
Blockchain-Enabled Resource Sharing and Inter-Library Loan

Vinayak Savatagi

Research Scholar

Department. of Library and Information Science,
Mangalore University, Mangaluru – 574199,
Karnataka, India vinayakslis@gmail.com

Umesha Naik

Professor and Chairman

Department. of Library and Information Science,
Mangalore University, Mangaluru – 574199,
Karnataka, India umeshanaik@gmail.com

Abstract

This research study explores the potential of blockchain technology in transforming resource-sharing and Inter Library Loan (ILL) services in libraries. Conventional ILL systems face time delays, operating costs, and data management issues. Blockchain technology offers a secure, transparent platform to manage resource requests, minimise transaction times, and maintain data accuracy. It also explores the use of smart contracts to automate lending processes, reducing human involvement and errors. The study also examines the impact of blockchain on data confidentiality, user verification, and library cooperation. It demonstrates the potential of blockchain in establishing a future-oriented infrastructure for resource sharing and ILL.

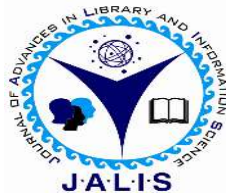
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Blockchain, Inter Library Loan, Resource Sharing, Information Technology, Library Services.

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1. Introduction

Libraries play a crucial role in the digital age, providing access to resources unavailable in local libraries. However, traditional interlibrary loan (ILL) systems face numerous challenges, such as inefficiencies in processing requests, delays in resource supply, high operating costs, and difficulties in managing user data and transaction records. Blockchain technology, which is decentralised, transparent, and safe, has been proposed as a potential solution. Blockchain technology was initially developed as the foundation for cryptocurrencies like Bitcoin and has since proven its promise across various fields, including supply chain management, healthcare, banking, and education. Its ability to generate a distributed ledger of transactions that is tamper-proof and visible to all users in the network allows libraries to manage resource sharing and interlibrary loans more effectively. Blockchain technology offers a decentralised, transparent, and safe approach to managing interlibrary loans, eliminating the possibility of data tampering and increasing confidence among participating libraries. Its immutability ensures that once a transaction is recorded, it cannot be changed or deleted, maintaining the integrity of the transaction history.

In the context of ILL, smart contracts, which automatically execute themselves and have the terms of the agreement put directly into code, are one of the most appealing characteristics of blockchain technology. This automation can significantly decrease the manual labour required by library staff, reduce errors, and speed up the process, making resource sharing more effective and user-friendly. Blockchain technology also has the potential to improve the safety and confidentiality of user information during the ILL process. Its decentralised architecture and modern encryption methods can create a more secure environment for storing and managing user information. Additionally, users can exercise more control over their data, determining who may access it and under what circumstances. Implementing blockchain technology into interlibrary lending systems may lead to more cooperation between libraries, enabling them to more readily find prospective partners and expedite the process of resource sharing. This could result in more extensive and durable networks of libraries that combine their resources and knowledge, benefiting users who depend on these services. However, libraries must address challenges and issues, such as the technical

difficulty of establishing blockchain systems, the need for uniformity among participating libraries, the possible adoption cost, and legal and ethical considerations of using blockchain technology in a library environment. Furthermore, more research and pilot projects are needed to investigate the practical uses of blockchain technology in this sector and create best practices for its implementation. In conclusion, the potential of blockchain technology to change interlibrary loans and resource sharing is significant, but libraries must address challenges and issues. By examining these concerns and exploring the potential of blockchain technology, libraries can contribute to the ongoing discussion on the future of libraries and the role new technologies will play in determining their development trajectory.

2. Review of Literature

Panda (2023) explores the potential applications of blockchain technology in information centers and libraries, focusing on its benefits such as digital preservation, tracking, and data-storing capabilities. Ashtagi (2023) highlights the challenges of incorporating blockchain technology in libraries, such as complexity and high initial costs. However, there is significant potential value in using blockchain technology in libraries. Kushwaha (2021) provides a comprehensive analysis of blockchain technology and its applications in various fields, focusing on libraries. The authors explore the unique characteristics of blockchain technology and its potential to transform library practices. They aim to raise awareness among library professionals about the technology and help them implement it effectively.

Oname (2021) examines the concept of blockchain technology and its potential applications in organizations like libraries and information centers. Blockchain technology, which is based on cryptography, creates a time-stamped, immutable, and dynamic database distributed among nodes in a network. This technology has the potential to revolutionize the way libraries and information centers operate, making them safer, more open, and more efficient. In conclusion, the potential of blockchain technology in libraries and information centers is significant, and further research and development are needed to fully realize its potential.

3. Research Methodology

This study makes use of a mixed-method approach, combining theoretical analysis with case studies, to

investigate the possibilities of blockchain technology in the context of ILL and resource-sharing applications.

3.1 Theoretical Analysis

The theoretical aspect of this article is doing a comprehensive investigation of blockchain technology and how it might be used for library services. This includes an examination of the fundamental characteristics of blockchain technology, such as its decentralized nature, immutability, and transparency, as well as an investigation of how these characteristics might be used to improve ILL systems.

Additionally, the research includes a comprehensive examination of smart contracts, with a particular emphasis on the potential of these contracts to automate different portions of the process of interlibrary lending. This involves the handling of penalties and fees, as well as the automation of other processes such as checking the availability of resources and loan requests. The theoretical investigation is based on the current body of literature about blockchain technology and the many implementations of this technology in different industries.

3.2 Case Study

This study provides case studies of libraries that have adopted blockchain or other comparable decentralized technology in their operations. These case studies are intended to supplement the theoretical analysis that was conducted. The obstacles and advantages of integrating blockchain technology into library systems are examined via the lens of these case studies, which provide practical insights.

The case studies consist of conducting interviews with members of the library staff, conducting an analysis of the implementation procedures, and evaluating the results of the adoption of blockchain technology. The purpose of the research is to give a complete knowledge of the possibilities for blockchain technology throughout the library sector. The study includes libraries of varying sizes and kinds, such as academic, public, and special libraries.

3.3 Data Collection and Analysis

An examination of the academic literature, news from the industry, and technical documents about

blockchain technology are the sources of information that are gathered for the theoretical study. To compile the case studies, interviews were conducted with important stakeholders, such as library directors, IT personnel, and users. Additionally, an examination of internal records and reports from the participating libraries was conducted.

Methods that are qualitative and quantitative are used in conjunction with one another to examine the data. A synthesis of theoretical ideas is performed to identify significant themes and patterns, and the data from the case study is studied to evaluate the practical consequences of developing blockchain technology.

4. Technology-Based on Blockchain Used in Inter-Library Loans

Transfer of Authority and Openness to Information

The fact that blockchain technology is decentralized is among the major benefits brought about by this technology. Transactions are often supervised by a central authority in conventional ILL systems. This particular authority may be a regional library network or consortia. Bottlenecks, delays, and a lack of transparency in the process are all potential outcomes that might result from this centralization.

Blockchain technology, on the other hand, makes it possible to create a decentralized network in which any library that participates has equal access to the system and is able to directly handle its transactions. By reducing the need for middlemen, this decentralization minimizes the amount of time it takes to complete the process and makes it more transparent. A public ledger is used to record every transaction that takes place on the blockchain. This ledger is accessible to all participants, which guarantees that the process is both transparent and verifiable.

Unchangeability and Safety Guaranteed

The immutability of blockchain data is yet another important characteristic that has the potential to improve the safety and dependability of medical information systems. A transaction that has been recorded on the blockchain cannot be changed or removed once it has been recorded. As a result, this guarantees that all records of resource requests, loans, and returns are correct and cannot be altered in any way.

On the other hand, with conventional systems, mistakes or illegal modifications to records might result in disagreements or the disposal of resources. By ensuring that the records' integrity is preserved, blockchain technology makes it less likely that problems of this kind would arise. In addition, the use of cryptographic methods guarantees the safety of all the data stored on the blockchain, therefore safeguarding the privacy of users and the secrecy of transactions.

Automated contracting with smart contracts

Contracts that are self-executing and consist of the terms of the agreement put into code are referred to as smart contracts. The use of smart contracts in the context of ILL has the potential to automate a number of different components of the process, hence lowering the need for human involvement and limiting the possibility of mistakes.

As an example, a smart contract may automatically validate the availability of a resource that has been requested, commence the process of loaning the resource, and monitor the progress of the loan until the resource is returned. If the resource is not returned within the specified time frame, the smart contract may automatically impose a charge or a punishment. The process is streamlined as a result of this automation, which makes it quicker and more efficient for everyone involved, including users and libraries.

5. Case Study-

5.1 Case Study 1: The Indira Gandhi National Centre for the Arts (IGNCA) Library in New Delhi is the subject of the first case study.

The Indira Gandhi National Centre for the Arts (IGNCA) Library, which can be found in New Delhi, is considered to be one of the most prestigious organizations in India when it comes to the research and preservation of educational and historical materials. The library is home to a vast collection of rare manuscripts, books, and audiovisual materials, which draws in academics, researchers, and students from all across the nation and even farther beyond. As a result of the one-of-a-kind characteristics of its collection, the IGNCA Library is regularly approached by other libraries and institutions with requests for ILL.

Processing of the Implementation

During the year 2022, the IGNCALibrary made the decision to test out a blockchain-based system for the management of its ILL. The library's objectives were to improve efficiency, increase transparency, and ensure the safety of transaction records. A customized ILL platform that could interact easily with the library's current library management software, KOHA, was developed via a collaborative effort between the library and BlockLib, a software company that specializes in blockchain technology.

A comprehensive requirements assessment was the first step in the implementation process, which was then followed by the framework design and construction of the blockchain platform. Staff members working in information technology at the library were given training on blockchain technology, smart contracts, and the particular functions of the new system. In addition, the library held training for the other collaborating institutions in order to guarantee a seamless transfer to the ILL platform that is based on blockchain technology.

It was one of the most important aspects of the new system that it used smart contracts in order to automate the verification of the availability of resources, the processing of loan requests, and the tracking of things that were borrowed. The technology also ensured that all participants in the ILL process received real-time updates, which reduced the probability of disagreements and ensured that there was transparency throughout the process.

Outcomes

The implementation of the blockchain-based ILL system at the IGNCALibrary yielded significant improvements in the efficiency and reliability of resource-sharing processes:

Reduced Processing Time: The time required to process ILL requests was reduced by approximately 40%. This was largely due to the automation of loan processing through smart contracts, which minimized manual intervention.

Improved Record Accuracy: The immutable nature of blockchain ensured that all transactions were recorded accurately and could not be altered, leading to greater trust among participating libraries.

Enhanced User Satisfaction: Users benefited from faster access to requested resources, and the transparency of the system allowed them to track the status of their requests in real-time.

Streamlined Collaboration: The blockchain platform facilitated better collaboration with other libraries, both within and outside New Delhi, enabling more efficient resource sharing across a wider network of institutions.

Challenges

Despite the overall success of the project, the IGNCALibrary faced several challenges during the implementation of the blockchain-based ILL system:

Technical Integration: Integrating the blockchain platform with the existing KOHA library management system required significant customization and technical support. This process took longer than initially anticipated, delaying the full deployment of the system.

Training and Adaptation: While the IT staff adapted quickly to the new system, some library staff and partner institutions required additional training to fully understand and utilize the blockchain platform. To address this, the IGNCALibrary organized ongoing training sessions and provided extensive documentation.

Initial Costs: The initial cost of developing and implementing the blockchain platform was higher than traditional systems. However, the library expects to offset these costs through long-term savings in operational efficiency and reduced manual workload.

Future Prospects

Encouraged by the success of the pilot project, the IGNCALibrary plans to expand the use of blockchain technology to other areas of library management, including digital rights management and archival preservation. The library is also exploring partnerships with international institutions to create a global network for resource sharing, further leveraging the capabilities of blockchain.

5.2 Case Study 2: Delhi Public Library (DPL), New Delhi

The Delhi Public Library (DPL) is a prominent public library system in India, with a vast network of

branches spread across New Delhi. Established in 1951, DPL serves a diverse population, offering a wide range of services including lending books, reference services, and educational programs. Given its extensive collection and large user base, DPL frequently participates in ILL programs, both within its network and with other libraries across India.

Implementation Process

In 2023, the Delhi Public Library initiated a project to modernize its ILL services by adopting blockchain technology. The goal was to create a more efficient and transparent system for managing resource-sharing requests while ensuring the security and integrity of transaction records. DPL partnered with a blockchain solutions provider, LibChain, to develop and implement a blockchain-based ILL system tailored to the needs of a large public library network.

The implementation began with a comprehensive assessment of DPL's existing ILL processes, followed by the development of a blockchain platform that integrated with DPL's existing library management software, e-Granthalaya. Training sessions were conducted for library staff across all branches to familiarize them with the new system, focusing on blockchain fundamentals, smart contracts, and the specific features of the new ILL platform.

The blockchain platform introduced several key features, including a decentralized ledger for recording all ILL transactions, smart contracts to automate the loan and return processes, and a user-friendly interface that allowed both library staff and users to track the status of their requests in real time.

Outcomes

The blockchain-based ILL system implemented at the Delhi Public Library brought about several notable improvements:

Increased Efficiency: The time required to process ILL requests was reduced by approximately 50%. The use of smart contracts eliminated the need for manual verification of resource availability and expedited the processing of requests.

Enhanced Collaboration: The decentralized nature of the blockchain platform facilitated better coordination and resource sharing between DPL branches and partner libraries. This led to an increase

in the number of successful ILL transactions and expanded the range of resources available to users.

Improved Data Security: The blockchain system provided a secure environment for managing user data and transaction records. The immutability of blockchain ensured that all records were accurate and protected against unauthorized changes, increasing trust among participating libraries.

User Engagement: The new system's transparency and real-time tracking features significantly improved user satisfaction. Users appreciated the ability to monitor the status of their requests and receive timely updates, leading to an increase in engagement with DPL's ILL services.

Challenges

Despite the positive outcomes, the implementation of the blockchain-based ILL system at DPL was not without its challenges:

Interoperability Issues: One of the major challenges was ensuring interoperability between the blockchain platform and the existing e-Granthalaya software used across DPL branches. The integration required extensive customization and coordination between DPL's IT team and the blockchain provider, leading to delays in the rollout of the system.

Cost Management: The initial investment in blockchain technology was substantial, particularly given the size and scope of the DPL network. While the long-term benefits were anticipated, managing the upfront costs and justifying the expenditure to stakeholders required careful planning and communication.

Training and Adoption: Ensuring that all staff members across DPL's numerous branches were comfortable using the new system was another challenge. While most staff adapted quickly, some required additional support and training, which was provided through ongoing workshops and helpdesk services.

Future Prospects

Building on the success of the blockchain-based ILL system, the Delhi Public Library plans to explore further applications of blockchain technology, including digital asset management and secure, decentralized archives for rare and historical

materials. Additionally, DPL is considering expanding its blockchain network to include partnerships with international libraries, thereby broadening the scope of resource sharing and enhancing its service offerings.

6. Advantages of Blockchain in Inter Library Loan Systems

The case studies highlight several key advantages of integrating blockchain technology into ILL systems. These include:

Efficiency: Blockchain reduces the time required to process loan requests, making resource sharing faster and more efficient.

Transparency: The decentralized and transparent nature of blockchain ensures that all transactions are visible to participants, reducing the risk of disputes and errors.

Security: Blockchain's immutability and cryptographic security provide a higher level of protection for transaction records and user data.

Automation: Smart contracts automate various aspects of the ILL process, reducing the administrative burden on library staff and minimizing the risk of errors.

7. Challenges and Considerations

Despite the advantages, there are also challenges and considerations that must be addressed when implementing blockchain in Inter Library Loan systems:

Technical Complexity: Implementing a blockchain-based ILL system requires significant technical expertise and may involve upgrading existing IT infrastructure.

Standardization: For blockchain to be effective in a multi-library environment, there must be standardization across the participating institutions. This includes agreeing on protocols for data exchange, transaction management, and smart contract development.

Cost: The initial cost of adopting blockchain technology can be high, particularly for smaller libraries with limited budgets.

However, these costs may be offset by long-term savings in operational efficiency.

Legal and Ethical Issues: The use of blockchain in libraries raises questions about data privacy, user consent, and the legal implications of automated transactions. These issues must be carefully considered and addressed.

Conclusion

There are several issues that conventional ILL systems are up against, and blockchain technology provides a viable answer to many of these challenges. Blockchain technology has the potential to improve the efficiency, security, and reliability of ILL procedures by offering a platform that is decentralized, transparent, and safe for managing resource sharing. A further streamlining of the process is achieved via the use of smart contracts, which lessens the administrative strain placed on library workers and enhances the overall user experience. However, in order to successfully use blockchain technology in ILL systems, extensive planning, technical competence, and coordination among participating libraries are required. Although there is a possibility that the early expenses and difficulties may be substantial, it is very probable that the long-term advantages of a resource-sharing system that is both more efficient and safe will surpass these difficulties. As libraries continue to adapt to the requirements of the digital era, blockchain technology has the potential to play a significant part in determining the future of resource sharing and interlibrary loans. This future might be significantly influenced by blockchain technology. It is necessary to conduct more research and pilot projects in order to investigate the full potential of blockchain technology in this context and to define industry standards for its use.

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