

## ACCESSING THE POTENTIALS OF BLOCKCHAIN TECHNOLOGY IN ENHANCING INFORMATION MANAGEMENT AND INFORMATION ORGANIZATION PRACTICES IN LIBRARIES: A CROSS-DISCIPLINARY ANALYSIS

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### Abstract

This study explored the potentials of blockchain technology in library information management and organization practices by drawing parallels from its successful applications in other fields like supply chain management, finance, healthcare, education, and intellectual property. How blockchain enhances processes like data security, transparency, and accountability in those fields provides valuable insights into how it could transform information management and information organisation within libraries. The study adopts a literature-based approach to explore relevant applications of blockchain technology in fields like supply chain management, finance, healthcare, education and intellectual property concerning use cases and principles that can be adapted to enhance library information management and organisation and to assess how blockchain can improve information management and organisation in terms of data security, ensuring intellectual property rights, enhancing cataloguing processes, and facilitating transparent and efficient resource sharing among institutions. On that basis, the study deduces that adopting Blockchain Technology to information management and information organisation in libraries can significantly reduce costs and increase efficiency, security and communication among the libraries, providing cardinal prospects for future growth.

**Keywords:** Blockchain Technology, Information Management, Information Organisation, Cross-disciplinary Applications, Decentralized Systems, Cross-field Innovations

## Introduction

Blockchain is an electronic process of storing data that is simultaneously secured, verified, transparent, and almost impossible to manipulate. Think of a series of compartments, each with a dab of information or a record on a particular transaction, record or agreement. Concerning block chaining, every new block is connected or linked to previous ones and creates chains with a permanent framework that is almost impossible to manipulate, thus upholding the honesty and reliability of data (Kuo, Shi & Bakshi, 2017; Hasan, 2020). In Blockchain, a new block is created through a process known as ‘mining’ and is then checked by several nodes. Any authorised institution does not control the blockchain. This formation helps avert fraud since the modification of a block impacts all subsequent blocks in every other copy of the chain – making it difficult to manipulate (Hyperledger, 2019).

Blockchain Technology (BCT) has changed several sectors by providing distributed, publicly transparent, secure ledgers, including finance, supply chain, logistics, and healthcare. Literature shows that enhancing the promising facets of BCT continues to be documented and applied in those domains (Bingzhang & Vladimirov 2021; Saeed, Malik, Bashir, Ahmad, Riaz Ilyas & Khan, 2022; Gobet & Melachrinou, 2023). Scholars in the library domain opined that BCT can be applied to librarianship just like other fields (Abid, 2021; Hassan, 2020; Jha, 2023).

According to Jha (2023), the main goal of applying blockchain technology (BT) in libraries is to give all possible users in participating library systems unrestricted access to digital content and print collections while minimising risk to protect each user’s privacy and identification. In particular, information management and organisation are areas where BCT can be applied

in libraries. Information management can be described as the orderly collection, direction, and utilisation of information within organisations to satisfy operational and/or strategic objectives (Rowley, 2017).

Information organisation, on the other hand, refers to the process of describing, representing, filing and organising documents (Hjørland, 2016). Both concepts are essential for the effective functioning of libraries, as they ensure that information resources are systematically managed and made easily accessible to users (Rowley, 2017; Hjørland, 2016). Information management strategically oversees information flows within the library, aligning them with organisational goals (Rowley, 2017). In contrast, information organisation emphasises the detailed processes of categorising and structuring resources for efficient retrieval (Hjørland, 2016). Together, they form the backbone of library services, supporting user needs, enhancing resource discoverability, and enabling libraries to fulfil their roles as information hubs in a knowledge-driven society.

Some libraries are beginning to explore the potential of BCT. For instance, the University of San Jose in Toronto, the Reference Library, and the Suffolk Collaborative Library System are experimenting with BCT in their services (Jha, 2023). However, conventional approaches still prevail, especially in the developing world. Nonetheless, interpreting the roles of blockchain technology in data security, integrity, and management makes the efficiency of applying the technology fit well with the strategic functions of libraries, especially in information management and information organisation functions. This paper explores the potential of BCT in reshaping the functions of information management and information organisation in libraries based on the analysis of its successes in other industries.

### Objectives of the Study

1. To explore relevant applications of blockchain technology in fields like supply chain management, finance, healthcare, education, and intellectual property that can be adapted to enhance library information management and organisation.
2. To assess how blockchain can improve library information management and organisation.

### Review of Related Literature

A blockchain serves primarily as a distributed ledger that records transaction details between parties. Functioning as a Peer-to-Peer (P2P) system, it enables nodes (peers) to maintain the network, exchange blocks, and process transactions collectively, eliminating the need for a central third party (Nakamoto, 2008; Jirgensons & Kapenieks, 2018). In blockchain, a cryptographic hash identifies each block and makes an attribute to the previous block, thus creating a chain (Nakamoto, 2008). Blockchain technology emerged in 2008 with the publication of the Bitcoin whitepaper by an anonymous person or group known as Satoshi Nakamoto, outlining a decentralised digital currency system (Nakamoto, 2008). The first blockchain was implemented in 2009 as the foundation of Bitcoin, enabling secure and transparent peer-to-peer transactions without intermediaries. Over time, blockchain's potential expanded beyond cryptocurrencies, with the launch of Ethereum in 2015 introducing smart contracts—self-executing agreements coded on the blockchain (Buterin, 2014). Today, blockchain is used in various sectors, including finance, supply chain, and healthcare, highlighting its transformative role in enhancing transparency, efficiency, and trust (Bingzhang & Vladaimir 2021). The first generation of blockchain was implemented to

support applications such as cryptocurrencies- digital currencies relying on cryptography and P2 P networks. One foundational idea in blockchain is mining, the process by which a miner gathers transactions, checks the block he has assembled through a mathematical computation, and adds it to the chain of transactions that has come before it. Some scholars in the field of library science have argued that blockchain technology can be applied to the discipline (Abid, 2021; Hassan, 2020; Jha, 2023). This work's authors add that BCT can be introduced further in information management and organisation as it affects librarianship.

Information Management (IM) refers to the ability of organisations to achieve optimum operations, generate insight for decision making and respond to a dynamic environment. Information management is an organisation's actions to obtain, structure, maintain, store, locate, and protect information in decision-making processes, planning, and operational actions (Artur, 2022; Agu, 2017). This definition points to how information is managed to support an organisation's strategic and operational goals. Marchand, Kettinger, and Rollins (2000) describe information management as "the management of the processes and systems responsible for collecting, processing, and distributing information to fulfil decision-makers' needs and improve organisational performance". Information management comprises data management, information seeking, and information archiving and organisation. This definition highlights the role of information management in ensuring that relevant data reaches the right people for effective decision-making.

Information Organization constitutes part of the information science discipline and is concerned with categorising, arranging and searching information in different systems (Hjorland, 2016). Information Organization allows users to get information when needed, which is especially important in the modern world, where vast amounts of information are

produced daily. Information organisation pertains to metadata, which can be defined as data about data that provides information about the content of the objects (Baca, 2016). According to Gilliland (2016), organisations can increase the compatibility between different information systems to increase the discovery of resources through metadata. Metadata standards like the Dublin Core present a schema that can effectively retrieve information across databases and digital libraries (Nilsson, 2010).

Library information organisations are also concerned with using tools like the Dewey Decimal and the Library of Congress Classification (LCC). These tools categorise knowledge by subjects and help users traverse the subjects in a pre-determined order (Satija, 2013). Hjørland (2013) highlights that a good classification is a mirror conceptual approach that enables users to identify relevant data in their learning and research. In its broad sense, information organisation deals with information management for use, storage, and recovery.

There is great concern regarding cybersecurity and data privacy, which may affect library information management and organisation. In this regard, Ward and Peppard (2016) pointed out that, in today's cloud-computing and social/mobile technologies, there is more than ever a need for stringent security or protection around information management practices. However, these measures may be too expensive for the organisations or require technical skills that the concerned organisation may not have (Ward & Peppard, 2016). Further, data privacy and protection measures towards data collection and use continue to face regulatory challenges, which call for compliance with Use laws such as GDPR in Europe (Alhadeff, 2018). Blockchain technology offers advantages in information management and organisation through enhanced data security, transparency, and traceability.

### **Exploring Blockchain Technology Applications across Domains and Its Potential Use in Librarianship**

Blockchain technology has penetrated the financial sector by introducing cryptocurrencies such as Bitcoin and Ethereum. Due to its decentralised application, everyone on the network can perform P2P transactions effectively with no interference from a middleman, as the records of each transaction are open for all and cannot be altered once recorded on the chain. According to Treleaven, Brown & Yang (2017), in their study 'Blockchain Technology in Finance,' this has complicated fraud and unauthorised change to data due to the application of BCT. It also addresses issues related to the financial data trust and validation that financial institutions encounter (Rijanto, 2021).

Blockchain has been applied in various fields in diverse ways. In supply chain management, BCT has proven helpful in improving transparency and accountability across many sectors. The agriculture, health finance, and education supply chain industry has used blockchain to improve transparency, traceability, and accountability in tracking goods and services from origin to destination. Bingzhang & Zirianov (2021) described how global blockchain-based systems implemented by Maersk and IBM in 2018 have improved transparency and traceability in their supply chain, ensuring that every stage of the process is recorded and can be audited in real-time. This has dramatically improved efficiency and mitigated counterfeiting, product recalls, and fraud.

Also, BCT has solved the problem of unreliability and data inaccuracy that leads to disputes and reduced the inefficiency of processes in the logistics industry. Bingzhang & Zirianov (2021) posit that this was achieved through smart contracts, which are described as self-executing digital contracts with the terms of the agreement directly written into code, automatically enforcing actions when predefined conditions are met. In the management of

supply chains, blockchain enhances the timely availability of information where there are stages of intermediation, especially when there's a collaboration between the players (Wang, Wu, Chen & Evans, 2020).

Studies in education and healthcare (Saeed, Malik, Bashir, Ahmad, Riaz, Ilyas, Bukhari, & Ali Khan, 2022; Awaji, Solaiman, & Albshri, 2020) show that blockchain and smart contract properties enable various innovative applications in higher education and healthcare sector. For example, multiple institutions employ blockchain in education to manage diplomas and evaluate achievements. Its secure and transparent record-keeping could help with credential verification, offer better student and learning paths and may provide an immutable record of the scholar's learning progress. Blockchain could be used to enhance the learning activities and teaching activities for both learners and educators, especially in the design and execution of the learning activities, conducting formative assessments, and even monitoring the learning process as a whole. It can also be implemented in healthcare, enabling secure storage and sharing of health records, promoting complete transparency of the methods in healthcare organisations and making the experience better for both the patient and healthcare provider. Blockchain technology has made significant strides in intellectual Property (IP) and Digital Rights Management (DRM). Onwubiko, Singh, Iqbal Awan, Pervez, and Ramzan (2023) discussed the evolving role of blockchain and Non-Fungible Tokens (NFTs) in regulating intellectual property within the digital art space, emphasising their potential to secure ownership rights for digital creators despite the ease of copying such works. NFTs allow creators to establish ownership of an original version of their work, enhancing its value and recognition and providing a promising tool for IP management by simplifying transactions and creating new market opportunities (Basu, Basu, & Austin, 2022). Blockchain platforms issue NFTs to artists, authors, and creators to reward them for their content. Buyers

of NFTs hold ownership of a unique digital asset, with the blockchain creating a transparent, immutable record of ownership that aids in licensing, distribution, and preventing unauthorised use. Platforms like Ethereum enable smart contracts that automatically execute licensing agreements under specific conditions, ensuring that creators are fairly compensated for their work (Basu, Basu, & Austin, 2022). In the library context, the secure and decentralised system in blockchain ensures that once data is recorded, it cannot be altered or deleted without a consensus mechanism (Asghar, Egaji & Griffiths, 2022). This could be useful for preserving catalogue records, historical metadata, and provenance information for rare collections. Blockchain can also protect against cyber threats and unauthorised modifications of bibliographic records. Blockchain guarantees the impossibility of altering catalogue records and metadata in library databases. This can ensure that the records are well protected from cyber threats and attacks.

Applying blockchain to digital archives, for instance, would ensure that classified information in catalogue entries cannot be edited without the approval of the network –the staff and systems involved. This can make the system secure, reliable and almost impossible to attack. Libraries often rely on centralised databases like OCLC or MARC for bibliographic records. A blockchain-based catalogue could enable a decentralised, peer-to-peer system where multiple libraries contribute and verify records without dependence on a single authority. It can also facilitate shared cataloguing efforts across institutions, reducing redundancy (Hasan, 2020; Jha, 2023). Libraries have always strived to ensure the security of their data. As such, blockchain technology can achieve information and data security in the organisation and manage its resources (Jha, 2023). Blockchain can ensure transparency in how records are updated or accessed, allowing library professionals to track changes in their information systems. This could prove especially useful in scenarios like digital rights

management and in monitoring the usage and distribution of digital resources, e.g. intellectual property; licensing and control; research accessibility, sharing and collaboration; data analytics and usage monitoring; bibliometrics, and other related areas (Hasan, 2020; Jha 2023). Blockchain can track the lifecycle of digital and physical resources, ensuring authenticity and ownership history. It helps manage archival materials, rare manuscripts, and digital assets where provenance verification is critical. BCT can facilitate secure and transparent user transactions regarding borrowing histories, fines, and payments, which could be securely managed while preserving privacy through encryption techniques. This could enhance user trust in library systems while reducing unauthorised data access. A blockchain system might extend the possibility for tracking resources, regarding who has been using the records, who has altered something, if the resource has been brought back on time, etc-based, on the records in the various institutions (Asghar, I., Egaji, D. A., & Griffiths, M. (2022). In essence, just as blockchain ensures that products in the supply chain can be traced from origin to destination, it could offer the exact solution for preserving the life-cycle of the information, from acquisition to de-accession. Blockchain can remove barriers in resource acquisition, lending, or interlibrary loan services and provide all interested parties with real-time access to bibliographic data (Emmanuel, Efemini, Oseni & David, 2023). Blockchain can support the idea that libraries function more efficiently and have less overhead in terms of paperwork while being more accountable (Emmanuel et al., 2023).

Blockchain can be used in academic and research libraries, where there is a need to store sensitive research data, publications and records and make it accessible to authorised audiences (Jha, 2023). Blockchain makes it possible for libraries to keep, for instance, unpublished manuscripts, restricted research data, or proprietary academic work safe and share with the right people only. Blockchain's decentralised system can also facilitate the

secure sharing of information between different library branches, similar to how education and healthcare institutions share records securely across networks (Hasan, 2020; Abid, 2021). In addition, just as in healthcare, a patient's experience can be enriched by providing an unchangeable record of treatments; blockchain can also be applied in libraries to enhance the reliability and integrity of academic research in libraries. Researchers can use blockchain to securely store and verify their research data, ensuring that no unauthorised changes are made and that their intellectual property is fully protected (Asghar, Egaji & Griffiths, 2022).

Libraries with extensive collections of copyrighted materials, digital assets, and licensed resources can leverage blockchain technology to implement a decentralised Digital Rights Management (DRM) system. In such a system, creators can register their works while libraries manage licensing agreements through smart contracts. This approach enhances transparency and provides a secure method for addressing intellectual property ownership. It allows creators to track the usage of their materials while ensuring that libraries and users pay fair compensation and access the content legally. In addition, such a system would make licensing and management of digital content a noble exercise of legal means for users while warranting the rights of the creators.

It can be inferred from the literature that Blockchain Technology has much potential. However, its integration with information management and organisation would not be easy. Since blockchain is a decentralised technology, it is computationally intensive and may not be financially feasible for libraries and significantly smaller institutions. There is also the scalability issue, as large volumes of data would require substantial storage capacity, leading to slower processing times in an already resource-constrained environment. Moreover, while beneficial for security and traceability, blockchain's transparency may conflict with privacy

concerns, particularly in environments where sensitive or personal information is stored (Bingzhang & Vladaimir, 2021).

Libraries must balance the need for transparency with the requirements of data protection laws like the General Data Protection Regulation (GDPR). The potential for conflict between blockchain's immutability and privacy regulations, which often require data to be erasable under certain circumstances, poses a challenge that must be addressed. Though blockchain has not yet found widespread application in libraries and information centres, its success in fields like finance, supply chain management, healthcare, and intellectual property offers valuable lessons about its potential for libraries. Blockchain's ability to ensure data security, transparency, and traceability makes it a promising solution for challenges in the organisation, management, and sharing of information in libraries.

There is great concern regarding cybersecurity and data privacy as they affect information management and library organisation. In this regard, Ward and Peppard (2016) pointed out that, in today's cloud-computing and social/mobile technologies, there is more than ever a need for stringent security or protection around information management practices. However, these measures may be too expensive for the organisations or require technical skills that the concerned organisation may not have (Ward & Peppard, 2016). Thus, data privacy and protection measures towards data collection and use continue to face regulatory challenges, which call for compliance with Use laws such as GDPR in Europe (Alhadeff, 2018).

### **Conclusion and Recommendations**

By examining how blockchain has transformed other industries, it becomes pertinent to harness its potential in revolutionalising information management and organisation in libraries, particularly in metadata management, digital rights, resource sharing, and information security. However, to realise this potential, libraries must carefully navigate the

challenges of cost, scalability, and privacy, as is generally advised in the blockchain technology literature. As blockchain technology evolves, solutions to these challenges will likely emerge, paving the way for its integration into the information systems of libraries.

### Recommendations

1. Due to BCT's heavy financial requirements, libraries can collaborate to harness the technology and benefit from its enormous advantages.
2. Libraries should make provisions for training on blockchain
3. Libraries should upgrade their systems to accommodate and take advantage of Blockchain Technologies for improved information management and organisation services.
4. Libraries should initiate and adopt data protection laws to ensure privacy concerns are factored into adopting BCT.

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