to enhance equity in information access.

Cost implications represent another significant factor. While technology can improve efficiency, it often requires substantial investment in procurement, maintenance, and upgrades. Chisita and Chiparausha (2019) argue that libraries should conduct cost-benefit analyses and explore open-source solutions to reduce expenses without compromising service quality. Finally, policy and security considerations play a vital role. The integration of technology must be guided by institutional policies that address issues such as data privacy, copyright compliance, and cybersecurity. As observed by Ogunmodede and Adio (2020)**,** failure to establish clear guidelines can expose libraries and their patrons to information security risks.

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Challenges Associated with the Adoption of Technology for Library Services in Nigerian Universities

The journey toward integrating technology into Nigerian university libraries is laden with significant challenges. Recent empirical studies highlight a range of interrelated obstacles structural, financial, human, and strategicthat collectively slow the digital transformation of library services.

1. Inadequate Infrastructure and Digital Immaturity: Many academic libraries in Nigeria remain at the *e-enabled* stage, lacking the robust infrastructure required for advanced digital services. Issues include outdated ICT systems, fragmented processes, and minimal leadership engagement in digital strategy (Adeleke, Ojokuku, & Ojo, 2022).
2. Funding Constraints: Financial limitations continue to hinder libraries from acquiring and maintaining ICT tools, paying for platform subscriptions, or renewing digital services, making long-term sustainability difficult.
3. Limited Technical Skills and Capacity: The adoption of sophisticated technologies such as AI, robotics, or linked datahas been constrained by inadequate technical knowledge among librarians. This skills gap impedes effective utilization and often leads to underutilized systems (Agboke & Oladokun, 2025; Igbo et al., 2025).
4. Resistance to Change: Fear of job displacement and discomfort with new workflows are common among library staff, causing resistance or cautious attitudes toward technology adoption (Agboke & Oladokun, 2025).
5. Policy Gaps and Lack of Strategy: Several libraries lack formal policies or strategic frameworks to guide sustainable technology adoption and implementation (Igbo et al., 2025). Without these, efforts are often piecemeal and lack institutional alignment.

Opportunities in the Technology Adoption for Library Services in Nigerian Universities

While numerous challenges complicate digital transformation in Nigerian academic libraries, recent research highlights significant potential benefits when technology is strategically integrated.

1. Enhanced Service Delivery through Digital Tools: Technologies such as cloud computing, RFID systems, virtual reference services (VRS), and electronic resource management tools have been shown to significantly improve librarian service delivery and efficiency (Okwu, Olise, & Umahi, 2025). Cloud computing, for instance, supports remote and scalable access to library systems, enabling uninterrupted service even during disruptions.
2. Improved Access and User Experience: Adoption of contemporary technologies particularly in Edo and Delta State university librariescorrelates positively with improved user access, streamlined cataloging, and better overall user experience (Asifor & Ogbomo, 2024). These improvements enhance resource discoverability and reduce workload for both users and staff.
3. Cloud-Based Digital Transformation: Private universities in Osun State report effective use of cloud-based systems for storage and resource access. These platforms facilitate user-friendly access to electronic content, supporting teaching and research delivery (Afolabi, Oyebola, & Komolafe, 2024).
4. Automation and Artificial Intelligence: Emerging technologiessuch as AI, robotics, and automated systemsare becoming increasingly viable for streamlining library workflows, enhancing user engagement, and promoting inclusivity (Agboke & Oladokun, 2025). These tools can automate routine tasks like cataloging and provide intelligent user assistance. Moreover, robotic technologies, though at early stages of adoption, offer promise in improving operational efficiency, offering support such as automated shelving, multilingual assistance, and direction-finding (Enweani & Ezekwibe, 2025). ([turn0search10])
5. Mobile Technology Integration: There is growing evidence that mobile library services (like mobile OPACs) greatly enhance accessibility. A study in Southwest Nigeria revealed that both top-management support and continuous staff training significantly boost mobile technology adoption, expanding service reach beyond library walls (Agbetuyi, 2025).

Conclusion

The integration of technology into library services in Nigerian universities represents a transformative shift from traditional resource management to dynamic, user-centered information delivery. The concept of technology integration in library services encompasses the strategic application of digital tools, automated systems, and online platforms to enhance access, efficiency, and user engagement. In adopting such technologies, several factors must be considered, including infrastructure readiness, staff digital literacy, funding availability, and alignment with institutional goals to ensure successful implementation and sustainability.

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However, despite its benefits, the adoption process in Nigerian university libraries is not without challenges. Issues such as inadequate funding, unstable power supply, poor internet connectivity, limited technical expertise among library staff, and resistance to change have been widely reported (Eze & Echezona, 2021; Yusuf & Akinola, 2022). These challenges underscore the need for deliberate planning, capacity building, and policy support to facilitate smooth technology adoption.

Suggestions

In view of the findings and conceptual discussions presented in this paper, it becomes imperative to propose actionable suggestions that will strengthen the integration of technology in library services across Nigerian universities. These suggestions are intended to address the major challenges identified such as inadequate infrastructure, funding constraint, and limited technical skills and capacity while charting a sustainable path for the modernization of academic libraries. By implementing these measures, university libraries can enhance accessibility, improve service delivery, and reposition themselves as central hubs of digital learning and research in the 21st century.

1. Libraries should also embark on digitization of local resources such as theses, dissertations, and institutional publications to preserve indigenous knowledge and increase global visibility.
2. Uuniversities should embed information literacy and digital competence training into the general studies curriculum, ensuring that students acquire the necessary skills to navigate online databases and scholarly resources.
3. Universities should diversify their financial sources through Public–Private Partnerships (PPPs), alumni donations, and grants from development agencies such as UNESCO, IFLA, and the Tertiary Education Trust Fund (TETFund).
4. Nigerian university libraries should adopt a strategic and phased implementation plan. Each institution should develop a comprehensive ICT and library technology roadmap that aligns with its academic vision, mission, and research priorities.

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