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Digital Transformation and Service Delivery in Academic Libraries in Nigeria: Challenges and Prospects in the Era of Emerging Technologies

Bola Christie Atulomah (PhD)
Federal Polytechnic Ilaro, now Federal University of Technology Ilaro
bolatuloma81@gmail.com | bola.atulomah@federalpolyilaro.edu.ng
https://orcid.org/0000-0002-5888-4852

Temitope Oluwabunmi Mabawonku
Department of Library and Information Science, Olabisi Onabanjo University, Ago-Iwoye, Ogun State.
mabawonku.temitope@oouagoiwoye.edu.ng;
https://orcid.org/0000-0002-2015-1071

Abstract
Digital transformation has become a critical driver of change in academic libraries globally, reshaping how information resources are acquired, managed, and delivered to users. This paper examines digital transformation and service delivery in academic libraries in Nigeria within the context of emerging technologies. It highlights how technologies such as artificial intelligence, cloud computing, big data analytics, and other digital innovations are influencing library operations and enhancing user-centered services. The paper adopts a conceptual and opinion-based approach, drawing on relevant literature to discuss the role of digital transformation in improving service delivery, the emerging technologies driving change, the challenges confronting implementation, and the prospects for academic libraries in Nigeria. Findings from the literature indicate that while digital transformation has significantly improved access to information resources, efficiency, and responsiveness of library services, its implementation in Nigeria is constrained by inadequate funding, poor ICT infrastructure, unstable electricity supply, limited digital skills among library personnel, and weak policy frameworks. Despite these challenges, the study identifies strong prospects, including improved research visibility, enhanced collaboration, personalized services, and global competitiveness of academic libraries. The paper concludes that sustained investment in infrastructure, capacity building, and institutional support is essential for effective digital transformation. Ultimately, emerging technologies present significant opportunities for repositioning academic libraries as dynamic knowledge hubs in the digital age.

Keywords: Digital transformation, Academic libraries, Service delivery, Emerging technologies, Nigeria.

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Introduction

The rapid advancement of information and communication technologies (ICTs) has significantly transformed the global information landscape, influencing how information is created, processed, stored, disseminated, and utilized across institutions and societies. The contemporary digital era has reshaped educational systems, research activities, communication patterns, and organizational operations, thereby compelling institutions to embrace innovative technologies to remain relevant and competitive. Digital transformation has become a defining feature of modern organizations as technological innovations continue to drive efficiency, accessibility, and service optimization across sectors. According to Egodawele, Sedera, and Bui (2022), digital transformation represents a broad organizational shift involving the integration of digital technologies into operational and service frameworks. Similarly, Furfuri (2025) observed that the digital revolution has fundamentally altered information management practices in academic libraries and necessitated new approaches to information service delivery. As the digital environment continues to evolve, academic libraries are increasingly confronted with the need to improve the quality and efficiency of their service delivery systems. The increasing pressure on academic libraries to meet evolving user expectations has brought the issue of effective service delivery to the forefront of scholarly and professional discussions.

Service delivery remains one of the fundamental responsibilities of academic libraries because libraries play crucial roles in supporting teaching, learning, research, and knowledge dissemination within higher educational institutions. However, the changing information-seeking behavior of users, coupled with technological advancement, has exposed deficiencies in traditional library service models. Many academic libraries, particularly in developing countries such as Nigeria, continue to experience challenges relating to delays in information access, limited digital services, poor user engagement, inadequate technological infrastructure, and inability to provide personalized information services. Saibakumo (2021) noted that the survival and continued relevance of academic libraries in the digital age depend largely on their ability to modernize and expand technology-driven services. Likewise, Oyedokun et al. (2023) emphasized that despite the emergence of new technologies, many Nigerian libraries still struggle to provide innovative services capable of attracting and satisfying digitally oriented users. These observable shortcomings in service delivery have intensified the need for academic libraries to embrace digital transformation as a strategic response to changing information demands. In response to these service delivery concerns; digital transformation has emerged as an important strategy for repositioning academic libraries in the contemporary information environment.

Digital transformation refers to the integration of digital technologies into organizational processes, services, and operational structures with the aim of improving efficiency, innovation, and user satisfaction. In academic libraries, digital transformation extends beyond simple automation to include the redesign of services, adoption of innovative technologies,

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enhancement of digital competencies, and development of user-centered information systems. Ikenwe and Udem (2022) argued that innovative digital transformation has become essential for sustaining dynamic information services in university libraries, especially in rapidly changing technological environments. Through digital transformation, libraries are now able to provide online catalogues, institutional repositories, digital reference services, electronic databases, remote access services, and virtual learning support systems. Agboke and Oladokun (2024) further observed that emerging technologies such as artificial intelligence, robotics, and automated systems are improving operational efficiency and expanding access to digital resources in academic libraries. Consequently, the growing integration of digital technologies has transformed the traditional structure and operations of academic libraries globally. The transformation of library operations through digital technologies has also contributed significantly to the evolution of academic libraries from traditional repositories into digitally driven knowledge centres.

The continuous advancement of emerging technologies has further accelerated the transformation of academic libraries and redefined the nature of library service delivery in the twenty-first century. Technologies such as artificial intelligence (AI), cloud computing, big data analytics, machine learning, Internet of Things (IoT), blockchain technology, and virtual reality are increasingly being integrated into library operations to improve information organization, retrieval, preservation, and user engagement. These technologies support the development of smart and user-centered library systems capable of delivering faster, more efficient, and personalized services to library users. According to Asemi and Asemi (2018), artificial intelligence has the capacity to transform academic library services through intelligent information retrieval systems, automated cataloguing, virtual reference services, and predictive user support. Similarly, Cox et al. (2019) observed that emerging technologies are reshaping scholarly communication and creating opportunities for libraries to expand their digital capabilities and research support functions. In Nigeria, the adoption of these technologies is gradually increasing as academic libraries seek to align with global technological trends and improve service effectiveness. Nevertheless, the level of adoption and implementation varies considerably across institutions due to differences in technological readiness and institutional support. Despite the growing recognition of the benefits associated with digital transformation and emerging technologies, academic libraries in Nigeria continue to face numerous challenges that hinder effective implementation and optimal service delivery.

Although digital transformation presents enormous opportunities for improving academic library services, several challenges continue to impede its effective implementation in Nigerian academic libraries. Among the major constraints are inadequate funding, unstable electricity supply, poor internet connectivity, inadequate ICT infrastructure, shortage of digitally skilled personnel, resistance to organizational change, and cybersecurity concerns. These challenges have limited the ability of many academic libraries to fully adopt emerging

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technologies and provide innovative digital services capable of meeting contemporary user expectations. Suleiman et al. (2025) noted that infrastructural deficiencies and insufficient technological investment remain major obstacles to digital transformation initiatives in many Nigerian university libraries. Similarly, Omehia et al. (2021) observed that inadequate digital competencies among library personnel continue to affect the effective utilization of emerging technologies in library operations and service delivery.

Nevertheless, the prospects associated with digital transformation remain significant, including improved access to information resources, enhanced research visibility, remote accessibility, resource sharing, personalized information services, and increased global relevance of academic libraries. Despite increasing scholarly discussions on ICT adoption and automation in libraries, there remains a need for broader discourse on digital transformation and emerging technologies in relation to service delivery within the Nigerian academic library context. This is particularly important because the rapidly evolving technological environment continues to redefine the expectations, functions, and sustainability of academic libraries globally. Therefore, this paper examines digital transformation and service delivery in academic libraries in Nigeria with emphasis on the challenges and prospects associated with emerging technologies.

Statement of the Problem

Academic libraries worldwide are undergoing significant transformation driven by the emergence of advanced digital technologies such as Artificial Intelligence (AI), Cloud Computing, Big Data Analytics, the Internet of Things (IoT), blockchain technology, and digital learning platforms. These technologies have redefined information access, management, and dissemination, compelling academic libraries to rethink traditional service delivery models in order to remain relevant in an increasingly digital and knowledge-driven society. In Nigeria, academic libraries have made considerable efforts to adopt Information and Communication Technologies (ICTs) to support teaching, learning, and research. However, evidence suggests that the level of digital transformation across many academic libraries remains uneven and inadequate to fully meet the growing expectations of twenty-first-century library users. Challenges such as inadequate technological infrastructure, insufficient funding, erratic power supply, limited digital competencies among library personnel, poor internet connectivity, cybersecurity concerns, and resistance to organizational change continue to affect the quality and effectiveness of library service delivery.

The increasing demand for seamless access to digital resources, remote library services, virtual learning support, and technology-enabled information services has further exposed gaps in the readiness of many academic libraries to leverage emerging technologies effectively. Consequently, concerns have been raised regarding the ability of academic libraries in Nigeria to sustain quality service delivery and maintain their relevance in an environment characterized by rapid technological innovation and changing user behaviors.

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Although previous studies have examined ICT adoption and automation in academic libraries, limited attention has been given to the broader concept of digital transformation and its implications for service delivery within the context of emerging technologies. This gap in knowledge creates the need for a comprehensive examination of the challenges hindering digital transformation and the prospects available for enhancing service delivery in Nigerian academic libraries. Addressing this gap is essential for informing policy, strategic planning, and investment decisions aimed at strengthening library services and supporting the educational and research missions of higher education institutions in Nigeria. This problem therefore necessitated an examination of digital transformation and service delivery in academic libraries in Nigeria, with particular emphasis on the challenges encountered and the prospects offered by emerging technologies.

Research Objective

The main objective of this paper is to critically discuss digital transformation and service delivery in academic libraries in Nigeria, with emphasis on the challenges and prospects in the era of emerging technologies. The specific objectives of the paper are to:

1. discuss the role of digital transformation in improving service delivery in academic libraries in Nigeria;
2. identify emerging technologies influencing service delivery in academic libraries;
3. highlight the challenges affecting the implementation of digital transformation in academic libraries in Nigeria;
4. present the prospects and opportunities of emerging technologies for enhancing library service delivery;
5. suggest strategies for strengthening digital transformation in academic libraries in Nigeria.

Theoretical Review

The Resource-Based View (RBV) was originally developed by Penrose (1959) and later refined by scholars such as Wernerfelt (1984) and Barney (1991), who significantly advanced its application in strategic management studies. The theory posits that organizations achieve and sustain competitive advantage through the effective acquisition, control, and utilization of valuable, rare, inimitable, and non-substitutable (VRIN) resources. These resources may be tangible, such as infrastructure and financial assets, or intangible, such as knowledge, skills, organizational culture, and technological capability. Barney (1991) further emphasized that it is not merely the availability of resources that determines organizational success, but the strategic capability to deploy these resources efficiently in ways that competitors cannot easily replicate. In this sense, RBV shifts focus from external environmental factors to internal organizational strengths as the foundation of performance and sustainability.

The Resource-Based View is highly relevant to this study because academic libraries in Nigeria can be understood as organizations whose effectiveness in service delivery depends

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largely on the quality and utilization of their internal resources. In the context of digital transformation, key resources include ICT infrastructure, digital platforms, skilled librarians, institutional repositories, internet connectivity, and technological competencies. The theory explains that libraries that possess and effectively deploy strong digital resources are more likely to achieve improved service delivery, user satisfaction, and operational efficiency in the era of emerging technologies. Conversely, institutions lacking these critical resources may struggle to implement digital transformation initiatives successfully. Therefore, RBV provides a strong theoretical lens for understanding why disparities exist among academic libraries in Nigeria regarding digital transformation and how strategic investment in internal capabilities can enhance sustainable and innovative library service delivery.

Literature Review

Role of Digital Transformation in Improving Service Delivery in Academic Libraries in Nigeria

Digital transformation has become a central driver in reshaping service delivery in academic libraries by enabling the integration of digital technologies into traditional library functions. It enhances access to information resources, improves service speed, and supports user-centered library systems. Vial (2019) conceptualizes digital transformation as the strategic application of digital technologies to fundamentally improve organizational performance and value creation. In academic libraries, this transformation is reflected in automation of cataloguing, digitization of collections, and deployment of integrated information systems that enhance access to scholarly content. Odunlade and Ojo (2023) similarly observed that Nigerian academic libraries adopting digital systems record improved efficiency in information dissemination and user satisfaction compared to those still relying on manual processes. While these studies confirm the benefits of digital transformation, much of the existing literature tends to focus on operational improvements, with limited attention to how such transformation translates into sustained service quality in resource-constrained environments like Nigeria. This gap suggests the need for deeper critical examination of contextual factors shaping digital transformation outcomes in academic libraries.

Beyond operational efficiency, digital transformation significantly improves accessibility and responsiveness of academic library services by enabling remote access to electronic resources, virtual reference services, and institutional repositories. Oyedokun et al. (2023) found that Nigerian libraries increasingly depend on digital platforms such as online databases and electronic catalogues to deliver services. Similarly, IFLA (2021) notes a global shift toward hybrid library service models that combine physical and digital services to meet evolving user expectations. This development allows users to access information anytime and anywhere, thereby enhancing flexibility in teaching and research support services. However, despite these advancements, empirical evidence still shows inconsistencies in service accessibility across Nigerian academic libraries, indicating a gap between digital adoption and effective service delivery outcomes. This paper argues that access to digital tools alone

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does not guarantee improved service delivery unless supported by adequate infrastructure and user competencies.

Furthermore, digital transformation strengthens library service delivery by promoting innovation in user engagement, research support, and information management. Tools such as institutional repositories, library management systems, and digital discovery platforms enhance visibility and accessibility of scholarly outputs. Cox, Pinfield, and Rutter (2019) emphasize that emerging digital technologies are reshaping academic libraries by improving research support services and enabling data-driven decision-making. In the Nigerian context, Sahabi and Otobo (2021) reported that digitization initiatives in university libraries have improved scholarly communication and institutional visibility. Nonetheless, existing studies have not sufficiently explored the sustainability of these gains, particularly in relation to funding instability, technological obsolescence, and staff capacity constraints. This represents a significant gap in the literature, which this study seeks to highlight by critically examining the real impact of digital transformation on service delivery in Nigerian academic libraries.

Emerging Technologies Influencing Service Delivery in Academic Libraries

Emerging technologies are increasingly reshaping academic library service delivery by introducing intelligent, automated, and data-driven systems that enhance information access and user experience. Technologies such as Artificial Intelligence (AI), cloud computing, Internet of Things (IoT), blockchain, big data analytics, and machine learning are transforming library operations and service delivery models. Cox et al. (2019) argue that AI is redefining academic library functions through intelligent search systems, automated cataloguing, and improved research support services. Similarly, Vial (2019) explains that digital transformation technologies fundamentally restructure how organizations create and deliver value. In academic libraries, these innovations improve information retrieval, metadata management, and user interaction systems. However, much of the literature remains largely conceptual, with limited empirical evidence on how these technologies are effectively integrated in resource-constrained environments such as Nigeria.

Cloud computing and IoT technologies are among the most widely applied innovations influencing modern library services due to their ability to enhance accessibility and operational efficiency. Cloud computing enables scalable storage, remote access to digital resources, and improved service delivery flexibility. Akawu (2026) reports that cloud computing adoption in Nigerian academic libraries improves remote access and service efficiency, although challenges such as unstable internet connectivity persist. Adegoke (2022) further notes that IoT applications, including RFID and smart sensors, improve circulation control, inventory management, and resource tracking. Despite these benefits, adoption in Nigerian libraries remains uneven, suggesting a gap between technological potential and actual implementation capacity.

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Blockchain and big data analytics are emerging as important tools for enhancing security, transparency, and decision-making in academic libraries. Blockchain supports digital rights management, authentication of records, and protection of digital assets, while big data analytics enhances user behavior analysis and service optimization. Fasola et al. (2024) observe that blockchain adoption in Nigerian academic libraries is still at an early stage but holds strong potential for improving trust and transparency. Similarly, Ogwo et al. (2025) found that AI-driven analytics improve research support and scholarly communication. Nonetheless, there is limited evidence on long-term sustainability and scalability of these technologies in Nigerian academic libraries, indicating an important gap in current research.

Finally, studies show that although awareness of emerging technologies is increasing in Nigerian academic libraries, actual implementation remains constrained by infrastructural and human capacity challenges. Agboke and Oladokun (2024) note that AI, robotics, and automation tools are gradually being explored to enhance efficiency, while Oyedokun et al. (2023) emphasize their role in improving user engagement and digital service delivery. However, Saibakumo (2021) reports that adoption is still limited due to inadequate funding, weak technical skills, and poor infrastructure. This suggests a clear disconnect between technological awareness and practical implementation, which this study highlights as a critical gap in the literature on digital transformation in Nigerian academic libraries.

Challenges Affecting the Implementation of Digital Transformation in Academic Libraries in Nigeria

Digital transformation in academic libraries in Nigeria is significantly constrained by inadequate infrastructure, limited financial investment, and weak institutional support, which collectively hinder the effective deployment of emerging technologies. Many libraries continue to experience poor internet connectivity, unstable electricity supply, and insufficient ICT facilities required for sustainable digital operations. Saibakumo (2021) notes that despite high awareness of emerging technologies, adoption levels in Nigerian academic libraries remain low due to infrastructural and funding limitations. Similarly, Ogunbote and Abimbola (2025) emphasize that inadequate financial allocation and weak institutional commitment significantly restrict the implementation of digital initiatives in university libraries. Agboke and Oladokun (2025) further argue that infrastructural deficiencies remain a major barrier to the integration of advanced technologies such as artificial intelligence and automation systems. While these studies highlight structural constraints, there is limited emphasis on how these infrastructural gaps interact with institutional readiness to influence the sustainability of digital transformation in academic libraries.

Another critical challenge is the shortage of skilled personnel, organizational resistance to change, and inadequate policy frameworks guiding digital transformation processes. The effective implementation of emerging technologies requires librarians with strong digital competencies in areas such as artificial intelligence systems, cloud computing, and digital

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repository management. However, many library professionals lack the necessary technical skills due to inadequate training and professional development opportunities. Aloysius and Ebong (2023) report that insufficient digital skills among library personnel significantly limit the effective utilization of emerging technologies in academic libraries, while Igbo et al. (2025) stress that AI adoption requires both infrastructure and sustained human capacity development. In addition, Ikenwe and Udem (2022) and Cox, Pinfield, and Rutter (2019) emphasize that organizational culture and resistance to change strongly influence the pace of digital transformation in libraries. Odunlade and Ojo (2022) further note that weak institutional policies and lack of structured frameworks hinder consistent implementation of digital services. Cybersecurity concerns also add another layer of complexity, as Nwala et al. (2025) and Ogwo et al. (2023) highlight risks related to data privacy and system vulnerabilities in digital library environments. Collectively, these issues reveal a gap in literature regarding integrated strategies that simultaneously address infrastructure, human capacity, governance, and security within Nigerian academic libraries.

Prospects and Opportunities of Emerging Technologies for Enhancing Library Service Delivery

Emerging technologies present significant opportunities for transforming academic library service delivery by improving access, efficiency, and responsiveness in information services. Technologies such as artificial intelligence, cloud computing, and big data analytics are enabling libraries to deliver faster, more accurate, and user-centered services. Cox, Pinfield, and Rutter (2019) argue that artificial intelligence is reshaping academic libraries by improving research support, automating routine tasks, and enhancing information discovery processes. Similarly, Vial (2019) explains that digital transformation creates new organizational value by restructuring traditional service models and enabling innovation in service delivery. In academic libraries, these developments support a shift from conventional service structures to flexible, digital-first environments that better align with evolving user expectations. However, while these studies emphasize the potential of emerging technologies, there is still limited focus on how contextual constraints in developing countries may affect the realization of these opportunities.

One major opportunity of emerging technologies lies in improved access to global information resources, enhanced scholarly communication, and more personalized library services. Digital platforms such as institutional repositories, electronic databases, and open-access systems enable wider dissemination of research outputs and support academic productivity. IFLA (2021) highlights that libraries globally are leveraging digital transformation to expand equitable access to knowledge and strengthen research support services. Similarly, Adeyemi and Adeyinka (2021) observed that Nigerian academic libraries adopting digital systems experience improved access to information resources and enhanced academic performance. Oyedokun et al. (2023) further note that digital platforms enable continuous and remote access to information services, strengthening teaching and research

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activities. In addition, AI-driven tools such as chatbots and recommendation systems improve user engagement and service personalization (Ogwo et al., 2023; Asemi & Asemi, 2018). Furthermore, cloud-based systems and digital repositories enhance collaboration, resource sharing, and institutional visibility, as noted by Agboke and Oladokun (2025) and Saibakumo (2021). Despite these opportunities, there remains a gap in literature on the sustainability and scalability of these innovations in resource-constrained academic environments such as Nigeria.

Strategies for Strengthening Digital Transformation in Academic Libraries in Nigeria

Strengthening digital transformation in academic libraries in Nigeria requires sustained investment in ICT infrastructure and the development of robust institutional support systems that enable effective service delivery. Essential infrastructure such as stable internet connectivity, reliable electricity supply, integrated library systems, and digital repositories forms the foundation for successful digital transformation. Adebayo and Olatoye (2024) note that inadequate funding and infrastructural deficiencies continue to hinder digital transformation in Nigerian university libraries, while Agboke and Oladokun (2025) emphasize that the absence of consistent infrastructural development limits the adoption of emerging technologies such as artificial intelligence and automation systems. IFLA (2021) similarly stresses that sustainable digital library development depends on continuous institutional and national investment in ICT infrastructure. However, existing literature pays limited attention to how these infrastructural investments can be strategically prioritized and sustained within financially constrained academic environments in Nigeria.

Another key strategy involves strengthening human capacity, policy frameworks, and collaborative structures to support effective implementation of digital transformation initiatives. Continuous capacity building is essential, as librarians require adequate digital literacy skills to manage technologies such as AI systems, cloud platforms, and digital repositories. Dauda and Haruna (2023) observe that limited digital competencies among library staff significantly hinder effective ICT utilization, while Igbo et al. (2024) emphasize the importance of training and re-skilling programs in enabling successful technology adoption. Cox et al. (2019) further highlight that organizational leadership and strategic direction strongly influence the success of digital transformation in libraries. In addition, Odunlade and Ojo (2022) note that weak policy frameworks hinder systematic implementation of digital initiatives, while collaborative approaches and phased implementation strategies have been identified as effective mechanisms for sustainability (Saibakumo, 2021; Oyedokun et al., 2023; Fasola et al., 2024). Nonetheless, there remains a gap in the literature regarding integrated models that combine infrastructure development, human capacity building, governance, and collaboration into a unified framework for Nigerian academic libraries.

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Conclusion

This paper has examined digital transformation and service delivery in academic libraries in Nigeria within the context of emerging technologies. The discussion shows that digital transformation is reshaping library services by improving access to information resources, enhancing efficiency, and supporting more user-centered service delivery. Academic libraries are increasingly adopting digital tools to complement or replace traditional service models, thereby responding to the evolving needs of users in higher education. However, the review also reveals a persistent gap between the potential of digital transformation and its actual implementation in Nigerian academic libraries. Challenges such as inadequate funding, weak ICT infrastructure, limited staff competencies, and weak institutional support continue to hinder effective adoption and use of emerging technologies. In conclusion, the study argues that the future effectiveness of academic libraries in Nigeria depends on bridging these implementation gaps through improved infrastructure, capacity development, and stronger institutional commitment. Without addressing these issues, the full benefits of digital transformation in library service delivery will remain unrealised.

Recommendations

Based on the literature reviewed, the following recommendations are made:

1. University management and relevant funding bodies should increase investment in ICT infrastructure by providing reliable internet connectivity, stable electricity supply, and modern digital systems to support effective library service delivery.
2. Library management and university authorities should organise continuous training and capacity-building programmes to improve librarians' digital skills and their ability to use emerging technologies effectively.
3. University management and policy-making units should develop clear institutional policies that guide, support, and sustain digital transformation in academic libraries.
4. Library management and ICT units should strengthen cybersecurity systems to protect digital resources, user data, and library platforms from cyber threats.
5. University management and academic library leadership should promote collaboration and partnerships with government agencies, ICT providers, and other institutions to enhance resource sharing and technical support.
6. Library management should adopt a phased and strategic implementation approach to ensure the sustainable integration of emerging technologies into library services.

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