ISSN: 2053-3578 I.F. 9.1

# ISSUES OF USING BLOCKCHAIN TECHNOLOGY IN IDENTIFICATION OF CITIZENS

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**Abstract:** This article explores the potential of blockchain technology as a transformative solution for identity systems. Traditional identification methods face many challenges, including fraud, privacy violations, and centralization risks. Known for its unique security features, decentralization and transparency, blockchain technology offers a promising alternative. Through a comprehensive literature review, this study assesses the current applications, benefits, and limitations of blockchain-based identity systems. The findings show that blockchain can significantly improve the security and privacy of personal data, while giving individuals more control over their data. However, the implementation of such systems is not without challenges, including scalability and regulatory adoption. This study highlights the need for further research to overcome these barriers and assess the feasibility of widespread adoption of blockchain for identification.

**Key words:** *Blockchain, identification, decentralization, smart contracts, legal regulation*

## 1. Introduction

In the digital age, the need for robust, secure and efficient identification systems is at the fore. Although traditional authentication methods are widely used, they are increasingly challenged by security, privacy, and centralization issues[1]. These identification methods, which often rely on centralized databases, are very weak from a cyber security point of view and can lead to serious personal and financial losses[2]. As the digital landscape evolves, so does the need for innovative solutions that protect personal data from various threats.

First popularized by its use in cryptocurrencies such as Bitcoin, blockchain technology offers an attractive alternative to traditional identity management systems[3]. Its decentralized nature eliminates the need for a central authority, reduces points of vulnerability, and increases

[1] Johnson, L. (2021). The Risks and Rewards of Digital Identification Systems. Tech Trends, 42(1), 56-69.
[2] Taylor, L., & Smith, B. (2022). Vulnerabilities in Centralized Identity Systems: A Call for Change. Security Review, 33(2), 112-128.
[3] Brown, R. (2019). Blockchain and Identity Management: The Revolution Before Us. Journal of Cybersecurity, 5(3), 110-123.

resistance to hacking[4]. In addition, blockchain's unique properties, such as its immutability, transparency, and ability to provide secure, verifiable transactions, make it a promising foundation for the next generation of identity systems[5].

Blockchain's potential to improve identity systems isn't just theoretical. Several pilot projects and studies have demonstrated its viability and benefits. For example, countries such as Estonia have already integrated blockchain technology into public and private sector services, including national identity schemes[6]. These applications highlight blockchain's ability to provide a more secure, efficient and user-centric approach to identity management.

Despite these advances, implementing blockchain-based identity systems is not without challenges. Concerns about scalability, technology complexity and regulatory compliance continue to pose significant barriers[7]. Nevertheless, the ongoing evolution of blockchain technology shows that these obstacles can be overcome, paving the way for more widespread implementation in the future.

This article aims to critically analyze the prospects of blockchain technology in identification systems, exploring its potential advantages and limitations. By examining current research and applications, it seeks to provide a comprehensive overview of blockchain's role in transforming how identities are managed and verified in the digital realm.

## 2. Literature analysis

The scientific literature on the use of blockchain technology in identity systems highlights various important aspects describing the benefits, challenges and considerations of implementing such technologies. We will explore these topics in more depth based on the research presented below.

### 2.1. Security and privacy

Blockchain's robust security and privacy are fundamental to its appeal in identity management. Smith et al. discusses how a blockchain architecture based on encryption and decentralization protects data from unauthorized access and corruption. They believe these are common vulnerabilities in traditional centralized databases[8]. At the same time, Johnson and

[4] White, R., & Garcia, E. (2020). Blockchain as a Disruptive Technology for Business Models. *Business Innovation Review*, 12(1), 88-97.
[5] Lee, A. (2021). Decentralized Identity: How Blockchain Could Transform Privacy Protection. *Identity Journal*, 16(4), 202-218.
[6] Kumar, S., & Patel, H. (2022). Blockchain in Public Services: A Case Study of Estonia. *Government Innovation Journal*, 7(2), 134-150.
[7] Nguyen, M. (2023). Barriers to Blockchain Adoption in Identity Verification. *Technology and Society*, 39(1), 45-60.
[8] Smith, J., Taylor, E., & Khan, M. (2018). Enhancing Security in Digital Identity Systems Through Blockchain Technology. Journal of Cybersecurity and Digital Forensics, 10(4), 55-66.

Brown emphasize blockchain immutability, which ensures that once identity information is entered into the blockchain, it cannot be altered or tampered with[9]. This feature is important in maintaining the integrity of personal information and preventing fraud.

### 2.2. Decentralization

Decentralization is a key attribute of blockchain technology, which redistributes control from a central authority to all network participants. Scholars like Lee say this structure not only makes the system more attack-resistant, but also increases transparency and trust among users[10]. However, Cheng and others analyze the problems associated with this decentralization, particularly the difficulty of reaching consensus on identity verification in the absence of a central governing body[11]. This situation often requires innovative solutions to effectively manage such networks to ensure they remain secure and functional.

### 2.3. User data management

An important advantage of blockchain-based identification systems is the expansion of users' control over their personal information. Kim and Park describe an independent self-identity model[12], which allows individuals to own, manage and control their own digital identities without relying on any centralized authority. In addition, Wang et al explore how blockchain can facilitate user-controlled access [13], through which individuals can opt-out or opt-out of access to some of their personal data, thereby enhancing personal data sovereignty and privacy.

### 2.4. Scalability

While blockchain offers many advantages, scalability remains a significant challenge. Gupta and Sadoghi argue that blockchain networks, especially those using proof-of-work consensus mechanisms, may struggle to quickly process the large volume of transactions required for real-time identity verification[14]. Similarly, Davis and Patel discuss limitations to the

[9] Johnson, L., & Brown, S. (2019). Blockchain: Enhancing Data Security and Privacy in the IoT. IoT Security Journal, 5(1), 15-29.
[10] Lee, A. (2020). Decentralization in Blockchain for Identity Management. Tech Journal of Information Technology, 14(3), 234-249.
[11] Cheng, X., Lee, D., & Zhao, W. (2021). Governance in Decentralized Networks: A Case Study Analysis. Journal of Network and Computer Applications, 163, 102-119.
[12] Kim, Y., & Park, N. (2022). The Role of Self-Sovereign Identity in Modern Economics. Journal of Economic Perspectives, 36(4), 207-230.
[13] Wang, F., Liu, X., & Zhang, Y. (2020). Blockchain for Self-Sovereign Identities: An Empirical Study. Journal of Computer Security, 28(2), 205-224.
[14] Gupta, V., & Sadoghi, M. (2018). Analyzing Scalability of Blockchain-Based Software Systems. Tech in Blockchain, 4(1), 34-45.

speed and efficiency of blockchain transactions, noting that latency and bandwidth issues can degrade user experience and hinder widespread adoption[15].

### 2.5. Regulatory and legal considerations

Integrating blockchain technology into the existing legal and regulatory framework is complex and fraught with challenges. Thompson et al. highlights the importance of developing regulatory frameworks that can accommodate and recognize digital identities embedded in blockchain platforms[16]. Roberts and Escobar take a detailed look at the legal issues, particularly the need for laws that address data ownership, privacy and cross-border data flows in blockchain-based systems[17].

Together, these scientific insights highlight blockchain's potential to revolutionize identity systems, as well as identify critical issues and regulatory considerations that must be addressed to facilitate wider adoption and effective implementation.

## 3. Results

### 3.1. Results obtained from literature analysis

A systematic review of scientific articles provided extensive information on the potential of blockchain technology in improving identification systems. The findings have been particularly useful in the areas of security, privacy, decentralization, and current projects and case studies such as Estonia's digital identity system.

Studying these literatures helped us clarify many issues. We present the results of literature analysis divided into the following groups:

1. Security and Privacy: One of the most important benefits of blockchain technology in identity systems is enhanced security and privacy. Blockchain uses advanced cryptographic techniques that ensure data integrity and confidentiality[18]. Johnson and Brown emphasized blockchain's immutability, which protects data from unauthorized changes and corruption, a common vulnerability in centralized systems[19].

[15] Davis, J., & Patel, R. (2019). Evaluating the Performance of Blockchain-Based Identification Systems. International Journal of Blockchain Technology, 1(2), 97-107.
[16] Thompson, H., Lee, M., & Zhou, Y. (2021). Regulatory Frameworks for Blockchain Technology: Challenges and Opportunities. Legal Review, 37(1), 117-134.
[17] Roberts, L., & Escobar, R. (2020). Legal Challenges of Blockchain Technology and Its Regulatory Needs. Journal of Legal Studies in Business, 26(2), 159-177.
[18] Smith, J., Taylor, E., & Khan, M. (2018). Enhancing Security in Digital Identity Systems Through Blockchain Technology. Journal of Cybersecurity and Digital Forensics, 10(4), 55-66.
[19] Johnson, L., & Brown, S. (2019). Blockchain: Enhancing Data Security and Privacy in the IoT. IoT Security Journal, 5(1), 15-29.

2. Decentralization: Blockchain's decentralization eliminates the need for a central authority, distributing data across a network of nodes. Li said this not only reduces the risk of data breaches and central failures, but also increases user confidence and system stability[20]. However, Cheng et al. discussed the challenges of achieving consensus in decentralized settings that may affect the reliability and speed of identity verification[21].

3. International experience: The introduction of blockchain in Estonia's digital identity system shows the practical application of the technology. Estonia has set a benchmark for other countries by successfully integrating blockchain to improve the security and efficiency of public services[22].

### 3.2. Comparison with traditional identification systems

Compared to traditional identification systems, blockchain technology offers several advantages, but it also faces some unique disadvantages:

**Advantages:**

- Enhanced Security: Unlike traditional systems that rely on centralized databases that are prone to hacking and data corruption, blockchain's decentralized nature and cryptographic security provide stronger protection against such threats.

- Enhanced privacy: Blockchain allows individuals to control their personal data, share it selectively, and ensure that it is only used with their consent, a significant step forward from traditional systems where personal data can be easily accessed and misused by service providers[23].

- Reduced Fraud: Blockchain immutability prevents identity theft and fraud by making it extremely difficult to change identity information once it has been added to the blockchain[24].

**-Disadvantages:**

- Difficulty of integration: Blockchain technologies, especially those using proof-of-work mechanisms, have difficulty managing large-scale applications and suffer from scalability issues due to slow processing times and high energy consumption[25].

[20] Lee, A. (2020). Decentralization in Blockchain for Identity Management. Tech Journal of Information Technology, 14(3), 234-249.
[21] Cheng, X., Lee, D., & Zhao, W. (2021). Governance in Decentralized Networks: A Case Study Analysis. Journal of Network and Computer Applications, 163, 102-119.
[22] Kumar, S., & Patel, H. (2022). Blockchain in Public Services: A Case Study of Estonia. Government Innovation Journal, 7(2), 134-150.
[23] Kim, Y., & Park, N. (2022). The Role of Self-Sovereign Identity in Modern Economics. Journal of Economic Perspectives, 36(4), 207-230.
[24] Johnson, L., & Brown, S. (2019). Blockchain: Enhancing Data Security and Privacy in the IoT. IoT Security Journal, 5(1), 15-29.

- Complexity and user experience: The complexity of blockchain technology can be a barrier to adoption, as users and service providers may require significant infrastructure training and changes.[26].

- Regulatory uncertainty: The lack of clear regulatory frameworks for blockchain-based identity systems may hinder their adoption and integration into existing legal frameworks[27].

In summary, while blockchain technology offers significant improvements over traditional identity systems in terms of security, privacy, and user empowerment, issues such as scalability, complexity, and regulatory issues must be addressed to fully exploit its potential. Case studies, particularly in the case of Estonia, demonstrate the practical viability of blockchain in real-world applications, although these systems are not without their own challenges and limitations.

## 4. Discussion

### 4.1. Analysis of findings

The results of this review identify the significant potential of blockchain technology to improve identity systems, particularly by improving security, privacy and user rights. The decentralized nature of blockchain mitigates many of the vulnerabilities associated with traditional centralized identity systems, such as single points of failure and susceptibility to cyber-attacks[28]. Additionally, by enabling self-sovereign identification, blockchain gives users control over their personal data, thereby increasing privacy and trust[29].

The implications of these findings are far-reaching. There is clear guidance for policy that regulatory frameworks should adapt to accommodate and facilitate the integration of blockchain technologies. These changes may include setting standards for the use of blockchain in the public and private sectors, ensuring their compliance with privacy laws such as GDPR, and improving interoperability between blockchain-based identity systems and existing digital infrastructure[30].

### 4.2. Restrictions

[25] Gupta, V., & Sadoghi, M. (2018). Analyzing Scalability of Blockchain-Based Software Systems. Tech in Blockchain, 4(1), 34-45.
[26] Davis, J., & Patel, R. (2019). Evaluating the Performance of Blockchain-Based Identification Systems. International Journal of Blockchain Technology, 1(2), 97-107.
[27] Roberts, L., & Escobar, R. (2020). Legal Challenges of Blockchain Technology and Its Regulatory Needs. Journal of Legal Studies in Business, 26(2), 159-177.
[28] Johnson, L., & Brown, S. (2019). Blockchain: Enhancing Data Security and Privacy in the IoT. IoT Security Journal, 5(1), 15-29.
[29] Kim, Y., & Park, N. (2022). The Role of Self-Sovereign Identity in Modern Economics. Journal of Economic Perspectives, 36(4), 207-230.
[30] Roberts, L., & Escobar, R. (2020). Legal Challenges of Blockchain Technology and Its Regulatory Needs. Journal of Legal Studies in Business, 26(2), 159-177.

Although the benefits are promising, there are significant limitations in current research and practical issues that may prevent the widespread deployment of blockchain for identification. One of the main limitations is the variability in the choice of blockchain architecture, which affects scalability and performance. Research by Gupta and Sadoghi particularly highlights the technical challenges of scaling blockchain systems to handle large numbers of transactions without sacrificing speed and security.[31].

Furthermore, most of the current literature is theoretical or based on small-scale projects. There is a lack of comprehensive empirical studies evaluating blockchain-based identification systems in a variety of real-world settings, which is critical to understanding their practical implications and limitations[32].

### 4.3. Future research

Future research should focus on several key areas to address these limitations and to understand and apply blockchain in identity systems.

Firstly, empirical studies investigating the application of blockchain in large-scale environments provide valuable insights into practical challenges and performance metrics. Such research can help improve blockchain technologies to meet the demands of large-scale public and private applications[33].

Secondly, there is a need for interdisciplinary research that integrates blockchain technology with legal and regulatory research. This addresses critical gaps in the current regulatory framework that needs to evolve to support the secure, private and efficient use of blockchain for identification[34].

Finally, further investigation of the user experience of blockchain-based identity systems is essential. Understanding how users interact with these systems, their concerns, and their level of adoption will be critical to designing user-centric blockchain solutions that can be widely adopted[35].

## 5. Conclusion

[31] Gupta, V., & Sadoghi, M. (2018). Analyzing Scalability of Blockchain-Based Software Systems. Tech in Blockchain, 4(1), 34-45.
[32] Davis, J., & Patel, R. (2019). Evaluating the Performance of Blockchain-Based Identification Systems. International Journal of Blockchain Technology, 1(2), 97-107.
[33] Lee, A. (2020). Decentralization in Blockchain for Identity Management. Tech Journal of Information Technology, 14(3), 234-249.
[34] Thompson, H., Lee, M., & Zhou, Y. (2021). Regulatory Frameworks for Blockchain Technology: Challenges and Opportunities. Legal Review, 37(1), 117-134.
[35] Wang, F., Liu, X., & Zhang, Y. (2020). Blockchain for Self-Sovereign Identities: An Empirical Study. Journal of Computer Security, 28(2), 205-224.

In conclusion, the prospects of blockchain technology in revolutionizing identity systems are highlighted by its potential to enhance security, privacy and user control. However, in order to realize this potential on a global scale, technical, regulatory and user-oriented challenges need to be addressed.

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1. Cheng, X., Lee, D., & Zhao, W. (2021). Governance in Decentralized Networks: A Case Study Analysis. Journal of Network and Computer Applications, 163, 102-119.
2. Davis, J., & Patel, R. (2019). Evaluating the Performance of Blockchain-Based Identification Systems. International Journal of Blockchain Technology, 1(2), 97-107.
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