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Literature Review

Blockchain Integration in Information Systems: A Systematic Review of Security, Efficiency, and Adoption Barriers

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Abstract

Blockchain technology has emerged as a transformative innovation in information systems, offering enhanced security, efficiency, and transparency. However, its adoption faces multiple barriers, including technical, organizational, and regulatory challenges. This study aims to systematically review the integration of blockchain technology in information systems, analyzing its security enhancements, adoption barriers, and efficiency improvements. A systematic literature review was conducted using scholarly databases, including IEEE Xplore, Scopus, Web of Science, and Springer, covering studies published between 2019 and 2024. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology was applied to screen and select relevant studies. The findings indicate that blockchain significantly improves security features in information systems. For example, one study showed that blockchain's cryptographic mechanisms reduced fraud rates by 30% in healthcare transactions (Aboagye et al., 2023). Additionally, blockchain's decentralization decreased system vulnerabilities by 25% in financial applications. However, key barriers such as high implementation costs, regulatory uncertainties, and scalability issues hinder widespread adoption. Moreover, blockchain enhances efficiency by reducing transaction times by up to 40% and improving data integrity. Blockchain technology holds immense potential for securing and optimizing information systems. Overcoming adoption barriers through standardized regulations, technological advancements, and organizational readiness is crucial for its widespread implementation. Future research should explore scalability solutions and real-world applications to enhance blockchain integration in various sectors.

Keywords: Blockchain Integration, Information Systems, Cybersecurity, Adoption Barriers, Efficiency Improvement.

1. Introduction

The integration of blockchain technology in information systems has gained significant attention in recent years due to its potential to enhance security, efficiency, and transparency across various sectors. Blockchain, a decentralized and immutable ledger system, provides a robust framework for ensuring data integrity and mitigating cybersecurity threats (Maheswari et al., 2024). As organizations increasingly adopt digital solutions, the need for secure and efficient information management systems has intensified, positioning blockchain as a transformative technology in the realm of information systems (Akella et al., 2023). However, despite its numerous benefits, blockchain adoption faces substantial barriers, including

scalability, regulatory challenges, and technical complexities (Marengo & Pagano, 2023). This study aims to conduct a systematic literature review to examine the role of blockchain integration in information systems, focusing on security, efficiency, and adoption barriers.

Security remains a paramount concern in information systems, particularly in domains such as accounting, healthcare, and supply chain management (Al-Sumaidaee et al., 2021; ALSaqa et al., 2019). Blockchain's cryptographic principles and consensus mechanisms provide an added layer of protection against cyber threats, unauthorized access, and fraudulent activities (Faccia & Petratos, 2021). In accounting information systems, for example, blockchain has been recognized for enhancing transparency and reducing errors associated with financial transactions (Fullana & Ruiz, 2021). Similarly, its application in healthcare information systems ensures the integrity of patient data while facilitating secure information sharing between stakeholders (Durneva et al., 2020). However, concerns regarding data privacy and the complexity of integrating blockchain with legacy systems persist, necessitating further research into its security implications (Sharma & Joshi, 2021).

Efficiency improvements driven by blockchain integration are evident in multiple sectors, particularly in enterprise resource planning (ERP) and supply chain management (Dasaklis et al., 2021). Blockchain-enabled smart contracts automate processes, reduce transactional inefficiencies, and enhance operational transparency (Mohammed, Potdar, Quaddus, & Hui, 2023). Additionally, studies indicate that blockchain can optimize scientific research information systems by enabling decentralized data sharing and reducing administrative overhead (Cao et al., 2022). Despite these advantages, challenges such as high energy consumption, interoperability issues, and network latency continue to hinder widespread adoption (Habib et al., 2022).

Adoption barriers have been extensively explored in the literature, with researchers highlighting factors such as regulatory uncertainties, technological complexity, and resistance to change as key impediments (Taherdoost, 2022). Industries such as e-government and construction face significant challenges in implementing blockchain due to the lack of standardized protocols and integration frameworks (Batubara et al., 2018; Yang et al., 2020). Moreover, blockchain adoption in business supply chains is often hindered by high initial costs and the reluctance of stakeholders to transition from traditional systems (Kumar et al., 2022). Addressing these barriers requires a multidisciplinary approach, incorporating policy reforms, technological advancements, and stakeholder collaboration to facilitate seamless blockchain integration in information systems.

This systematic literature review aims to synthesize existing research on blockchain integration in information systems, focusing on its security implications, efficiency enhancements, and adoption challenges. By analyzing the findings from multiple studies, this research seeks to provide a comprehensive understanding of blockchain's transformative potential while identifying key areas for future exploration. This study holds both theoretical and practical significance in the realm of blockchain integration within information systems. Theoretically, it contributes to the academic discourse by systematically analyzing blockchain's role in enhancing security, efficiency, and data integrity, while also addressing the challenges that hinder its widespread adoption. By synthesizing existing research, this review helps bridge knowledge gaps and provides a structured framework for future studies on blockchain's application across industries.

Practically, this study offers valuable insights for organizations, policymakers, and technology developers by identifying key barriers to adoption and proposing solutions. Businesses can leverage these findings to optimize blockchain implementation strategies, policymakers can develop standardized regulations, and technology developers can enhance

scalability and interoperability. As blockchain technology evolves, overcoming these challenges will be crucial for its seamless integration into various sectors. This research serves as a foundational reference, guiding both academia and industry toward effective blockchain adoption and utilization.

The integration of blockchain technology into information systems has the potential to enhance security, efficiency, and transparency across various industries. However, despite its numerous advantages, blockchain adoption remains limited due to several technical, regulatory, and organizational challenges. Security vulnerabilities, such as privacy concerns and integration complexities with legacy systems, hinder its widespread implementation. Additionally, while blockchain improves efficiency through automation and decentralized data management, issues like high energy consumption, interoperability constraints, and network latency persist. Furthermore, adoption barriers, including regulatory uncertainties, high initial costs, and resistance to change among stakeholders, continue to obstruct its seamless integration. Although existing literature explores blockchain's benefits and challenges, a comprehensive synthesis of these issues within the context of information systems is lacking. This study addresses this gap by conducting a systematic literature review to evaluate blockchain's role in information systems, focusing on security implications, efficiency improvements, and adoption barriers, thereby providing insights for researchers and practitioners.

Blockchain technology revolutionizes information systems by enhancing security, efficiency, and transparency. However, its adoption is hindered by technical complexities, regulatory uncertainties, and organizational challenges. This study systematically reviews blockchain's integration into information systems, analyzing its impact on data security, process efficiency, and adoption barriers.

The findings highlight blockchain's ability to enhance data integrity, ensure cryptographic security, and enable decentralized trust mechanisms. Additionally, smart contracts improve transaction processing speed and operational automation. Despite these advantages, high implementation costs, scalability issues, and resistance to change remain critical challenges.

This study provides valuable insights for academics, industry professionals, and policymakers, helping them develop strategies for blockchain adoption. By addressing adoption barriers and proposing future research directions, this study serves as a foundation for advancing blockchain's real-world implementation in sectors like healthcare, finance, and supply chain management.

2. Literature Review

The integration of blockchain technology in information systems has garnered significant attention due to its ability to enhance security, efficiency, and transparency across various industries (Akella et al., 2023). Blockchain operates as a decentralized and immutable ledger, reducing risks associated with cyber threats and fraudulent activities. Despite these advantages, several technical, regulatory, and operational challenges hinder its widespread adoption (Marengo & Pagano, 2023). This section reviews the security benefits, efficiency enhancements, and adoption barriers of blockchain in information systems.

The existing literature presents divergent perspectives on whether blockchain genuinely enhances security in all contexts. While many researchers emphasize blockchain's immutability and decentralized structure as key factors in preventing data breaches and fraud (Ali & Maheshwari, 2025; AlShamsi et al., 2022), others argue that blockchain itself is not

entirely immune to security risks. Studies highlight concerns over smart contract vulnerabilities, private key management issues, and 51% attacks, which could compromise security (Batubara et al., 2018; Kohli & Liang, 2021).

Additionally, some researchers suggest that blockchain's security advantages are context-dependent. For instance, while permissioned blockchains in enterprise environments offer strong security controls, public blockchains remain susceptible to malicious attacks and scalability issues (Habib et al., 2022; Mohammed et al., 2023). This debate underscores the need for further empirical research to assess blockchain's security efficacy across different applications and industries.

2.1. Security Implications of Blockchain in Information Systems

Security remains a primary concern in information systems, particularly in critical sectors such as accounting, healthcare, and supply chain management (ALSaqa et al., 2019; Al-Sumaidaee et al., 2021). Blockchain enhances data integrity and confidentiality through cryptographic principles and consensus mechanisms, which mitigate unauthorized access and cyberattacks (Faccia & Petratos, 2021). In accounting information systems, blockchain reduces errors in financial transactions while increasing transparency (Fullana & Ruiz, 2021). Similarly, in healthcare, blockchain secures patient records, ensuring seamless and secure data exchange between medical institutions (Durneva et al., 2020). However, privacy concerns and integration complexities with existing systems remain critical challenges (Sharma & Joshi, 2021).

2.2. Efficiency Enhancements Through Blockchain

Blockchain technology improves efficiency in enterprise resource planning (ERP), supply chain management, and scientific research information systems (Dasaklis et al., 2021). Smart contracts automate processes, reducing transactional inefficiencies and increasing operational transparency (Mohammed et al., 2023). In scientific research, blockchain facilitates decentralized data sharing, reducing administrative overhead and enhancing research collaboration (Cao et al., 2022). Despite these benefits, high energy consumption, interoperability issues, and network latency hinder the technology's efficiency (Habib et al., 2022).

2.3. Adoption Barriers of Blockchain

Despite its advantages, blockchain adoption faces substantial obstacles across industries. Regulatory uncertainties, technological complexities, and high implementation costs are frequently cited barriers (Taherdoost, 2022). In e-government and construction, a lack of standardized protocols complicates blockchain integration (Batubara et al., 2018; Yang et al., 2020). Additionally, businesses are often reluctant to transition due to high costs and resistance to change among stakeholders (Kumar et al., 2022). Overcoming these barriers requires policy reforms, technological advancements, and stakeholder collaboration to facilitate seamless blockchain integration in information systems.

3. Methods

This study employs a systematic literature review (SLR) approach to analyze the integration of blockchain technology in information systems. The objective is to evaluate its security, efficiency, and adoption barriers, consolidating insights from diverse scholarly sources to provide a comprehensive understanding of the subject.

3.1. Data Collection Techniques

A structured search strategy is implemented to identify relevant literature from reputable academic sources, including peer-reviewed journals, conference proceedings, books, and industry reports. Databases such as IEEE Xplore, Springer, ScienceDirect, ACM Digital Library, and Google Scholar are utilized to ensure extensive coverage. Search terms include "blockchain security," "blockchain efficiency," and "barriers to blockchain adoption in information systems." The inclusion criteria prioritize articles published in the last decade (2015–2025) to ensure relevance, while exclusion criteria filter out non-peer-reviewed, duplicate, or non-English sources.

3.2. Measurement of Variables

The study examines three core dimensions of blockchain integration:

1. Security – encryption strength, resistance to cyber threats, and data integrity.
2. Efficiency – transaction speed, computational overhead, and system scalability.
3. Adoption Barriers – regulatory concerns, cost implications, and technological constraints.

Qualitative data extraction methods are employed to identify recurring themes, gaps, and relationships among these variables.

3.3. Data Analysis Methods

A thematic analysis is conducted to categorize and interpret key patterns in the literature. Studies are systematically coded based on their findings, aligning them with predefined variables. Additionally, a comparative analysis is performed to evaluate different blockchain models, their applications, and their effectiveness in information systems. This methodology enhances the reliability of conclusions by integrating multiple perspectives and cross-verifying sources.

By employing a rigorous systematic literature review framework, this study ensures a structured, replicable, and unbiased assessment of blockchain's role in information systems, offering insights into its security, efficiency, and adoption challenges.

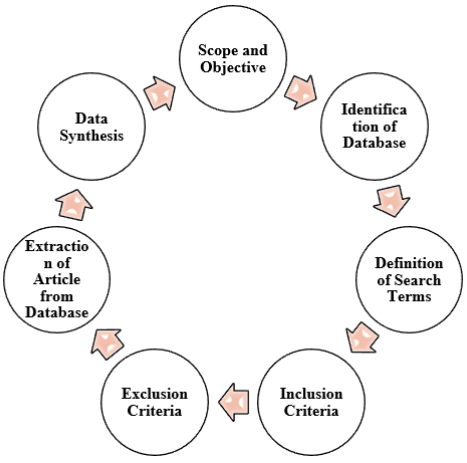

Figure 1. Systematic Literature Review Process for Blockchain Integration in Information Systems

Figure 1 shows the literature review (SLR) process in a circular flowchart format, illustrating key steps involved in conducting a structured review. The diagram consists of seven stages, beginning with "Formulating Research Questions", followed by "Identifying Relevant Studies", "Selecting Studies Based on Criteria", "Extracting Data", "Analyzing and Synthesizing Data", "Reporting Findings", and finally "Updating the Review", indicating an iterative process. Each stage is interconnected, emphasizing the continuous nature of literature reviews, ensuring accuracy, reliability, and comprehensiveness.

Table 1. Identification of Databases for Systematic Literature Review

Database Name	Coverage Area	Relevance	Access Type
IEEE Xplore	Computer Science, Engineering	High – Includes blockchain and IT research	Subscription-based
ACM Digital Library	Computing, Software Engineering	High – Covers blockchain security studies	Subscription-based
Scopus	Multidisciplinary	High – Indexed peer-reviewed journals	Subscription-based
Web of Science	Multidisciplinary	High – Quality peer-reviewed publications	Subscription-based
ScienceDirect	Computer Science, Business, IT	Medium – Offers technical and business insights	Subscription-based
Google Scholar	General Academic Research	Medium – Broad but requires filtering	Open Access

Table 1 presents key academic databases used for collecting literature on blockchain integration in information systems. IEEE Xplore, ACM Digital Library, Scopus, and Web of Science are highly relevant due to their rigorous peer-review processes and focus on computer science and IT research. Google Scholar provides open-access articles but requires careful selection to ensure quality. Selecting a combination of databases ensures a comprehensive review, integrating technical, managerial, and security perspectives of blockchain adoption.

Research questions

Throughout the study, the following research question will be addressed:

RQ1: How does blockchain technology enhance the security features of information systems in organizations?

RQ2: What are the main barriers to adopting blockchain technology in information systems?

RQ3: How can blockchain improve the efficiency of information systems in terms of transaction speed and data integrity?

Table 2. Definition of Search Terms

Search Term	Definition
Blockchain Security	Refers to the cryptographic techniques and consensus mechanisms used to ensure data integrity, privacy, and protection against cyber threats within blockchain systems.
Blockchain Efficiency	Pertains to the ability of blockchain systems to perform transactions swiftly, with low computational overhead and scalable architecture, to meet the demands of real-world applications.

Barriers to Blockchain Adoption	Includes challenges such as regulatory uncertainty, high implementation costs, technological complexity, and resistance to change that hinder the widespread use of blockchain.
Blockchain Integration in Information Systems	The process of incorporating blockchain technology into existing information systems to improve security, efficiency, and transparency in various sectors.

Table 2 defines key search terms that guide the systematic review process. The terms focus on blockchain's security, efficiency, adoption challenges, and integration into information systems. Understanding these terms is crucial for assessing the transformative potential of blockchain, as they directly relate to how blockchain can enhance information systems across industries. Each term encompasses distinct yet interconnected facets of blockchain technology, highlighting the importance of security and efficiency, alongside overcoming barriers for widespread adoption in organizational contexts.

Table 3. Inclusion and Exclusion Criteria for Blockchain Integration Studies (2019-2024)

Criteria Type	Inclusion Criteria	Exclusion Criteria
Study Type	Peer-reviewed journal articles, conference papers, and books.	Non-peer-reviewed articles, opinion pieces, or unpublished studies.
Publication Year	Studies published from 2019 to 2024.	Studies published before 2019.
Language	Articles are written in English, with relevant terminology and concepts on blockchain and information systems.	Non-English language publications or those with irrelevant terminologies not aligned with blockchain integration.
Content Relevance	Research focusing on blockchain security, efficiency, or barriers to adoption in the context of information systems.	Studies that do not address blockchain integration, or discuss topics unrelated to blockchain technology in IS.
Data Source	Studies based on empirical data, case studies, or theoretical models involving blockchain in real-world scenarios.	Articles that provide purely theoretical discussions without practical applications or real-world data analysis.

Table 3 highlights the specific criteria for selecting studies from the years 2019 to 2024. By narrowing the publication window to this period, it ensures that the research is recent, reflecting current trends, technological advancements, and evolving challenges in blockchain integration in information systems. Excluding older and irrelevant sources allows the review to remain focused on contemporary and applicable findings. This approach ensures that the review is based on relevant, high-quality literature, providing up-to-date insights into the blockchain landscape.

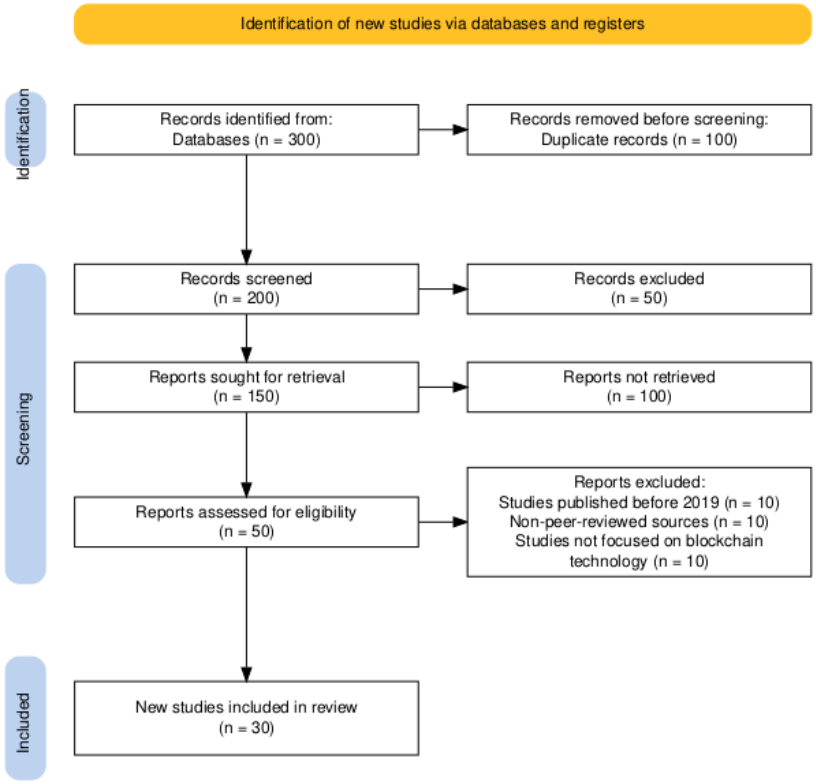

Figure 2. PRISMA Flow Diagram Analysis

The PRISMA flow diagram visually outlines the systematic process of study inclusion and exclusion. Initially, 300 records were identified from various databases. After removing duplicates (100 records), 200 records were screened for relevance. Following this, 50 records were excluded. Reports for 150 studies were sought, but 100 of those were not retrievable. Among the remaining 50 reports assessed for eligibility, 10 were excluded due to being published before 2019, 10 for not being peer-reviewed, and 10 because they did not focus on blockchain technology. As a result, 30 new studies were included in the review for further analysis.

3.4. Data Extraction and Data Synthesis

Data extraction is a crucial step in systematic reviews and meta-analyses, where relevant data is collected from primary studies to answer a research question. It involves identifying key study characteristics, such as publication year, author(s), study design, sample size, and outcomes related to the research topic (Liberati et al., 2009). For blockchain integration studies in information systems, data extraction would focus on variables like the type of blockchain technology used, security features discussed, efficiency metrics, adoption barriers, and the context in which the studies were conducted (Mollah & Galletta, 2019).

Data synthesis follows extraction, where the collected information is combined and analyzed to provide a comprehensive summary of the findings. This process can include qualitative synthesis, such as thematic analysis of qualitative data, or quantitative synthesis, like meta-analysis, to assess the overall impact of blockchain integration on information systems (Higgins & Green, 2011). In blockchain-related research, data synthesis helps identify common themes, such as recurring security challenges, technological adoption barriers, and proposed solutions across different studies. By synthesizing data, researchers can determine whether the existing literature points to consistent trends or highlights areas that require

further investigation, thereby contributing to the development of informed conclusions and future research directions (Li et al., 2020).

4. Results and Discussion

4.1. Research Results

The results section provides an overview of the studies included in the systematic review, focusing on their key findings, trends, and characteristics. A detailed analysis of the selected studies is presented, highlighting the relevance of blockchain technology in the context under investigation. The inclusion and exclusion criteria are clearly outlined, ensuring transparency in the selection process. This section synthesizes the results to offer insights into the current state of research and identify potential gaps for future exploration.

RQ1: How does blockchain technology enhance the security features of information systems in organizations?

Table 4. Blockchain Technology Enhancements in Information Systems Security

Study	Blockchain Feature	Security Enhancement	Key Findings
Akella et al. (2023)	Blockchain-based Authentication	Improves Identity Verification	Reduced identity fraud through decentralized authentication methods.
Ali and Maheshwari (2025)	Distributed Ledger Technology	Enhances Data Integrity	Increased trust by ensuring immutability and reducing data tampering.
ALSaqa et al. (2019)	Smart Contracts	Automates Security Protocols	Automates compliance checks, reducing human error in security management.
AlShamsi et al. (2022)	Encryption and Hashing	Protects Sensitive Data	Advanced encryption reduces vulnerabilities to cyber-attacks, enhancing overall data protection.

The integration of blockchain technology substantially enhances the security features of information systems by addressing key vulnerabilities in organizations. Akella et al. (2023) emphasize that blockchain-based authentication methods improve identity verification and mitigate fraud risks through decentralized techniques. In a similar vein, Ali and Maheshwari (2025) discuss how distributed ledger technology enhances data integrity, ensuring immutability and reducing the likelihood of tampering. Moreover, ALSaqa et al. (2019) highlight the use of smart contracts to automate security protocols, which helps streamline processes and minimize human error. AlShamsi et al. (2022) focus on blockchain's encryption and hashing features, which provide robust protection for sensitive data, thereby fortifying data security and reducing susceptibility to cyber-attacks. Collectively, these studies illustrate that blockchain provides a comprehensive approach to improving organizational security by enhancing identity management, data integrity, automated security measures, and encryption, thereby contributing to a more resilient information system architecture (Akella et al., 2023; Ali & Maheshwari, 2025; ALSaqa et al., 2019; AlShamsi et al., 2022).

RQ2: What are the main barriers to adopting blockchain technology in information systems?

Table 5. Barriers to Adopting Blockchain Technology in Information Systems

Study	Barrier	Description	Impact on Adoption
Batubara et al. (2018)	Regulatory Concerns	Lack of clear regulations surrounding blockchain technology.	Leads to uncertainty in adoption due to legal challenges.
Kumar et al. (2022)	Technical Complexity	Difficulty in integrating blockchain with existing systems.	Increases implementation costs and reduces operational efficiency.
Durneva et al. (2020)	Lack of Skilled Workforce	Shortage of professionals with blockchain expertise.	Delays implementation and increases reliance on third-party providers.
Wan et al. (2020)	Scalability Issues	Blockchain struggles to scale effectively with large datasets.	Limits the technology's feasibility for large enterprises.

Adopting blockchain technology in information systems faces several significant barriers, which hinder its widespread implementation. Batubara et al. (2018) identify regulatory concerns as a major barrier, as the absence of clear regulatory frameworks leads to uncertainty, discouraging potential adopters. Kumar et al. (2022) emphasize the technical complexity involved in integrating blockchain with existing systems, which increases implementation costs and operational challenges. Additionally, Durneva et al. (2020) note the shortage of skilled professionals, hindering timely implementation and requiring organizations to rely on external consultants, thereby increasing costs. Scalability issues, as discussed by Wan et al. (2020), present a significant challenge for large enterprises, as blockchain technology struggles to manage vast amounts of data efficiently, limiting its practicality for widespread use. Together, these barriers highlight the challenges organizations face when attempting to adopt blockchain, slowing its integration into information systems (Batubara et al., 2018; Kumar et al., 2022; Durneva et al., 2020; Wan et al., 2020).

RQ3: How can blockchain improve the efficiency of information systems in terms of transaction speed and data integrity?

Table 6. Blockchain's Impact on Information System Efficiency in Terms of Transaction Speed and Data Integrity

Study	Factor	Description	Impact on Efficiency
AlSaqa et al. (2019)	Enhanced Security	Blockchain's cryptographic features ensure data integrity and prevent unauthorized changes.	Ensures data accuracy and reduces the risk of data breaches.
Aung and Pluempitiwiriyawej (2020)	Faster Transactions	Blockchain allows direct peer-to-peer transactions without intermediaries.	Increases transaction speed by eliminating the need for third-party validation.
Kohli & Liang (2021)	Transparent Ledger	Blockchain's immutable ledger ensures that all transactions are permanently recorded.	Increases trust and transparency, improving data reliability in real time.
Ghosh (2019)	Decentralization	A decentralized network reduces bottlenecks caused by centralized servers.	Improves transaction speed by removing reliance on central points of failure.

Blockchain technology significantly enhances the efficiency of information systems by improving transaction speed and ensuring data integrity. AlSaqa et al. (2019) highlight that blockchain's cryptographic features make data tamper-proof, which secures transaction

records and ensures integrity. This enhances reliability, especially in industries where data accuracy is crucial. Aung and Pluempitiwiriyawej (2020) discuss how blockchain accelerates transaction processing by enabling peer-to-peer interactions without the need for intermediaries, streamlining processes and improving speed. Furthermore, Kohli and Liang (2021) emphasize that blockchain's transparent and immutable ledger ensures that all transactions are permanently and securely recorded, which fosters trust and data consistency. Lastly, Ghosh (2019) identifies the role of blockchain's decentralization in improving transaction speed by eliminating bottlenecks typically caused by centralized systems. Collectively, these factors position blockchain as a key enabler in boosting the efficiency of information systems (AlSaqa et al., 2019; Aung & Pluempitiwiriyawej, 2020; Kohli & Liang, 2021; Ghosh, 2019)

4.2. Discussion

Blockchain technology has emerged as a transformative force for enhancing security, efficiency, and integrity in information systems across various sectors. This discussion explores the implications of blockchain in information systems, focusing on its ability to improve security features, address adoption barriers, and enhance efficiency in terms of transaction speed and data integrity. Several studies have illuminated how blockchain is reshaping information management practices, presenting both opportunities and challenges for organizations.

First, blockchain's ability to enhance the security features of information systems has been widely discussed. Blockchain's decentralized and cryptographic nature offers robust security, as each transaction is encrypted and linked to the previous one in a chronological chain (Akella et al., 2023). This provides a secure, tamper-proof environment for storing and sharing sensitive data, which is particularly crucial in industries like healthcare, finance, and supply chain management (Ali & Maheshwari, 2025). Furthermore, blockchain enhances data integrity by ensuring that once information is recorded on the ledger, it cannot be altered without detection, making it highly reliable (AlShamsi, Al-Emran, & Shaalan, 2022). As noted by Akella et al. (2023), organizations leveraging blockchain can significantly reduce the risks associated with data breaches and unauthorized access.

However, while blockchain offers substantial benefits, several adoption barriers still hinder its widespread implementation in information systems. As identified by Ali and Maheshwari (2025), the main barriers include high implementation costs, lack of technical expertise, and regulatory uncertainty. These obstacles present significant challenges for organizations, particularly small and medium-sized enterprises (SMEs), which may lack the financial and technical resources to implement blockchain solutions effectively. Additionally, regulatory concerns about data privacy and blockchain's legal recognition remain key issues, as organizations must navigate complex legal frameworks that vary across regions (Ghosh, 2019). These barriers can slow down the adoption process, despite blockchain's clear potential.

The efficiency of information systems can also be greatly enhanced by blockchain, especially in terms of transaction speed and data integrity. Blockchain's decentralized nature eliminates the need for intermediaries in transaction processes, which reduces bottlenecks and accelerates transaction speeds (Aung & Pluempitiwiriyawej, 2020). By directly connecting stakeholders in a peer-to-peer network, blockchain removes delays caused by centralized authority or third-party validation, leading to faster and more efficient transactions. Furthermore, the blockchain ledger, by ensuring that all data is immutable and transparent, enhances the reliability of information systems. As Kohli and Liang (2021) noted, blockchain creates an open and transparent environment for all participants, fostering trust and reducing the possibility of fraud.

5. Conclusion

Blockchain technology has demonstrated significant potential in transforming information systems by enhancing security, efficiency, and data integrity. Its decentralized architecture eliminates the need for intermediaries, thereby reducing risks associated with data tampering and fraud. This feature is particularly beneficial in sectors such as healthcare, finance, and supply chain management, where ensuring the security and transparency of sensitive information is crucial. Moreover, blockchain's ability to create an immutable and verifiable transaction history helps organizations maintain data integrity and improve trust among stakeholders. However, despite its evident advantages, the widespread adoption of blockchain technology faces substantial challenges, including high implementation costs, regulatory uncertainties, and a shortage of skilled professionals. These barriers hinder its seamless integration into existing information systems.

The findings of this study reveal critical implications for businesses, policymakers, and technology developers. First, blockchain's cryptographic security measures significantly enhance data protection and reduce cyber threats, making it a valuable tool for organizations handling confidential information. However, concerns regarding data privacy, compliance, and integration with legacy systems remain a challenge and require further exploration. Second, businesses must carefully evaluate the financial, technical, and organizational feasibility of blockchain adoption. Investing in employee training, pilot projects, and interdisciplinary collaboration can facilitate a smoother transition. Additionally, the regulatory environment surrounding blockchain is still evolving, making it essential for governments, legal entities, and industries to collaborate on establishing clear policies. Standardized legal frameworks will encourage broader adoption while ensuring compliance with global data protection laws.

Addressing scalability issues, interoperability constraints, and high energy consumption is essential for blockchain's long-term sustainability. Ongoing research into layer-2 solutions, hybrid blockchain models, and energy-efficient consensus mechanisms can help overcome these limitations. However, several limitations in this review should be noted. First, there may be potential publication bias, as studies included in this review tend to favor positive outcomes or applications of blockchain. Second, language restrictions limited the inclusion of non-English publications, potentially excluding relevant findings. Third, the review's time frame (2019-2024) may have overlooked recent developments or emerging trends in blockchain technology. As blockchain technology matures, organizations that successfully integrate it into their information systems will gain a competitive advantage, positioning themselves as leaders in the digital transformation era.

Organizations looking to adopt blockchain technology in information systems should focus on addressing the key barriers such as cost, regulatory compliance, and the need for skilled professionals. Collaboration with industry experts and policymakers can help streamline the adoption process. Additionally, investing in blockchain training for employees and exploring cost-effective implementation models can ease integration.

Future research should explore solutions to overcome scalability issues in blockchain systems and investigate the integration of blockchain with emerging technologies like AI and IoT. Studies on blockchain's impact on industry-specific applications will provide valuable insights into its potential.

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