



Leveraging Blockchain Technology for Efficient Library Information Management in Federal Polytechnic, Wannune

¹Kaaie Teghtegh Felix, ²Dinah Innocent Adahnu

^{1&2}Polytechnic Library, Federal Polytechnic, Wannune, Benue State.

Corresponding author's email: kaaie123@gmail.com / dinahadahnu@gmail.com

Abstract

This study investigated the potential of blockchain technology for efficient library information management at Federal Polytechnic, Wannune, Benue State, Nigeria. The study was motivated by challenges associated with conventional library information systems, including data insecurity, limited transparency, record inconsistencies, unauthorized access, and inefficient transaction management. A Design Science Research (DSR) approach integrated with a mixed-methods research design was adopted. Data were collected from 216 respondents comprising students, library staff, and ICT staff using questionnaires, interviews, direct observation, and document review. Descriptive statistics, including frequencies, percentages, and mean scores, were used for data analysis, while system performance was evaluated using a 5-point Likert scale. Results showed that the existing system recorded an overall mean score of 2.75, whereas the proposed blockchain-based system achieved a substantially higher mean score of 4.45. Improvements were recorded in data integrity (2.68 to 4.52), security (2.57 to 4.48), reliability (2.81 to 4.45), cost efficiency (2.74 to 4.31), and user satisfaction (2.93 to 4.50). The study concludes that blockchain technology offers considerable potential for improving library information management through decentralization, immutability, transparency, traceability, data security, and smart contracts. A blockchain development framework was therefore proposed for phased implementation at the Polytechnic.

Keywords: Blockchain Technology, Library Information Management, Data Security, Data Integrity, Digital Library.

Introduction

The rapid advancement of information and communication technologies (ICTs) has significantly transformed the way information is created, stored, accessed, and managed across various sectors, including education, health, and other sectors of the economy. Academic libraries, as central hubs of knowledge dissemination, have increasingly adopted digital systems to improve service delivery and meet the evolving needs of users (Pagore, 2024; Rajput & Pandey, 2025). In polytechnics and other higher institutions, library information management systems are essential for organizing resources, facilitating access, and supporting teaching, learning, and research activities. However, despite the integration of automated and digital library systems, many institutions continue to face persistent challenges related to efficiency, security, transparency, and data integrity. Conventional library management systems, whether manual or partially automated, are often centralized in nature. This centralization creates vulnerabilities such as single points of failure, susceptibility to data manipulation, unauthorized access, and system downtime. In many cases, inconsistencies in record-keeping, delays in updating transactions, and difficulties in tracking borrowed materials undermine the reliability of the system, making it difficult to maintain accurate and up-to-date records (Pathan et al., 2026).

Furthermore, issues such as loss of records, duplication of entries, and lack of real-time synchronization across library operations hinder effective service delivery. These challenges are particularly pronounced in developing countries like Nigeria, where infrastructural limitations, inadequate funding, and limited technical expertise further complicate the effective management of library information systems (Adewumi & Adeniran, 2020; Issa et al., 2019). The relevance of blockchain technology extends beyond financial transactions to various sectors, including healthcare, supply chain management, governance, and education (Abou Jaoude & Saade, 2019; Casino et al., 2019). In the context of library information management, blockchain offers the potential to revolutionize how records are created, stored, and accessed. By decentralizing data storage and ensuring that all transactions are securely recorded and verifiable, blockchain can eliminate many of the inefficiencies associated with traditional library systems. For instance, it can provide a transparent and tamper-proof record of book circulation, ensuring that borrowing and returning transactions are accurately tracked (Hoy, 2017). It can also enhance user authentication processes, reduce the risk of data breaches, and improve overall system reliability (Casino et al., 2019; Lemieux, 2016).

At the Federal Polytechnic, Wannun, like many other academic institutions in Nigeria, the library plays a critical role in supporting academic excellence. However, the effectiveness of the library is often constrained by challenges such as outdated record management systems, limited automation, and concerns over data security and accountability. As the volume of information resources and the number of users continue to grow, there is an increasing need for a more robust, secure, and efficient system that can handle complex library operations while ensuring transparency and trust among stakeholders. The adoption of blockchain technology in library information management presents a promising solution to these challenges (Bashir & Warraich, 2023; Tella et al., 2022). Despite its potential benefits, the implementation of blockchain technology in library systems is still at an emerging stage, particularly in developing countries. There are concerns related to the cost of implementation, technical complexity, scalability, and the need for skilled personnel to design and maintain such systems (Ahmad, 2024; Usman & Ullah, 2024). Moreover, resistance to change and lack of awareness about the technology may also pose challenges to its adoption (Kanyika et al., 2025). Existing systems are often centralized and vulnerable to unauthorized access, data loss, and manipulations, which undermines trust and service delivery (Ibrahim et al., 2025; Ewwiekpaefe et al., 2025).

According to Dutta et al. (2020), blockchain technology has gained widespread attention due to its ability to ensure data integrity, security, and reliability in information systems. Academic libraries, particularly in higher institutions, now rely heavily on Integrated Library Management Systems (ILMS) to manage cataloguing, circulation, and user services (Sodipe et al., 2025; Achugbue, 2025). However, despite these advancements, existing systems still face critical challenges such as data insecurity, lack of transparency, inefficiencies in record management, and vulnerability to unauthorized access. These issues have prompted scholars to explore innovative technologies such as blockchain as a viable solution for improving library information management (Safdar et al., 2023; Oyelude, 2019). Recent research on academic libraries in Nigeria reveals that, even with the use of RFID, automation, and other digital tools, libraries continue to struggle with proper record administration, auditing, and stocktaking. For instance, Sodipe et al. (2025) discovered that automated cataloguing and library systems in Nigerian institutions continue to have problems with precise inventory control during regular operations and data inconsistencies. In the same vein, Yusuf et al. (2023) found that while RFID-based library systems at Nigerian academic institutions increase productivity, system mistakes, incomplete scanning, and difficulties tracking physical items during circulation and stock verification procedures still have an impact. Furthermore, more comprehensive research on library automation in Nigeria shows that human mistake and technology infrastructure constraints still have an impact on accurate records and dependable audits in contemporary library settings (Oyetola et al., 2023). These challenges underscore the need for more robust and reliable systems that can enhance efficiency and trust in library operations.

Zheng et al. (2017) emphasized that blockchain enhances information security, transparency, and operational efficiency in library systems by eliminating centralized control and enabling distributed data storage. Afolabi and Ojo (2023) and Nwosu et al. (2024) highlighted that blockchain can create a transparent record of all transactions, allowing stakeholders to verify and audit activities such as book circulation and user interactions. Meeramani et al. (2025) noted that smart contracts enable automation and ensure compliance with established rules, thereby reducing human intervention and minimizing errors. Zhang et al. (2023) proposed a blockchain-based smart library architecture that integrates secure data storage, intelligent resource sharing, and optimized borrowing systems. Ali et al. (2026) analyzed the elements fostering adoption of blockchain technology-based services in academic libraries using the TOE and TAM frameworks, providing valuable insights into adoption determinants. Bankole et al. (2026) conducted a scoping review on blockchain technology adoption for enhancing user privacy and data security in libraries, further reinforcing the potential of blockchain in library environments. Shahzad et al. (2024) systematically reviewed the effects of blockchain technology on university librarians and libraries,

while Bashir and Warraich (2023) explored future libraries' blockchain opportunities and challenges. Tella et al. (2022) examined the relevance of blockchain technology for the management of libraries and archives in the Fourth Industrial Revolution. Kanyika et al. (2025) conducted a systematic literature review on adapting to new technologies, specifically focusing on blockchain implementation in academic libraries.

Ahmad (2024) noted that the integration of blockchain requires specialized knowledge and expertise, which may not be readily available in many institutions. Additionally, the cost of implementation and maintenance can be a significant barrier, particularly for institutions in developing countries. Usman and Ullah (2024) also pointed out that scalability and energy consumption are potential challenges that need to be addressed for effective deployment of blockchain systems. In the Nigerian context, the challenges of library information management are further compounded by infrastructural limitations, inadequate funding, and limited access to advanced technologies. Many academic libraries still rely on outdated systems that are inefficient and prone to errors. Liu et al. (2023) demonstrated that blockchain-based systems can improve data verification, error tracking, and overall system security in educational data management. Tahora et al. (2023) opined that blockchain has the potential to create more secure, transparent, and efficient higher education systems by addressing existing challenges in data management and governance. This study seeks to bridge this gap by investigating the implementation of a blockchain-based library information management system at the Federal Polytechnic, Wannune. By building on existing literature and addressing contextual challenges, the research aims to contribute to the advancement of knowledge in library and information science and support the adoption of innovative technologies in Nigerian academic institutions. Therefore, this study is warranted since it investigates a novel approach that can enhance operational effectiveness, bolster accountability, and promote long-term digital transformation in Nigerian institutions' libraries.

Conceptual Framework

The framework establishes the presumed relationship between the application of blockchain technology and the effectiveness of library information management within Federal Polytechnic, Wannune. Blockchain technology provides a decentralized and distributed digital ledger through which transactions and records can be securely recorded, verified, and maintained (Nakamoto, 2008; Narayanan et al., 2016). The framework therefore proposes that selected blockchain technology attributes constitute independent variables, while efficient library information management represents the dependent variable. The major blockchain attributes considered in the study include decentralization, data security, immutability, transparency, traceability, smart contracts, and distributed data storage. These attributes are expected to influence the efficiency of library information management through improved record integrity, secure access to information, automated library transactions, accountability, and reliable information retrieval (Pilkington, 2016; Crosby et al., 2016).

Blockchain Technology as the Independent Variable

Blockchain technology is conceptualized as a distributed digital ledger that enables information and transactions to be recorded across a network in a manner that is difficult to alter without authorization (Zheng et al., 2017; Guo & Yu, 2022). In the context of library information management, blockchain can provide a trusted platform for managing bibliographic records, circulation transactions, user authentication, digital resources, acquisition records, and other library-related information.

Decentralization is expected to reduce excessive dependence on a single central database or server. By distributing records across participating nodes, the library can improve system resilience and reduce the risk of a single point of failure (Düdder & Ross, 2017).

Data security represents the ability of blockchain-based systems to protect library information from unauthorized access, manipulation, and destruction. Cryptographic mechanisms and controlled access can enhance the protection of users' records and library resources (Lin & Liao, 2017; Dai et al., 2019).

Immutability refers to the difficulty of altering information once it has been validated and recorded on the blockchain. This characteristic can help preserve the integrity of library records and reduce fraudulent or unauthorized modification of transactions (Hölbl et al., 2018).

Transparency allows authorized participants to verify transactions and records within the system. In library management, transparency can improve accountability in areas such as acquisition, circulation, resource sharing, and administrative transactions (Abou Jaoude & Saade, 2019).

Traceability enables library transactions and information records to be tracked through their history. This can make it easier to identify the origin, modification, or movement of information and library resources (Fang et al., 2021).

Smart contracts are programmable blockchain-based agreements that automatically execute predefined actions when specified conditions are satisfied. In a library environment, smart contracts could support automated processes such as issuing and returning materials, calculating overdue penalties, controlling access to digital resources, or managing resource-sharing agreements (Szabo, 1997; Mohanta et al., 2018; Rouhani & Deters, 2019).

Efficient Library Information Management as the Dependent Variable

The dependent variable in the framework is efficient library information management. Efficiency is conceptualized in terms of the extent to which library information and services can be managed accurately, securely, promptly, transparently, and reliably. The indicators of efficient library information management include:

- **Information accuracy:** The correctness and consistency of library records.
- **Information accessibility:** The ability of authorized users and staff to access required information when needed.
- **Information retrieval efficiency:** The speed and ease with which library information can be located and retrieved.
- **Data integrity:** The preservation of library information from unauthorized modification or corruption.
- **Information security:** Protection of library records and users' information against unauthorized access.
- **Transparency and accountability:** The ability to verify and trace library transactions.
- **System reliability:** The capacity of the library information system to remain available and dependable.

Intervening Factors

The relationship between blockchain technology and efficient library information management may also be influenced by intervening factors. These include ICT infrastructure, staff ICT competence, financial resources, institutional policies, management support, electricity supply, internet connectivity, user acceptance, and data privacy requirements (Kanyika et al., 2025; Ali et al., 2026). These factors may determine the extent to which blockchain technology can be successfully adopted and utilized in Federal Polytechnic, Wannune. For example, inadequate internet connectivity, insufficient technical expertise, or limited institutional funding may reduce the effectiveness of a blockchain-based library information management system, even where the technology itself has substantial potential.

Conceptual Model

The application of blockchain characteristics is expected to create a more secure and trustworthy information environment in which library records can be stored, verified, retrieved, and shared efficiently. For Federal Polytechnic, Wannune, the framework assumes that the successful integration of blockchain into library operations can strengthen the integrity and security of library information while reducing errors and improving transaction processing. However, the framework does not assume that blockchain technology alone guarantees efficient library information management. Its effectiveness depends on the availability of appropriate ICT infrastructure, competent personnel, institutional support, adequate funding, reliable internet and electricity, and users' willingness to adopt the technology (Bankole et al., 2026). The conceptual framework is represented diagrammatically in Figure 1.

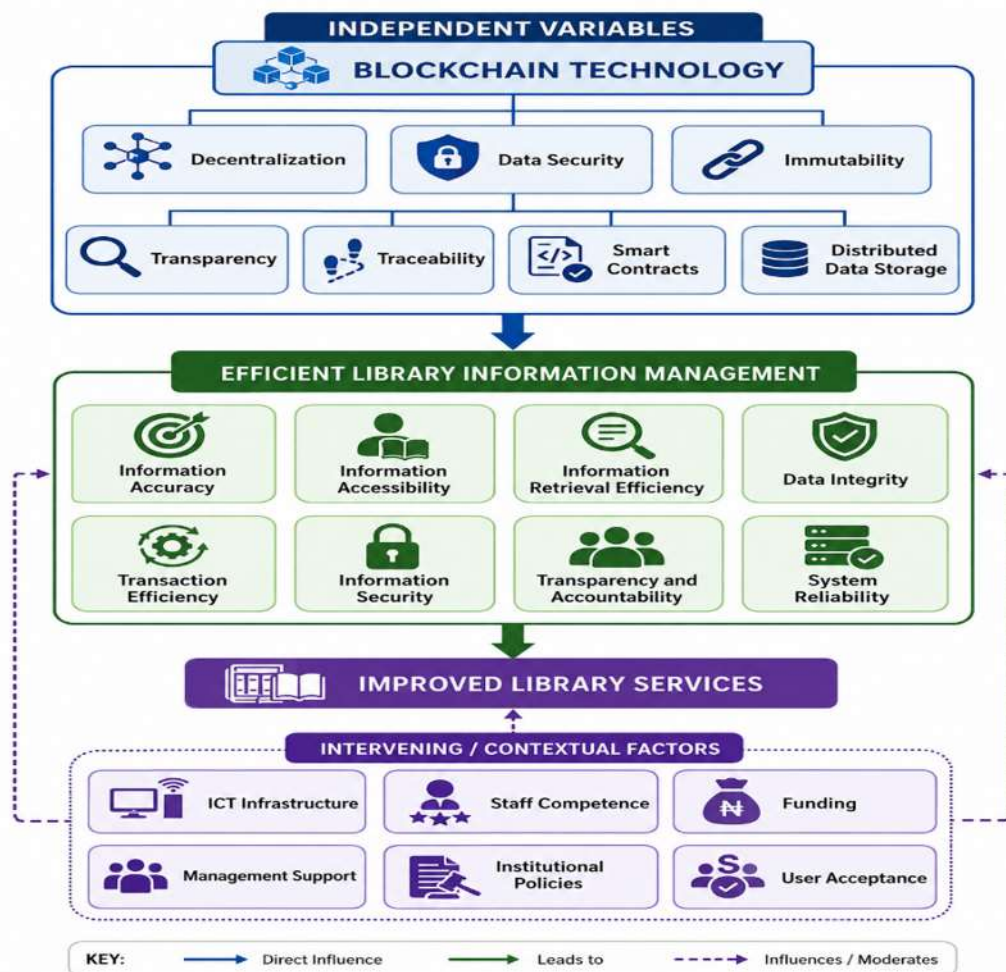


Figure 1: Conceptual Framework Model

Methodology

Research Design

The study adopts a Design Science Research (DSR) approach integrated with a mixed-methods research design, involving three complementary components: the descriptive component to assess the existing library information-management system at Federal Polytechnic, Wannune; the empirical component that collects quantitative and qualitative data from librarians, library staff, ICT personnel, and relevant library users; and the development component that uses the findings to design and validate a blockchain-based library information-management framework.

Area of the Study

The study was carried out at the Library in Federal Polytechnic, Wannune, Benue State, Nigeria. Wannune is the administrative headquarters of Tarka Local Government Area in Benue State (Figure 2). It is a town covering an area of 371 km², with a population of 79,494 according to the 2006 census (NPC, 2006). Tarka LGA is predominantly rural, and the primary occupation of its residents is farming. The institution's library serves students, academic staff, and non-academic staff, making it an appropriate environment for examining library information management processes and implementing a blockchain-based solution for efficient service delivery.

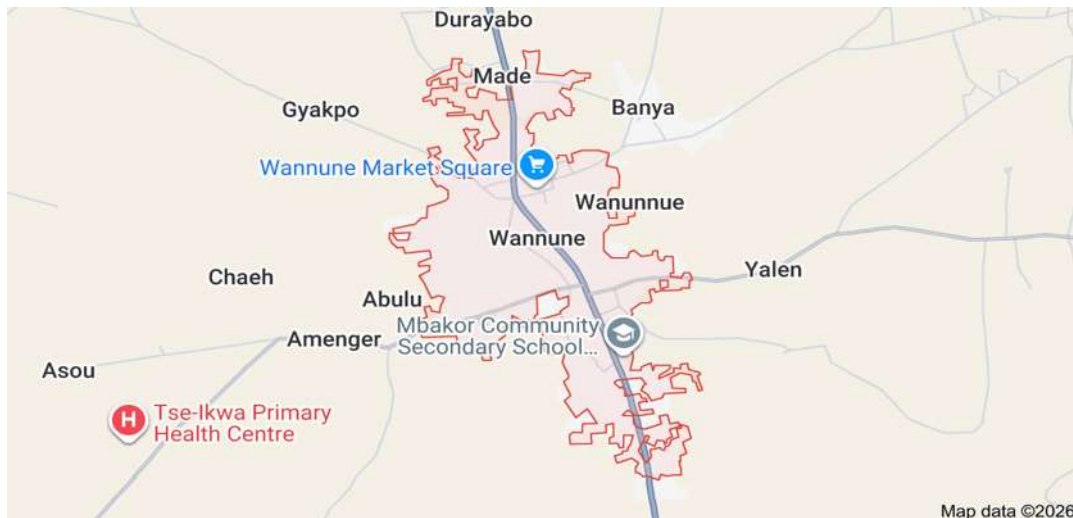


Figure 2: Map of Wannune showing the Study Area
Source: Alkali et al. (2024)

Sample Size and Sampling Technique

A stratified random sampling technique was used to ensure fair representation of all user categories comprising the students, academic staff, and members of the polytechnic's library staff. A sample size of 216 respondents was considered adequate for the study. This ensured that opinions from all stakeholders were captured in order to obtain accurate analysis and holistic results for the study.

Data Collection Procedure

Data for the study were collected using both primary and secondary sources via:

- i. **Questionnaires:** Structured questionnaires were administered to students to gather information on current library system challenges and user requirements.
- ii. **Interviews:** Interviews were conducted with the polytechnic's library administrators and ICT staff to obtain deeper insights into system operations and limitations in the course of their service delivery.
- iii. **Direct Observation:** Direct observation of library processes such as cataloguing, borrowing, and returning of books was monitored in order to derive findings necessary for the study.
- iii. **Document Review:** Existing library records, reports, and system documentation were also reviewed to understand current practices, which rightly aided the study process.

Data Analysis Techniques

Data collected from questionnaires were analyzed using descriptive statistics, including frequency counts, percentages, and mean scores. Qualitative data from interviews and observations were also analyzed thematically to identify recurring issues and insights. For system evaluation, performance indicators such as data integrity, response time, security level, and user satisfaction were assessed by comparing the proposed blockchain system with the previously existing library system in the polytechnic, and these data were adequately presented in a 5-point Likert scale.

Validity and Reliability

To ensure validity and reliability, a pilot test was conducted on a small sample of respondents before the main study was carried out. This process helped to identify ambiguities and inconsistencies, ensuring that the instruments produce stable, consistent, and dependable results in the full-scale research.

Results and Discussion

Study Population Indicator

The population of the study comprises all registered users of the Federal Polytechnic, Wannune library. This includes the Students at all levels (ND and HND), ICT and Library staff (Table 1). These groups form selected stakeholders that interact directly with the library information system. Figure 3 shows respondent distribution.

Table 1: Percentage Distribution

Category	Frequency	Percentage (%)
ND I	58	26.85
ND II	49	22.69
HND I	51	23.61
HND II	37	17.13
Library staff	13	6.02
ICT staff	8	3.70
Total	216	100

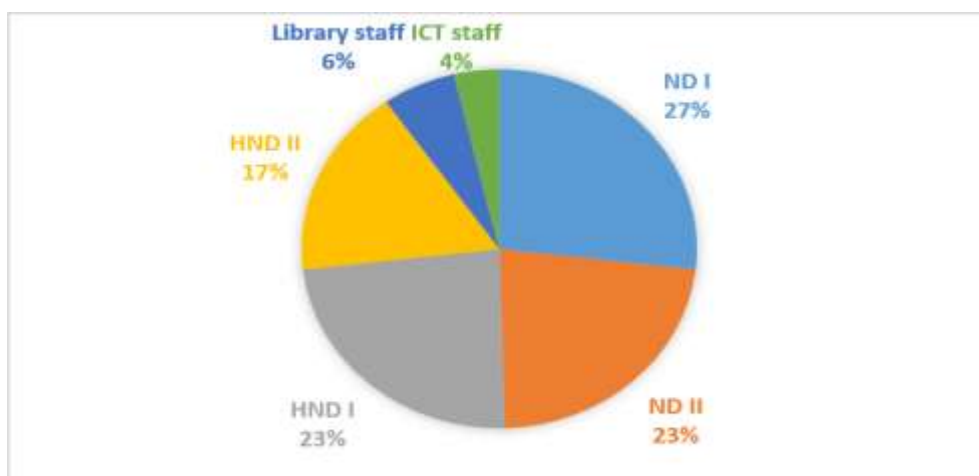


Figure 3: Chart showing Respondent Distribution

The result in Table 1 and Figure 3 showed that the study involved 216 respondents, comprising students, Library staff, and ICT staff. ND I students had the highest representation with 58 respondents (26.85%), followed by HND I with 51 (23.61%), ND II with 49 (22.69%), and HND II with 37 (17.13%). Library staff accounted for 13 respondents (6.02%), while ICT staff had the lowest representation with 8 (3.70%). Overall, students constituted 90.28% of the respondents, while Library and ICT staff represented 9.72%. The distribution adequately represents the major stakeholders and provides relevant perspectives for assessing blockchain technology in library information management.

Table 2: Comparative Evaluation of the Existing and Proposed Blockchain-Based Library Information Management Systems

Performance Indicator	Evaluation Statement	Existing System (1–5)	Proposed Blockchain System (1–5)
Data integrity	The system maintains accurate, complete and consistent library information records.	2.68	4.52
Security level	The system provides adequate protection against unauthorized access, alteration and loss of library information.	2.57	4.48
Reliability	The system provides consistent and dependable access to library information and services.	2.81	4.45
Cost efficiency	The system reduces the operational and administrative costs associated with library information management.	2.74	4.31
User satisfaction	Users are satisfied with the efficiency, accessibility and quality of library information services.	2.93	4.50
Mean		2.75	4.45

Likert Scale Index: 1 – Very poor, 2 – Poor, 3 – Fair, 4 – Good, 5 – Very Good.

The results analyzed in Table 2 indicate that the proposed blockchain-based system performs considerably better than the existing system across all five performance indicators. The existing system recorded an overall mean score of 2.75, indicating a moderate level of performance, whereas the proposed blockchain system recorded an overall mean of 4.45, indicating a very high level of performance. The highest improvement is observed in data integrity, increasing from 2.68 to 4.52. This suggests that blockchain's immutable and distributed ledger characteristics could substantially improve the accuracy, consistency, and integrity of library records (Lemieux, 2016; Guo & Yu, 2022). The higher ratings recorded for data integrity, security level, reliability, transparency,

and traceability suggest that blockchain provides a more robust framework for managing library information. These findings agree with Sharma et al. (2025), who found that blockchain-based library records management achieved superior performance in terms of security, transparency, and efficiency when compared with traditional approaches. Similarly, Safdar et al. (2023) and Bashir and Warraich (2023) documented the transformative potential of blockchain for library operations.

Similarly, the security level increased from 2.57 to 4.48, indicating the potential of blockchain to provide stronger protection against unauthorized modification and access. Reliability improved from 2.81 to 4.45, while cost efficiency increased from 2.74 to 4.31. User satisfaction also recorded a substantial improvement, from 2.93 to 4.50. This result is consistent with the findings of Ojobor (2023), who identified blockchain's potential for enhanced metadata systems, peer-to-peer information sharing, and digital rights management in Nigerian libraries. These values support the proposition by Dutta et al. (2020) and Liu et al. (2023) that blockchain technology enhances the efficiency and effectiveness of library information management. Furthermore, the findings align with Tella et al. (2022) and Kanyika et al. (2025), who emphasized the relevance of blockchain for library and archive management in the Fourth Industrial Revolution.

Blockchain System Design

The Blockchain development framework for efficient library information management at Federal Polytechnic, Wannune, begins with stakeholders, including library staff, students, management, and external partners, whose needs guide system development. The framework incorporates blockchain modules for digital asset management, membership, circulation, cataloguing, and auditing (Teredesai et al., 2026; Zhang et al., 2026). Its technology layer employs decentralized networks, smart contracts, immutable ledgers, encryption, and consensus mechanisms (Zheng et al., 2017; Guo & Yu, 2022). These components integrate with the Library Management System, data storage, user access platforms, and notifications. The development process progresses through requirements analysis, system design, development, testing, deployment, and monitoring. The system improves data integrity, security, reliability, transparency, and traceability, consistent with the frameworks proposed by Malkov and Kharitonova (2023) and Patel and Sharma (2024).

Conclusion and Recommendations

Conclusion

The study established that:

- i. Although the existing library information management system provides basic services, it is associated with limitations in data integrity, security, reliability, cost efficiency, and user satisfaction. These limitations create a need for a more secure, transparent, reliable, and efficient technological framework for managing library information and transactions.
- ii. Blockchain technology has considerable potential to strengthen the effectiveness and efficiency of library information management (Bashir & Warraich, 2023; Shahzad et al., 2024).
- iii. The study further established that the major characteristics of blockchain including decentralization, data security, immutability, transparency, traceability, smart contracts, and distributed data storage provide suitable mechanisms for addressing weaknesses associated with conventional centralized library systems (Tella et al., 2022; Kanyika et al., 2025).
- iv. A successful adoption requires adequate institutional preparation, technical capacity building, infrastructure development, and appropriate implementation policies (Ali et al., 2026; Bankole et al., 2026).

Recommendations

The following recommendations are proposed based on the findings:

- i. Federal Polytechnic, Wannune should consider adopting the proposed blockchain framework to improve data integrity, security, reliability, transparency, traceability, and user satisfaction. The substantial improvement from an overall mean of 2.75 for the existing system to 4.45 for the proposed system supports its potential effectiveness.
- ii. The Polytechnic should invest in reliable internet connectivity, network infrastructure, computing facilities, and appropriate data-storage resources required for successful blockchain deployment. This is important because

infrastructure limitations were identified as intervening factors that could affect the effectiveness of the proposed system.

iii. Regular capacity-building programmes should be organized for librarians, ICT personnel, and other relevant staff on blockchain administration, cybersecurity, data management, and system maintenance (Kanyika et al., 2025).

iv. Rather than replacing the existing system abruptly, the Polytechnic should adopt a phased implementation strategy beginning with important functions such as membership management, cataloguing, circulation, digital asset management, and auditing.

v. Management should also promote awareness and user acceptance among students, academic staff, library personnel, and other stakeholders to ensure successful adoption and long-term sustainability (Ali et al., 2026).

Conflict of interests: The authors declare no conflict of interests.

Acknowledgements: The authors sincerely appreciate the Tertiary Education Trust Fund (TETFund) Nigeria, for providing the grant that facilitated the successful execution of this study, under the Institution-Based Research (IBR) 2026 Intervention Line. Also, to the Management of the Federal Polytechnic, Wannune, for providing institutional support necessary for the successful conduct of this study.

References

- Abou Jaoude, J., & Saade, R. G. (2019). Blockchain applications—Usage in different domains. *IEEE Access*, 7, 45360–45381. <https://doi.org/10.1109/ACCESS.2019.2902501>
- Achugbue, E. I. (2025). Artificial intelligence (AI) and the future of academic library services in South-South Nigerian universities. *Nigerbiblios: Journal of the National Library of Nigeria*, 34(1), 36–49.
- Adewumi, O. M., & Adeniran, P. (2020). Challenges of library automation in developing countries. *The Electronic Library*, 38(3), 567–583.
- Afolabi, M. O., & Ojo, A. T. (2023). Blockchain technology and data transparency in African information systems. *African Journal of Information Systems*, 15(2), 44–58.
- Ahmad, M. I. (2024). Use of blockchain technology in library. *Synergy: International Journal of Multidisciplinary Studies*, 1(2), 9–14. <https://sijmds.com/index.php/pub/article/view/15>
- Ali, M., Lyu, C., Tian, X., Jiang, C., & Li, Q. (2026). An analysis of elements fostering adoption of blockchain technology-based services in academic libraries: TOE and TAM framework study. *SAGE Open*. <https://doi.org/10.1177/21582440261420896>
- Alkali, D. M., Iorhemen, O., Otun, J., & Alfa, M. I. (2024). Provision of sustainable water supply system in Nigeria: A case study of Wannune, Benue State. *World Journal of Environmental Engineering*, 2(1), 1–5. <https://doi.org/10.12691/wjee-2-1-1>
- Bankole, Q. A., Akanbi, M. L., Falaiye, S. J., & Egbebi, F. O. (2026). Blockchain technology adoption for enhancing user privacy and data security in libraries: A scoping review. *Journal of Librarianship and Information Science*. <https://doi.org/10.1177/09610006261442995>
- Bashir, F., & Warraich, N. F. (2023). Future libraries' blockchain opportunities and challenges: A systematic literature review and research agenda. *Digital Library Perspectives*, 39(3), 293–310. <https://doi.org/10.1108/DLP-08-2022-0065>
- Casino, F., Dasaklis, T. K., & Patsakis, C. (2019). A systematic literature review of blockchain-based applications: Current status, classification and open issues. *International Journal of Information Management*, 36(1), 55–81.
- Crosby, M., Pattanayak, P., Verma, S., & Kalyanaraman, V. (2016). Blockchain technology: Beyond Bitcoin. *Applied Innovation Review*, 2, 6–19.
- Dai, W., Dai, C., Choo, K. K. R., Cui, C., Zou, D., & Jin, H. (2019). SDTE: A secure blockchain-based data trading ecosystem. *IEEE Transactions on Information Forensics and Security*, 15, 725–737.
- Düdder, B., & Ross, O. (2017). Blockchain technologies and the smart city: A systematic literature review. *International Journal of Computer Applications*, 179(25), 1–9.
- Dutta, P., Choi, T. M., Somani, S., & Butala, R. (2020). Blockchain technology in supply chain operations: Applications, challenges and research opportunities. *Transportation Research Part E: Logistics and Transportation Review*, 142, 102067. <https://doi.org/10.1016/j.tre.2020.102067>
- Evwiekpaefe, A. E., Chinyio, D. T., Ajakaiye, F., & Aleke, P. O. (2025). A blockchain-based digital library system integrated with CryptoJS for enhanced security and transparency. *Journal of Information Systems and Informatics*.

- Fang, Y., Zhang, Y., & Zhang, Y. (2021). Blockchain technology and its applications in digital information management. *Journal of Information Science*, 47(6), 780–795.
- Guo, H., & Yu, X. (2022). A survey on blockchain technology and its security. *Blockchain: Research and Applications*, 3(2), 100067.
- Hölbl, M., Kompara, M., Kamišalić, A., & Nemec Zlatolas, L. (2018). A systematic review of the use of blockchain in healthcare. *Symmetry*, 10(10), 470.
- Hoy, M. B. (2017). An introduction to the blockchain and its implications for libraries and medicine. *Medical Reference Services Quarterly*, 36(3), 273–279. <https://doi.org/10.1080/02763869.2017.1332261>
- Ibrahim, U., Abba, A., & Oriyomi, A. A. (2025). Blockchain technology and information security management: A case of Nigerian libraries. *Advance Journal of Education and Social Sciences*, 10(7), 129–136.
- Issa, A. O., Amusan, B. B., & Daura, U. D. (2019). Effects of ICT infrastructure and funding on library service delivery in Nigeria. *Library Hi Tech*, 37(2), 345–360.
- Kanyika, M. E., Sadykova, R., Tuenbaeva, K., Chuwa, L., et al. (2025). Adapting to new technologies: A systematic literature review of blockchain implementation in academic libraries. *Information Development*. <https://doi.org/10.1177/02666669241312153>
- Lemieux, V. L. (2016). Trusting records: Is blockchain technology the answer? *Records Management Journal*, 26(2), 110–139.
- Lin, I. C., & Liao, T. C. (2017). A survey of blockchain security issues and challenges. *International Journal of Network Security*, 19(5), 653–659.
- Liu, F., He, S., Li, Z., & Li, Z. (2023). An overview of blockchain efficient interaction technologies. *Frontiers in Blockchain*, 6, Article 996070. <https://doi.org/10.3389/fbloc.2023.996070>
- Malkov, A., & Kharitonova, D. (2023). Blockchain in academic libraries: Opportunities and challenges. *Scientific and Technical Information Processing*, 50(4), 314–321. <https://doi.org/10.3103/S0147688223040063>
- Meeramani, N., Anthoniraj, S., Beemkumar, & Shreyas. (2025). Application and mechanism of blockchain technology in libraries. *Information Security Education Journal*, 12(1), 21–27. <https://doi.org/10.6025/isej/2025/12/1/21-27>
- Mohanta, B. K., Panda, S. S., & Jena, D. (2018). An overview of smart contract and use cases in blockchain technology. In *Proceedings of the 2018 9th International Conference on Computing, Communication and Networking Technologies* (pp. 1–4). IEEE. <https://doi.org/10.1109/ICCCNT.2018.8494045>
- Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*.
- Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). *Bitcoin and cryptocurrency technologies: A comprehensive introduction*. Princeton University Press.
- National Population Commission. (2006). *Official records of the 2006 census*. Abuja.
- Nwosu, I. C., Eze, S. C., & Okafor, U. C. (2024). Blockchain adoption for secure digital record management in developing economies: Evidence from Africa. *Journal of African Digital Innovation*, 6(1), 21–35.
- Ojobor, R. C. (2023). Blockchain technology for library services: Challenges and opportunities for libraries from a Nigerian perspective. In M. Fombad, C. Chisita, O. Onyancha, & M. Minishi-Majanja (Eds.), *Information services for a sustainable society: Current developments in an era of information disorder* (pp. 7–23). De Gruyter Saur. <https://doi.org/10.1515/9783110772753-003>
- Oyelude, A. A. (2019). What's trending in blockchain technology and its potential uses in libraries. *Library Hi Tech News*, 36(9), 17–18.
- Oyetola, et al. (2023). Emerging technologies in academic libraries: Prospects and challenges in Nigeria. *Communicate: Journal of Library and Information Science*.
- Pagore, R. B. (2024). Impact of ICT on academic libraries: Challenges for library professionals. *IP Indian Journal of Library Science and Information Technology*, 9(2), 128–131.
- Patel, K., & Sharma, S. (2024). Adoption of blockchain technology in digital knowledge to increase transparency in transactions using library resources. In *Proceedings of the 2024 International Conference on Computational Intelligence and Knowledge Economy* (pp. 1–6). IEEE.
- Pathan, S., Roy, H., Singh, P., Sinha, T., & Sarpate, D. D. (2026). Drawbacks of existing inventory management systems. *Library Progress International*.
- Pilkington, M. (2016). Blockchain technology: Principles and applications. In C. Olleros & M. Zhegu (Eds.), *Research handbook on digital transformations* (pp. 225–253). Edward Elgar Publishing.
- Rajput, A., & Pandey, P. K. (2025). Transforming academic libraries with ICT: Enhancing knowledge sharing and resource management in Indian universities. *South Asia Journal of Multidisciplinary Studies*, 10(2).
- Rouhani, S., & Deters, R. (2019). Security, performance, and applications of smart contracts: A systematic survey. *IEEE Access*, 7, 50759–50779. <https://doi.org/10.1109/ACCESS.2019.2911031>
- Safdar, M., Qutab, S., Ullah, F. S., Siddique, N., & Khan, M. A. (2023). A mapping review of literature on blockchain usage by libraries: Challenges and opportunities. *Journal of Librarianship and Information Science*, 55(3), 848–858. <https://doi.org/10.1177/09610006221090225>

- Shahzad, K., Khan, S. A., & Iqbal, A. (2024). Effects of blockchain technology (BT) on university librarians and libraries: A systematic literature review (SLR). *Library Hi Tech*. Advance online publication. <https://doi.org/10.1108/LHT-10-2023-0486>
- Sharma, S., Lakshmanan, L., Sahu, P. K., Agarwal, T., & Tejeshwari, M. R. (2025). Blockchain for library records management: A secure and decentralized approach. *Indian Journal of Information Sources and Services*, 15(2), 28–37. <https://doi.org/10.51983/ijiss-2025.IJISS.15.2.05>
- Sodipe, O. M., Bamgbose, A. A., Fajiwe, O. T., Mabawonku, T. O., & Rafiu, W. K. (2025). Assessing the impact of automated cataloguing systems on cataloguing efficiency in academic libraries in South-West, Nigeria. *Communicate: Journal of Library and Information Science*.
- Szabo, N. (1997). Formalizing and securing relationships on public networks. *First Monday*, 2(9). <https://doi.org/10.5210/fm.v2i9.548>
- Tahora, S., Saha, B., Sakib, N., Shahriar, H., & Haddad, H. (2023). Blockchain technology in higher education ecosystem: Unraveling the good, bad, and ugly. *arXiv*. <https://arxiv.org/abs/2306.04071>
- Tella, A., Amuda, H. O., & Ajani, Y. A. (2022). Relevance of blockchain technology and the management of libraries and archives in the 4IR. *Digital Library Perspectives*, 38(4), 460–475. <https://doi.org/10.1108/DLP-08-2021-0065>
- Teredesai, A., et al. (2026). A comparative and synthesized literature review for a blockchain-based autonomous library management system. In *Proceedings of the 2026 International Conference on Emerging Technologies* (pp. 1–8). IEEE.
- Usman, M., & Ullah, A. (2024). Blockchain technology implementation in libraries: An overview of potential benefits and challenges. *AVE Trends in Intelligent Computing Systems*, 1(1), 42–53. <https://avepubs.com/user/journals/details/atrics>
- Yusuf, M., Akintunde, A., Habeeb, S., & Quadri, A. (2023). Radio Frequency Identification (RFID)-based library management system. *International Journal of Technology and Systems*, 8(2), 21–35.
- Zhang, P., Kelley, A., Schmidt, D. C., & White, J. (2023). Design pattern recommendations for building decentralized healthcare applications. *Frontiers in Blockchain*, 6, Article 1006058. <https://doi.org/10.3389/fbloc.2023.1006058>
- Zhang, Y., et al. (2026). Blockchain-based library management systems: A comprehensive review. *Blockchain: Research and Applications*, 7(2). Advance online publication.
- Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2017). An overview of blockchain technology: Architecture, consensus, and future trends. In *Proceedings of the 2017 IEEE International Congress on Big Data* (pp. 557–564). IEEE. <https://doi.org/10.1109/BigDataCongress.2017.85>

How to cite this Article: Kaaie, T. F., & Dinah, I. A. (2026). Leveraging blockchain technology for efficient library information management in Federal Polytechnic, Wannunne. *International Journal of Engineering, Science, and Environmental Research (IJESER)*, 2(1), 302–313.