

Bibliometric Analysis of Blockchain for E-Government: Historical Institutionalism and Governance of Secure Digital Identity in Public Sector Services

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ABSTRACT

Blockchain has increasingly been discussed as a strategic technology for strengthening e-government, particularly in the development of secure digital identity systems. However, existing studies tend to emphasize technical benefits such as transparency, security, efficiency, and decentralization, while paying less attention to the institutional conditions that shape blockchain adoption in the public sector. This study aims to map the development of blockchain research in e-government and to interpret its implications for secure digital identity governance through the lens of Historical Institutionalism. The data were retrieved from on 20 June 2025 using keywords related to blockchain, e-government, public sector services, and digital identity. A total of 1,709 documents published between 2000 and 2025 were analyzed. Data collection was conducted through a structured bibliometric search strategy, followed by data cleaning, duplicate removal, and keyword standardization. The data were analyzed using VOSviewer to examine publication trends, keyword co-occurrence networks, thematic clusters, and the relationship among dominant research topics. The findings show a significant increase in publications after 2017, indicating the growing academic and policy attention to blockchain-based digital governance. The dominant themes are related to public services, government, health services, adoption challenges, regulation, cost, and data security. These findings suggest that blockchain adoption in e-government is not merely a technical issue, but also an institutional process shaped by regulatory readiness, administrative legacies, interoperability constraints, and public sector capacity. The theoretical contribution of this study lies in integrating bibliometric analysis with Historical Institutionalism, particularly the concepts of path dependence, critical juncture, institutional layering, and policy feedback. This study contributes to a more critical understanding of blockchain-based digital identity governance and offers implications for policymakers seeking to design secure, adaptive, and institutionally feasible digital public services.

Keywords : Blockchain; Digital Identity; E-Government; Public Sector

INTRODUCTION

This section Digital transformation in public sector services has become a major focus in many countries, especially with the increasing need for secure, efficient, and transparent systems. One promising technology for addressing these challenges is blockchain (Hosseini Dehshiri et al., 2024). With its ability to provide secure and immutable record-keeping, blockchain has the potential to revolutionize how digital identities are managed and verified within the e-government framework (Babaei, Babaei Tirkolae, et al., 2025). Governments worldwide are exploring the use of blockchain to reduce fraud, enhance trust, and streamline administrative processes in the delivery of public services (Babaei, Tirkolae, et al., 2025). Many ASEAN countries have included and prioritized blockchain technology in their 2020-2025 ICT Master Plans (Oudani, 2023). Indonesia and Malaysia have shifted blockchain technology from important to critical and placed it among the top five strategic priorities of their 2020-2025 ICT Master Plans (Babaei et al., 2023). Thailand appears to be the most advanced country in terms of blockchain development and standardization, with a dedicated team, cross-sector committees, and the adoption of various international standards (Babaei, Tirkolae, & Ali, 2024). Other countries like Vietnam and Indonesia are taking more progressive steps compared to others, although not all have adopted the same standards (Yu et al., 2024).

Digital transformation is reshaping governance across the world, and blockchain has emerged as one of the most strategic technologies capable of addressing long-standing issues of transparency, trust, and administrative efficiency (Jagustović et al., 2019). The rapid integration of blockchain into ASEAN ICT strategies demonstrates a regional recognition of its transformative potential, yet the maturity of implementation varies significantly among member states (Huang et al., 2023). This divergence underscores the importance of understanding not only its technical attributes but also the policy, institutional, and governance capacities required for sustainable adoption.

In the public sector (Charles et al., 2022), the Indonesian government plans to implement blockchain-based digital certificates in various public services, with a significant initiative recently undertaken by the West Java Provincial Government (Roehl, 2022). This initiative, which is part of the local government's digital transformation strategy, uses blockchain to simplify administrative processes and improve data security and transparency (Müller et al., 2025). At the heart of this progress is the regulatory support provided by the Indonesian Standard Industrial Classification (Klasifikasi Baku Lapangan Usaha Indonesia or KBLI), specifically KBLI 62014, which facilitates blockchain-based businesses (Babaei, Tirkolae, & Anka, 2024). Indonesia's early experimentation with blockchain particularly through initiatives such as West Java's blockchain-based certification system illustrates rising institutional interest in leveraging distributed ledger technologies to enhance administrative integrity (Sarma et al., 2022). Regulatory reinforcement through KBLI 62014 indicates an emerging alignment between technological innovation and national governance frameworks, strengthening Indonesia's readiness for broader blockchain integration.

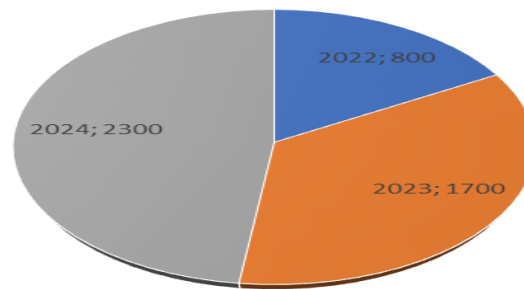


Figure 1. Blockchain Adoption in Indonesia

Based on the image of blockchain technology development in Indonesia to harmonize business operations and registration in the blockchain sector in Indonesia (Yu et al., 2024). With the aim of improving efficiency, transparency, and facilitating businesses operating in this industry, the implementation of KBLI 62014 has shown significant results (Yue & Shyu, 2024). Based on data recorded through the government's Online Single Submission (OSS) system, which is used to simplify the business licensing process, there has been rapid growth in the blockchain sector in Indonesia (Aslam et al., 2021). In 2022, there were 800 businesses registered under KBLI 62014. This number surged to 1,700 in 2023 and is projected to reach 2,300 by 2024 (Abdullah & Ibrahim, 2019).

This significant increase reflects the growing adoption of blockchain technology in the Indonesian business world (Engin & Treleven, 2019). Several factors driving this growth include increased awareness of blockchain's potential to improve transparency and efficiency in various sectors, as well as the ease of registration and licensing processes thanks to the integration of the OSS system. In addition, government support in providing clear regulations related to the blockchain sector is increasingly giving investors and entrepreneurs confidence to engage in this technology (Babaei, Tirkolae, et al., 2025). With this rapid growth rate, the blockchain sector is predicted to continue to expand, with more blockchain applications being implemented in various sectors, such as banking, healthcare, and government (Alzahrani et al., 2022). The year 2024 is expected to be the peak for the development of this sector, with more businesses utilizing blockchain to improve efficiency and reduce risk (Hosseini Dehshiri et al., 2024). Overall, the implementation of KBLI 62014 has provided a positive boost to the blockchain industry in Indonesia and opened up significant opportunities for further innovation and investment in the future (Casares, 2018).

The rapid escalation of blockchain-related business registrations highlights an expanding national ecosystem in which regulatory clarity, digital licensing reform, and rising technological awareness converge (Liu et al., 2022). This growth not only demonstrates increasing private sector confidence but also signals potential spillover effects on public sector adoption particularly in areas requiring secure identity management, interoperable data systems, and tamper-proof administrative records (Solaiman & Dimitropoulos, 2024).

This study focuses on how blockchain can be utilized to create a secure digital identity system that is scalable and adaptable to the evolving needs of the public sector. This article aims to explore the integration of blockchain technology in the e-government domain, with a focus on the advantages and challenges of implementing secure digital identities. Through a literature

review and case studies, this article seeks to identify the key factors contributing to the successful implementation of blockchain-based digital identity systems in the government sector.

Given the increasing policy interest and technological experimentation in blockchain-driven identity systems, this study positions itself to provide an evidence-based understanding of how blockchain can reinforce the foundations of secure, citizen-centered digital identity in public administration. By synthesizing bibliometric patterns and contextual case insights, the study aims to articulate the conditions that enable effective and scalable implementation.

Empirical studies and theoretical frameworks discussing blockchain in government operations have revealed both the potential and complexity of this initiative. While the technical benefits of blockchain, such as security and transparency, have been widely discussed, its practical application in the public sector remains an active area of research. This article aims to bridge the gap between theoretical discussions and real-world applications, and provide insights into the future direction of blockchain-driven e-government services.

Although blockchain has been widely discussed as a promising technology for improving transparency, efficiency, security, and trust in e-government, much of the existing literature remains technologically oriented. Previous studies tend to emphasize blockchain's technical architecture, cryptographic security, decentralization, and potential applications in public service delivery. However, less attention has been given to the institutional conditions that determine whether blockchain-based digital identity systems can be successfully adopted, scaled, and sustained within public administration.

This gap is important because the implementation of blockchain in e-government does not occur in an institutional vacuum. Public sector organizations operate within established legal frameworks, administrative routines, legacy information systems, budgetary constraints, and regulatory traditions. These institutional arrangements may either facilitate or constrain the adoption of blockchain-based digital identity. Therefore, a purely technical understanding is insufficient to explain the uneven development of blockchain adoption across public sector contexts. To address this gap, this study combines bibliometric analysis with the theoretical lens of Historical Institutionalism. This perspective allows the study to interpret blockchain adoption as an institutional process shaped by path dependence, critical junctures, institutional layering, and policy feedback. By doing so, the article contributes not only to mapping the development of blockchain research in e-government, but also to explaining how institutional structures shape the trajectory of secure digital identity governance in the public sector.

THEORETICAL FRAMEWORK: HISTORICAL INSTITUTIONALISM

This study employs Historical Institutionalism as a theoretical lens to understand the development of blockchain adoption in e-government, particularly in relation to secure digital identity systems. Historical Institutionalism emphasizes that institutional arrangements, policy legacies, administrative routines, and past decisions shape the direction of future policy and technological change. From this perspective, technology adoption in the public sector is not only determined by technical efficiency or innovation capacity, but also by the institutional structures in which the technology is introduced.

One important concept in Historical Institutionalism is path dependence. Path dependence explains how previous institutional choices create patterns that influence subsequent policy decisions. In the context of e-government, existing administrative procedures, legacy information systems, regulatory traditions, and bureaucratic routines may shape how blockchain technology is adopted. Governments that already have fragmented data systems, weak interoperability, or rigid administrative procedures may face greater difficulty in adopting

blockchain-based digital identity systems, even when the technology offers potential benefits in terms of transparency, security, and efficiency.

The concept of critical juncture is also relevant in explaining the rise of blockchain adoption in the public sector. A critical juncture refers to a period of significant change in which existing institutional arrangements become open to reform. In digital governance, moments such as rapid digital transformation, public demand for secure online services, cybersecurity concerns, and post-pandemic acceleration of digital public services can create opportunities for governments to reconsider existing identity management systems. These moments may encourage the adoption of blockchain as an alternative infrastructure for secure, transparent, and tamper-resistant digital identity.

Historical Institutionalism also introduces the idea of institutional layering, which refers to the process by which new rules, technologies, or practices are added to existing institutional arrangements without fully replacing them. Blockchain adoption in e-government often follows this pattern. Rather than replacing existing digital government systems entirely, blockchain may be layered onto existing identity databases, licensing systems, health records, or administrative platforms. This creates both opportunities and challenges. On the one hand, blockchain may strengthen data integrity and public trust. On the other hand, integration with legacy systems may generate technical complexity, institutional resistance, and regulatory uncertainty.

Policy feedback is another key concept that helps explain how earlier policies shape future institutional choices. Once governments introduce digital identity policies, data protection rules, or e-government platforms, these policies create expectations, administrative capacities, and stakeholder interests that influence future innovation. Blockchain adoption is therefore shaped not only by technological potential but also by accumulated policy experiences, institutional learning, and the interests of public and private actors involved in digital governance.

Based on this theoretical perspective, blockchain adoption should not be understood as a purely technical process. It is an institutional process embedded in existing governance structures, legal frameworks, administrative capacities, and historical policy trajectories. Therefore, this study uses Historical Institutionalism to interpret bibliometric trends in blockchain and e-government research. The framework helps explain why blockchain-based digital identity has gained increasing scholarly attention, why its adoption remains uneven across public sector contexts, and why issues such as regulation, cost, interoperability, and institutional readiness continue to appear as major challenges in the literature.

Method

This study utilizes bibliometric analysis to map and evaluate the current state of research related to Blockchain for digital government (Guthrie & Fosso-Wamba, 2025). Bibliometric analysis itself is a method that measures various aspects related to publication and literature usage, which has previously been used to research topics such as social media platforms, environmentally friendly information technology, and artificial intelligence in the context of Industry 4.0 and 5.0. In this study, a total of 1,709 documents were collected using search keywords such as e-government, public sector, digital government, public service, digital identity, and "blockchain for e-government on June 20, 2025. Data analysis was conducted using VOSviewer, which was used to calculate descriptive statistics, bibliometric measures, and generate network visualizations (Al-Ashmori et al., 2022).

The inclusion criteria were: (1) publications discussing blockchain or distributed ledger technology in relation to e-government, digital government, public sector services, or digital identity; (2) journal articles, conference papers, book chapters, and review articles; (3) publications written in English; and (4) documents published between 2000 and 2025. The exclusion criteria were: (1) publications that discussed blockchain only in private-sector contexts without relevance to government or public services; (2) documents unrelated to digital identity, public administration, or e-government; (3) duplicate records; (4) non-academic documents such as editorials, news items, and undefined document types; and (5) records with incomplete bibliographic information.

After applying the search strategy, a total of 1,709 documents were obtained. The data were exported in [CSV/RIS/BibTeX] format, including information on authors, titles, abstracts, keywords, affiliations, sources, publication years, citations, and references. The data cleaning process was conducted before analysis. Duplicate records were removed, inconsistent keywords were standardized, and synonymous terms were merged. For example, “e-government,” “electronic government,” and “digital government” were harmonized where appropriate, while terms such as “blockchain technology” and “blockchain” were treated consistently to avoid fragmentation in the keyword network.

The analysis was conducted using VOSviewer version [insert version]. VOSviewer was used to perform science mapping, including keyword co-occurrence analysis, co-authorship analysis, citation analysis, and bibliographic coupling. Thresholds were applied to ensure that the visualization focused on meaningful relationships among documents and keywords. For keyword co-occurrence analysis, only keywords appearing at least [insert threshold, for example 5] times were included. For citation and bibliographic coupling analysis, the threshold was set at [insert threshold] citations/documents to identify influential sources, authors, and research clusters.

The bibliometric analysis was carried out in four stages. First, performance analysis was used to examine publication growth, citation trends, leading sources, productive authors, and dominant countries. Second, keyword co-occurrence analysis was used to identify the main themes and conceptual structure of blockchain research in e-government. Third, network visualization and overlay visualization were used to detect emerging topics and temporal shifts in the literature. Fourth, the results were interpreted through the lens of Historical Institutionalism, particularly the concepts of path dependence, critical juncture, institutional layering, and policy feedback. This theoretical interpretation allowed the study to move beyond descriptive mapping and explain how institutional conditions shape the adoption of blockchain-based digital identity in the public sector.

This methodological design provides a systematic and replicable approach for understanding the evolution of blockchain research in e-government. By combining bibliometric mapping with Historical Institutionalism, the study not only identifies dominant research trends but also critically examines how regulatory frameworks, administrative legacies, institutional capacity, and governance structures influence the development of secure digital identity systems in public administration.

Results And Discussion

A bibliometric analysis of research on digital government reveals several key insights into trends and directions in this field. A total of 1,709 documents retrieved using search keywords such as e-government, public sector, digital government, public services, digital identity, and blockchain for e-government show an increase in the volume of research focusing on the relationship between blockchain technology and government services. The analysis indicates a significant rise in publications since 2017, reflecting growing interest in blockchain as a potential

solution to improve efficiency, transparency, and security in public sector services. These studies primarily explore the application of blockchain in areas such as digital identity management, service delivery optimization, and the enhancement of data security. Furthermore, the data points to an evolving recognition of blockchain's potential in solving challenges related to digital governance, although its widespread adoption still faces substantial barriers, including high implementation costs, regulatory hurdles, and integration issues with existing government systems. This trend underscores the need for further research and policy development to facilitate the seamless integration of blockchain technology in public services.

Institutional Design and Blockchain Implementation in E-Government

The bibliometric findings indicate that blockchain adoption in e-government is closely associated with keywords such as public sector, government, regulation, cost, challenges, data security, and public services. These patterns suggest that blockchain implementation cannot be understood merely as a technical process. Instead, it is shaped by the institutional design of public administration, including regulatory frameworks, administrative coordination, data governance structures, interoperability standards, and bureaucratic capacity.

From the perspective of Historical Institutionalism, institutional design plays an important role in determining whether blockchain-based digital identity systems can be effectively adopted and sustained. Public institutions operate within established rules, legacy information systems, administrative routines, and policy traditions. These institutional arrangements influence how new technologies are introduced, interpreted, and integrated into existing public service systems. Therefore, the implementation of blockchain in e-government is not only a question of technological readiness, but also a question of institutional compatibility. The relationship between institutional design and blockchain implementation can be seen in three important aspects. First, regulatory design determines the legal basis for digital identity, data protection, authentication, and the recognition of blockchain-based records. Without clear regulatory support, blockchain initiatives may remain fragmented pilot projects rather than integrated public service infrastructure. Second, administrative design affects coordination among government agencies. Since digital identity systems often require data exchange across multiple institutions, weak inter-agency coordination and fragmented databases may limit the effectiveness of blockchain implementation. Third, technological governance design determines the capacity of the state to ensure interoperability, cybersecurity, accountability, and citizen trust.

These findings also show that institutional legacies may create path dependence in e-government reform. Governments with fragmented digital systems, centralized administrative traditions, or limited data-sharing mechanisms may face greater challenges in adopting blockchain-based identity systems. In this sense, blockchain implementation often involves institutional layering, where new blockchain-based mechanisms are added to existing administrative systems rather than fully replacing them. This layering process can create opportunities for innovation, but it may also produce complexity when old and new systems are not properly integrated. Thus, the success of blockchain implementation in e-government depends on the alignment between technological innovation and institutional design. Blockchain may strengthen transparency, security, and efficiency, but these benefits can only be realized when supported by coherent regulations, interoperable systems, sufficient administrative capacity, and collaborative governance between public and private actors. This confirms that blockchain-based digital identity should be treated as an institutional reform agenda, not merely as a technological modernization project.

This upward trajectory suggests that blockchain research has become an integral part of the broader digital governance discourse. Yet, the coexistence of growing academic attention and persistent adoption barriers highlights a critical gap between technological capability and institutional readiness. This gap indicates the need for governance frameworks that balance innovation opportunities with regulatory, financial, and infrastructural constraints.

Table 1. Articles Data

Description	Result
Timespan	2000 - 2025
Papers	1709
Citations	1351544
Authors/papers	2.77
h-index	849
g-index	1170

Source: VOSviewer Processed Results

The bibliometric indicators in Table 1 show that research on blockchain for e-government has developed into a mature and rapidly expanding field. The dataset covers publications from 2000 to 2025 and includes 1,709 documents. This indicates that blockchain is no longer discussed merely as a technical innovation, but has become an important topic in the broader discourse of digital government, public service reform, and secure digital identity governance. The increase in scholarly attention can be explained by several factors. First, the growing demand for secure and trusted digital identity systems has encouraged researchers and policymakers to explore blockchain as an alternative infrastructure for public sector services. Second, the acceleration of digital transformation, particularly after the expansion of online public services, has intensified the need for transparent, interoperable, and tamper-resistant data systems. Third, concerns over cybersecurity, data integrity, privacy, and institutional trust have made blockchain increasingly relevant to e-government studies.

From the perspective of Historical Institutionalism, this publication trend can be understood as a response to a critical juncture in digital governance. The rapid expansion of digital public services created pressure on governments to reconsider existing identity management systems and administrative data infrastructures. However, the adoption of blockchain is shaped by institutional legacies, including existing legal frameworks, bureaucratic routines, fragmented information systems, and uneven administrative capacity. These institutional conditions influence how blockchain-based digital identity is introduced, adapted, and sustained in the public sector. Therefore, Table 1 should not be read merely as a summary of publication performance. It also reflects the institutional dynamics of blockchain research in e-government. The growing number of studies suggests increasing academic and policy interest, while the repeated emphasis on cost, regulation, security, and integration reveals the persistent institutional barriers that must be addressed before blockchain-based digital identity can be implemented effectively in public services.

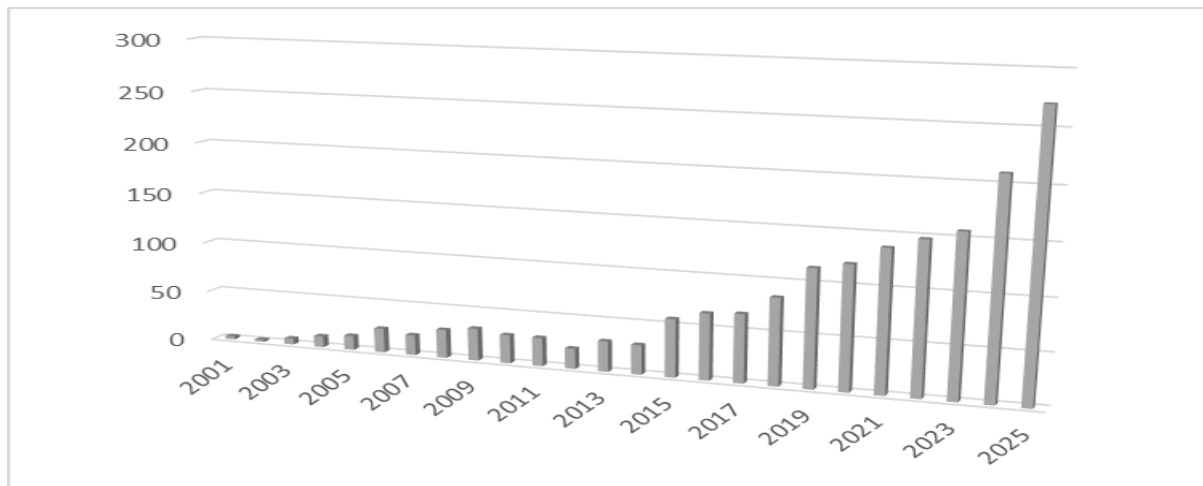


Figure 2. Number of Publications

Available data shows that in the previous period (2001 to 2016), the number of publications was relatively stable at a much lower level. This may reflect limited awareness of blockchain technology in the context of government and the public sector in general. Most of the attention and research at this time tended to focus on the theory and early application of blockchain in the technology and finance sectors, rather than on digital government. Over time, starting in 2017, we can see a very significant surge in the number of publications covering blockchain in e-government. This sharp increase indicates that interest in and adoption of blockchain technology in the public sector are growing rapidly. Key factors contributing to this growth include advancements in blockchain technology itself, government policies supporting digital innovation, and the urgent need to enhance transparency and security in public services. Specifically in 2025, the data shows a very sharp peak, reflecting a huge surge in publications related to blockchain and digital identity in the government sector. This could be due to the increasingly intensive implementation of blockchain technology in government programs, such as in Indonesia and other ASEAN countries, in order to address the challenges of e-government in the digital age. There has been a significant increase in the number of publications on blockchain technology and digital government, particularly in recent years. One topic that consistently emerges in the literature is the relationship between the public sector, public services, and the use of new technologies like blockchain to enhance these services. This increased awareness and research reflects a significant increase in government efforts to adopt digital innovations to improve efficiency and transparency in various sectors, particularly in the health and public services sectors.

The publication spike in 2025 likely reflects global acceleration of digitalization initiatives following the COVID-19 period, as governments sought resilient, secure, and interoperable digital infrastructure. Emerging policy frameworks across ASEAN also helped normalize blockchain experimentation, contributing to increased scholarly output.

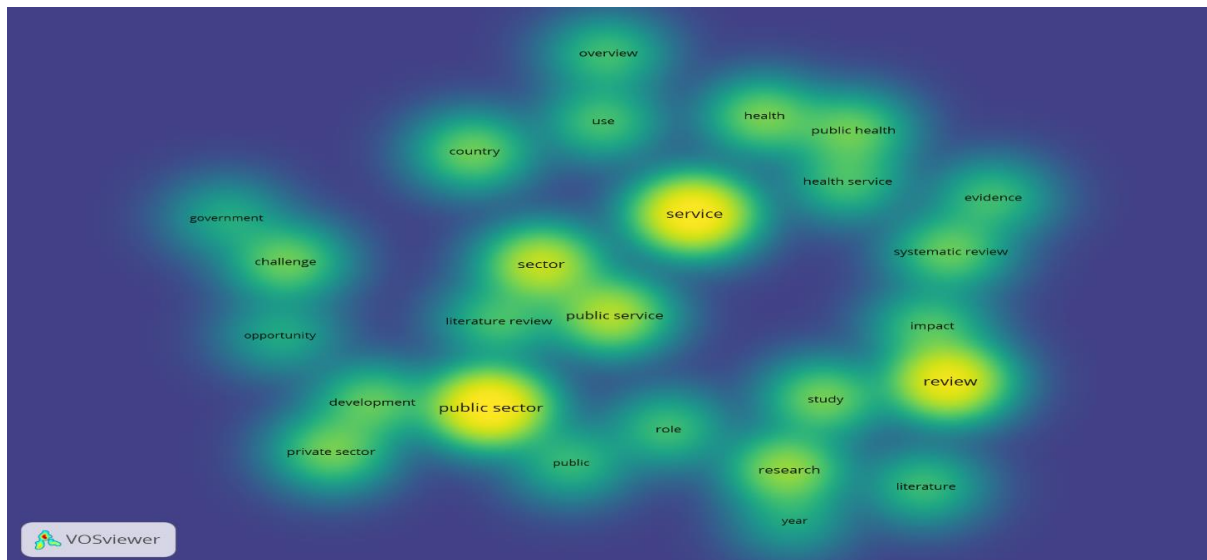


Figure 3. Keywords in the Analysis Article

A visual representation of a more in-depth bibliometric analysis related to public sector research, public services, and factors influencing the implementation of new technologies in this sector. The most prominent words in this visualization are service, public sector, review, and health, indicating that the primary focus of this research is on improving public services, with many studies focusing on evaluating and reviewing literature related to the impact of technology on the public sector. The prominence of keywords such as public sector, service, health, and review illustrates that blockchain research is strongly anchored in service delivery improvement. This indicates that scholars increasingly focus on real-world administrative problems rather than purely technical functions of the technology.

The focus on the words service and public sector emphasizes the importance of the public sector in applying technology to improve the quality of public services, including the health sector. This reflects that existing research has largely focused on how the public sector, with the help of new technologies, can improve the services provided to the community. Words such as health, evidence, and impact indicate that further research assesses the effectiveness of technology in improving healthcare services and its impact on society as a whole.

This study shows that despite increased interest and application in the use of technology for the public sector, especially in healthcare services, challenges in its implementation still need more attention. Thus, it is important to continue exploring existing empirical evidence and case studies to gain a deeper understanding of the challenges and opportunities in implementing this new technology. There has been a significant surge in research related to the public sector and public services using blockchain technology, particularly in the fields of healthcare and digital government. This research highlights the close relationship between the public sector and the technology sector, as well as how policies and regulations can support the integration of new technologies like blockchain into the government sector. This concentration mirrors global shifts toward data-driven governance models in which public value creation, healthcare modernization, and transparency reforms dominate policy priorities. As such, blockchain becomes situated not merely as a technical artifact but as a governance-enabling infrastructure.

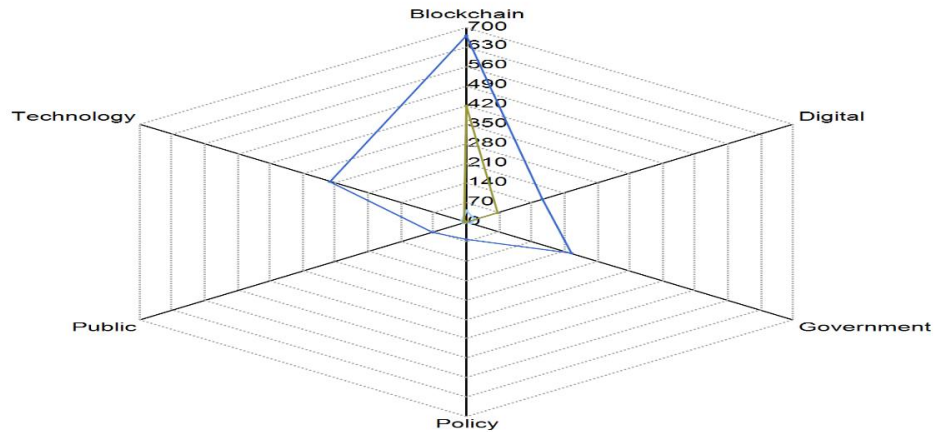


Figure 4. Matrix of Article Analysis Results

This matrix provides an overview of the distribution of main topics in the literature related to blockchain, with an emphasis on four main categories: Technology, Public Sector, Policy, and Government. It can be seen that the most dominant topics are Blockchain in the context of Technology and Government, with the highest number of references in both categories. This indicates that the primary focus of blockchain research is its application in the technology sector and its role in supporting government policy, particularly regarding efficiency and transparency in public services.

In addition, the Digital category shows lower figures, but remains important, indicating that although blockchain technology is more widely discussed in the context of the public sector and policy, its application in the digital sector as a whole is still developing. This indicates that much research is focused on developing blockchain-based solutions for the public sector and government, with the aim of improving public services at the digital level. This research also highlights the importance of policies that support the adoption of blockchain in government. To encourage broader adoption of the technology, policies are needed that not only support the development of blockchain technology but also its safe and efficient integration into public services. With the growing adoption of blockchain technology, existing research shows that attention is increasingly focused on its application in various industrial sectors, particularly in terms of efficiency, transparency, and cost reduction. In this context, blockchain is recognized as a potential solution for improving business processes that are more transparent and reducing risks associated with costs and operational challenges.

Blockchain is at the center of the network, with keywords such as government, blockchain adoption, challenges, and opportunity significantly connected. This illustrates that blockchain technology is highly relevant to the government sector, which is increasingly focusing on the use of blockchain to improve efficiency, transparency, and security in public services. The government sector shows great interest in the application of blockchain, which can facilitate data management and more secure and open administrative processes.

However, despite its enormous potential, blockchain adoption also faces challenges that cannot be ignored. The main challenges associated with blockchain adoption in the public sector are technical issues, implementation costs, and regulations that are not yet fully prepared. This shows that although blockchain offers many benefits, its implementation in the public sector requires careful planning and effort to overcome various obstacles. Additionally, the opportunities associated with blockchain adoption highlight that despite the challenges, the potential offered by this technology is immense, particularly in fostering innovation across critical sectors such as government, banking, and healthcare.

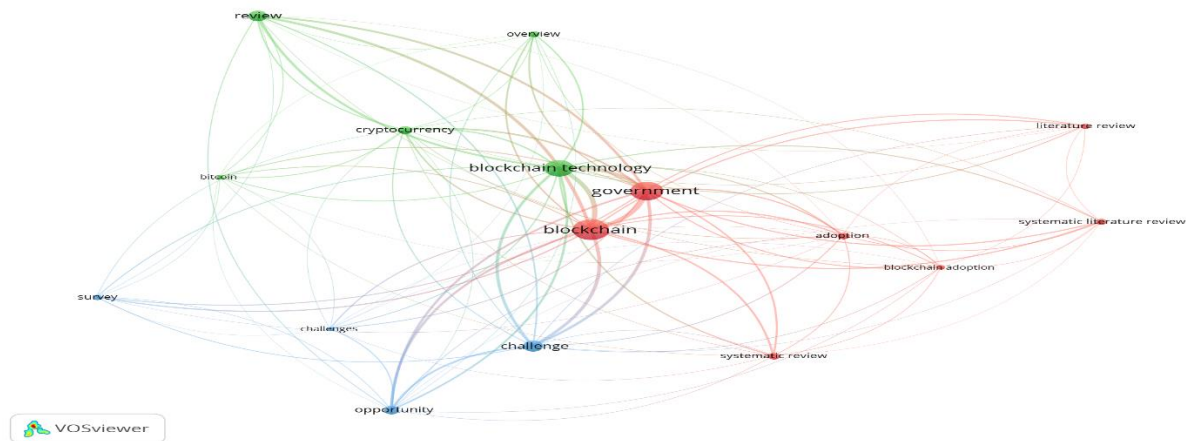


Figure 6. Keywords Visualization

The systematic reviews that frequently appear in this network show that many studies focus on literature reviews to identify trends and evaluations related to blockchain implementation. This illustrates that although much potential has been found in theory, the application of blockchain in the real world still requires more in-depth analysis in order to understand its overall impact and provide clearer insights into the future direction of this technology in the public sector.

In analyzing blockchain usage trends in the public sector, particularly in healthcare and digital government services, we see that much research focuses on the challenges faced by the public sector in adopting new technologies. Although blockchain technology has the potential to improve transparency, efficiency, and security, its adoption in the public sector faces various obstacles that need to be overcome, such as integration issues with existing systems, implementation costs, and data protection. This network visualization provides further insights into how the concepts related to this research are interconnected and creates a more comprehensive picture of the opportunities and challenges that exist.

public administration processes, reduce bureaucracy, and enhance data security. The study also shows that the healthcare sector, with the prominent keyword "health service," is one of the main areas of focus in the application of blockchain. This reflects efforts to integrate blockchain in managing medical data, which can improve accuracy and reduce errors in healthcare services.

However, despite many studies highlighting the great potential of blockchain, its adoption in the public sector still faces various challenges. Cost, barriers, and challenges emerge as major obstacles, with many studies pointing to the high implementation costs, the complexity of system integration, and the need for supportive policies. These challenges indicate that, although blockchain offers many benefits, its implementation in the public sector requires careful planning and clear policies to support a safe and efficient transition. Public policy and government regulation are two important aspects that need to be addressed to ensure smooth and effective blockchain adoption. The visual analysis results in Figure 4 emphasize that blockchain is not only related to the technology itself but also closely interacts with existing policies and regulations. The government plays a crucial role in driving blockchain implementation, and the private sector's role as a technology solution provider is also very important. The private sector, with its technology and innovations, can collaborate with the government to introduce and implement blockchain-based solutions tailored to the needs of public services. Overall, this research highlights that while blockchain technology holds great potential to bring about positive change in the public sector, particularly in healthcare and digital governance, challenges related to costs, policies, and technology integration remain the main barriers. Further research is needed to identify ways to overcome these challenges and explore the broader application of blockchain in other public sectors.

These challenges echo broader digital transformation barriers found in public administration literature, emphasizing that technology must be accompanied by capacity-building, change management, and institutional reform to achieve its intended benefits. Healthcare's prominence within the cluster demonstrates the sector's critical need for secure and interoperable data systems. Blockchain's potential role in medical record accuracy, pharmaceutical tracking, and public health administration makes it a natural focal point for innovation. The findings collectively indicate that the future of blockchain-enabled digital governance depends on aligning technological capabilities with institutional readiness, regulatory coherence, and multi-stakeholder collaboration. Addressing these systemic challenges will be essential for maximizing blockchain's contributions to public value creation and secure digital identity ecosystems.

CONCLUSION

This study examined the development of research on blockchain for e-government, with particular attention to secure digital identity in public sector services. The bibliometric findings show that scholarly attention to blockchain and digital government has increased significantly since 2017, indicating a growing recognition of blockchain as a potential infrastructure for improving transparency, security, data integrity, and trust in public administration. The main finding of this study is that blockchain adoption in e-government cannot be understood merely as a technical innovation. Although blockchain offers potential benefits for secure digital identity and public service delivery, its implementation is strongly shaped by institutional factors. Regulatory readiness, administrative capacity, interoperability, legacy information systems, bureaucratic coordination, and public-private collaboration influence whether blockchain-based digital identity can be effectively adopted and sustained. The theoretical contribution of this study lies in integrating bibliometric analysis with Historical Institutionalism. Through the concepts of

path dependence, critical juncture, institutional layering, and policy feedback, this study shows that blockchain adoption is an institutional process embedded in existing governance structures. The rise of blockchain research after 2017 can be interpreted as a critical juncture in digital governance, while the persistent challenges of regulation, cost, and system integration reflect the influence of institutional legacies and administrative path dependence. This perspective enriches e-government studies by shifting the analysis from a purely technology-centered approach to an institutionally grounded understanding of digital transformation.

The policy implications of this study are clear. Governments should not treat blockchain-based digital identity as a stand-alone technological project. Instead, it should be designed as part of broader institutional reform in digital governance. Policymakers need to establish clear legal frameworks for digital identity, data protection, authentication, and blockchain-based public records. Public institutions also need to strengthen interoperability standards, improve data governance, enhance cybersecurity capacity, and develop mechanisms for inter-agency coordination.

Based on these findings, this study recommends several institutional reforms. First, governments should develop an integrated regulatory framework that defines the legal status, accountability mechanisms, and data protection standards for blockchain-based digital identity. Second, public agencies should reduce fragmented data systems by building interoperable digital infrastructure across institutions. Third, bureaucratic capacity should be strengthened through digital skills development, institutional learning, and technical training for public officials. Fourth, public-private collaboration should be governed through transparent accountability mechanisms to ensure that blockchain innovation serves public value rather than merely technological efficiency.

REFERENSI

- Abdullah, H., & Ibrahim, A. H. (2019). Blockchain technology opportunities in kurdistan, applications and challenges. In *Indonesian Journal of Electrical ...* pdfs.semanticscholar.org. <https://pdfs.semanticscholar.org/ebdd/128f28540afaae71280a72392a88541ed6c5.pdf>
- Al-Ashmori, A., Basri, S. B., Dominic, P. D. D., Capretz, L. F., & ... (2022). Classifications of sustainable factors in blockchain adoption: a literature review and bibliometric analysis. In *Sustainability*. mdpi.com. <https://www.mdpi.com/2071-1050/14/9/5176>
- Alzahrani, A. G., Alhomoud, A., & Wills, G. (2022). A framework of the critical factors for healthcare providers to share data securely using blockchain. *Ieee Access*. <https://ieeexplore.ieee.org/abstract/document/9741768/>
- Aslam, J., Saleem, A., Khan, N. T., & Kim, Y. B. (2021). Factors influencing blockchain adoption in supply chain management practices: a study based on the oil industry. *J Innov Knowl*, 6(2), 124–134. <https://doi.org/10.1016/j.jik.2021.01.002>
- Babaei, A., Babae Tirkolaee, E., & Ali, S. S. (2025). Assessing the viability of blockchain technology in renewable energy supply chains: a consolidation framework. *Renew Sustain Energy Rev*, 212. <https://doi.org/10.1016/j.rser.2025.115444>
- Babaei, A., Khedmati, M., & Jokar, M. R. A. (2023). A new model for production and distribution planning based on data envelopment analysis with respect to traffic congestion, blockchain technology and uncertain conditions. *Annals Oper Res*, 348(3), 1145–1181. <https://doi.org/10.1007/s10479-023-05349-8>
- Babaei, A., Tirkolaee, E. B., & Ali, S. S. (2024). Innovative supply chain network design with two-

step authentication and environmentally-friendly blockchain technology. *Annals Oper Res.* <https://doi.org/10.1007/s10479-024-05950-5>

Babaei, A., Tirkolaei, E. B., & Anka, F. (2024). Efficiency-sustainability models to assess blockchain adoption strategies with uncertainty in the oil and gas sector. *Environment, Development and Sustainability.* <https://doi.org/10.1007/S10668-024-05604-3>

Babaei, A., Tirkolaei, E. B., Simic, V., Golpîra, H., & Anka, F. (2025). Assessing the Impacts of Blockchain Technology on Supply Chain Efficiency: A Data-Driven Integrated Decision-Making Framework. *Group Decision and Negotiation*, 1–32. <https://doi.org/10.1007/S10726-025-09934-Z/TABLES/4>

Casares, A. P. (2018). The brain of the future and the viability of democratic governance: The role of artificial intelligence, cognitive machines, and viable systems. *Futures*, 103, 5–16. <https://doi.org/10.1016/j.futures.2018.05.002>

Charles, V., Rana, N. P., & Carter, L. (2022). Artificial Intelligence for data-driven decision-making and governance in public affairs. *Government Information Quarterly*, 39(4), 101742. <https://doi.org/10.1016/J.GIQ.2022.101742>

Engin, Z., & Treleaven, P. (2019). Algorithmic government: Automating public services and supporting civil servants in using data science technologies. *The Computer Journal.* <https://ieeexplore.ieee.org/abstract/document/8852885/>

Guthrie, C., & Fosso-Wamba, S. (2025). The digital transformation of government. A bibliometric study and research agenda. *Procedia Computer Science*, 256, 624–632. <https://doi.org/10.1016/J.PROCS.2025.02.160>

Hosseini Dehshiri, S. J., Amiri, M., & Hosseini Bamakan, S. M. (2024). Evaluating the blockchain technology strategies for reducing renewable energy development risks using a novel integrated decision framework. *Energy*, 289. <https://doi.org/10.1016/j.energy.2023.129987>

Huang, B., Choi, Y., Chng, S., & Neo, H. (2023). Examining Policy Strategies for Electrifying Transportation in ASEAN: A STEELUP Framework Evaluation. *Sustainability.* <https://doi.org/10.3390/su152215708>

Jagustović, R., Zougmore, R. B., Kessler, A., Ritsema, C. J., Keesstra, S., & Reynolds, M. (2019). Contribution of systems thinking and complex adaptive system attributes to sustainable food production: Example from a climate-smart village. *Agricultural Systems*, 171, 65–75. <https://doi.org/10.1016/j.agsy.2018.12.008>

Liu, F., Fan, H. Y., & Qi, J. Y. (2022). Blockchain technology, cryptocurrency: entropy-based perspective. In *Entropy*. [mdpi.com. https://www.mdpi.com/1099-4300/24/4/557](https://www.mdpi.com/1099-4300/24/4/557)

Müller, A. P. R., Bosch, J. M., & ... (2025). An overview of the expected public values arising from blockchain adoption in the European public sector. In *International Journal of ...* [emerald.com. https://doi.org/10.1108/IJPSM-12-2023-0363](https://doi.org/10.1108/IJPSM-12-2023-0363)

Oudani, M. (2023). A combined multi-objective multi criteria approach for blockchain-based synchromodal transportation. *Comput Ind Eng*, 176. <https://doi.org/10.1016/j.cie.2023.108996>

Roehl, U. B. U. (2022). *Understanding Automated Decision-Making in the Public Sector: A Classification of Automated, Administrative Decision-Making.* 35–63.

https://doi.org/10.1007/978-3-030-92644-1_3

Sarma, M., Septiani, S., & Nanere, M. (2022). The Role of Entrepreneurial Marketing in the Indonesian Agro-Based Industry Cluster to Face the ASEAN Economic Community. *Sustainability*. <https://doi.org/10.3390/su14106163>

Solaiman, B., & Dimitropoulos, G. (2024). The legal considerations of AI-Blockchain for securing health data. ... *Handbook on Health, AI and the* <https://www.elgaronline.com/edcollchap-oa/book/9781802205657/book-part-9781802205657-15.xml>

Yu, T., Guan, Z., Zhang, J., & Dong, J. (2024). Blockchain adoption and contract coordination of poverty alleviation supply chain considering altruistic preference. *Computers and Industrial Engineering*, 188. <https://doi.org/10.1016/J.CIE.2023.109879>;

Yue, Y., & Shyu, J. Z. (2024). A paradigm shift in crisis management: The nexus of AGI-driven intelligence fusion networks and blockchain trustworthiness. *Journal of Contingencies and Crisis* <https://doi.org/10.1111/1468-5973.12541>