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Transforming E-governance: the potential of blockchain in the public sector

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ABSTRACT

Blockchain technology has become a transformative innovation in the digital governance landscape, offering new opportunities to enhance transparency, accountability, and citizen trust. This study offers an extensive bibliometric and thematic examination of international research on blockchain in E-governance from 2019 to 2024. Using data from the Scopus database, the analysis examines publication trends, leading countries, collaboration networks, and the intellectual structure of the field. The findings reveal that research output has grown steadily, dominated by technologically advanced nations such as China, India, and the United Kingdom. The thematic mapping identifies core clusters, including transparency, E-government, and public sector innovation, alongside emerging themes such as artificial intelligence (AI) integration, smart cities, and digital transformation. By integrating bibliometric and thematic analyses, this study offers a comprehensive understanding of how blockchain research evolves within public governance. Despite significant progress, challenges remain, particularly regarding empirical validation, governance frameworks, and regional disparities in adoption. Future research should explore a more complex roadmap for blockchain implementation in government through three interrelated dimensions: technical development, policy and regulatory frameworks, and socio-institutional adaptation. This multidimensional perspective underscores blockchain's capacity to support secure, inclusive, and data-driven forms of digital governance.

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1. INTRODUCTION

Digital transformation has become a key priority for governments worldwide, seeking to strengthen governance capabilities, streamline public service delivery, and enhance policy responsiveness [1], [2]. Traditional public administration models that rely heavily on manual processes and bureaucratic procedures are increasingly seen as inefficient in addressing the dynamic needs of modern society. The growing expectations of citizens for faster, more transparent, and accountable services have pushed governments to adopt innovative digital solutions. Information and communication technologies (ICT) play a pivotal role in this transformation by facilitating data-driven decision-making, strengthening inter-agency coordination, and promoting citizen-centric service delivery [3]. However, while bureaucratic inefficiencies have long been criticized, eliminating bureaucracy entirely is not necessarily the best solution for achieving impartiality,

equity, and justice in public administration. Instead, ICT adoption should enhance the administrative capacity of public institutions to deliver efficient and effective services [4]. In the post-pandemic era, digital transformation and the rise of generative artificial intelligence (AI) have brought new challenges and opportunities, demanding greater agility, real-time decision-making, and innovative approaches to public service delivery [5]. Moreover, digital governance increasingly depends on seamless information sharing, , communication, transaction, participation, openness, and integration to reduce system duplication and accelerate administrative modernization [6]. Consequently, the concept of E-governance has emerged as a key strategy for modernizing public administration and building trust between governments and citizens [3].

E-governance involves leveraging ICT to improve government operations, streamline decision-making, enhance the delivery of public services, and foster greater community engagement [7]. Based on its functions, E-governance primarily aims to increase transparency and accountability, boost citizen participation through digital services, and accelerate administrative processes. In the context of E-government, ICT can facilitate the digital exchange of information between government departments and agencies, support e-business, tax returns, and all forms of digital communication [8]. However, despite its clear benefits, E-governance faces challenges, such as a lack of transparency that makes it vulnerable to corruption [9], issues of public trust [10], and the need for more transparent systems [11]. These challenges require comprehensive reforms through the adoption of technology, enhancement of human resource competencies, and improvements in transparency and accountability within the government to ensure that citizens receive proper and high-quality public services. Governments often set unique requirements for technology use, such as ensuring accessibility for all (inclusivity), transparency, and accountability [12]. Blockchain has emerged as one of the most disruptive technologies in recent years. Its applications are not limited to cryptocurrencies like Bitcoin but also extend to various sectors, including finance, logistics, healthcare, and governance. The global use of blockchain demonstrates its ability to enhance transparency, security, and efficiency across numerous processes.

E-governance faces enduring challenges related to transparency, accountability, data security, and citizen trust due to its reliance on centralized systems and fragmented digital infrastructures. These limitations often lead to inefficiencies, corruption risks, and poor interoperability among government agencies. In response, emerging technologies such as blockchain have gained attention for their potential to address these issues. With its decentralized and immutable architecture, blockchain offers secure, transparent, and tamper-resistant data management that can reduce fraud, enhance traceability, and strengthen trust in public administration [13]. A key feature that reinforces blockchain's reliability is its immutability, once data are committed to the blockchain network, alteration or deletion is not possible [14]. Its application in areas like identity management, land registration, and digital record-keeping demonstrates how blockchain can improve efficiency and accountability. These applications offer innovative solutions to persistent weaknesses in traditional E-governance systems.

However, despite its growing significance, existing studies on blockchain in E-governance remain fragmented and lack a holistic understanding. Most research has primarily focused on technical aspects, while the social, economic, and governance dimensions are still underexplored. In practice, the adoption of blockchain in the public sector remains in its early stages and faces multiple challenges, such as the lack of clear regulatory frameworks and limited technical expertise, which hinder its widespread implementation and integration within government institutions [14]. Moreover, the lack of standardized practices further limits the potential and practical value of blockchain applications in public administration, constraining their scalability and effectiveness beyond isolated pilot projects [15]. These limitations indicate that, despite blockchain's promise to enhance transparency, efficiency, and trust in public services, a comprehensive and systematic understanding of its development and application in E-governance remains insufficient.

Therefore, conducting a bibliometric analysis is essential to trace the evolution, thematic directions, and existing research gaps, offering valuable insights for scholars and policymakers into how blockchain technology has been explored and implemented within the public sector over time. Building upon this need, the present study provides comprehensive insights into the application of blockchain within the public sector by identifying key themes, challenges, and opportunities in blockchain research for E-governance. Unlike previous reviews that focus on isolated case studies or conceptual discussions, this study integrates bibliometric mapping and analysis to offer a data-driven and holistic understanding of the field. The results highlight research gaps and thematic trends that can serve as a foundation for future investigations. From a practical perspective, this study helps policymakers and practitioners leverage blockchain to improve transparency, efficiency, and trust in public services. Theoretically, it enriches academic discourse by synthesizing global research patterns and emerging themes. Together, these insights support evidence-based digital governance and guide future research and policy priorities.

2. LITERATURE REVIEW

2.1. Blockchain in government and public administration

Technological advancements have prompted decision-makers in various organizations and governments to consider implementing secure and manageable technologies to maintain accountability in practice [16]. Blockchain technology has limitless potential for application across sectors, offering enhanced efficiency and security. Initially associated with cryptocurrencies, blockchain technology has evolved into a decentralized and immutable ledger system, positioning itself at the forefront of technological innovation [17]. A key characteristic of blockchain is its ability to ensure data transparency. All digital transactions are securely documented in distributed ledgers, whether private, public, or semi-private, that are resistant to tampering and accessible across multiple devices [18]. This feature enables users to view the entire transaction history, creating an auditable transaction trail. In general, blockchain functions as a decentralized database that records all transactions among users from its inception. This secure, distributed ledger operates without intermediaries, enabling participants to independently verify the authenticity and integrity of the entire chain [19].

The integration of blockchain with other emerging technologies, such as the internet of things (IoT), further strengthens its role in driving digital transformation and providing competitive advantages for organizations [16]. Achieving digital transformation requires organizational changes, including policy digitization, process modernization, and addressing user needs [20]. Successful digital transformation in the public sector relies on two key elements: strong internal support [21] and changes in governance practices [22]. This combination enables public sector organizations to fully realize the benefits of digital transformation, such as improved public services, operational efficiency, and enhanced accountability. In this context, E-government has emerged as a key driver of public sector innovation and a conceptual framework for testing and implementing diverse ICT in governance [23].

2.2. Previous studies and emerging trends

Research on blockchain in E-governance has grown significantly since 2019, aligning with the global wave of digital transformation in the public sector. Early studies emphasized conceptual frameworks and cryptographic foundations, while more recent works focus on practical applications that enhance transparency, efficiency, and accountability in government operations. Key research areas include blockchain-based identity and data management for secure authentication, smart contracts for automated and transparent administration, and blockchain-enabled public records and e-voting systems that improve integrity and trust. The integration of emerging technologies such as AI and the IoT further strengthens smart governance initiatives and fosters innovation in data-driven public service delivery. Despite these advancements, the distribution of research remains uneven. Most publications originate from technologically advanced countries, whereas studies from developing regions are still limited. Moreover, much of the literature emphasizes technological feasibility rather than institutional, legal, or socio-political implications. This leaves a gap in understanding how blockchain adoption aligns with governance structures, public policy, and citizen trust.

In China, for example, the 2020 pilot program for the development and utilization of public data resources marked a significant step toward integrating blockchain into government data systems. The technology has been used to achieve tamper-proof data storage, distributed management, privacy protection, traceability, and access control across public services [24]. Meanwhile, in Dubai, blockchain has been applied to intellectual property (IP) management, enabling users to securely register, verify, and protect their IP rights. The Dubai Customs' blockchain-based IP system, recognized by the Ministry of Economy and the World Intellectual Property Organization (WIPO), demonstrates how blockchain supports fast and secure data exchange between global and government entities [25].

Overall, existing studies reveal a clear evolution from theoretical exploration to real-world implementation, with a growing emphasis on transparency, data integrity, and institutional trust. However, future research should pay more attention to policy alignment, cross-sector collaboration, and socio-technical integration to fully realize blockchain's potential in digital governance.

3. METHOD

This research employs a bibliometric approach to quantitatively and systematically analyze scientific literature. Bibliometric analysis facilitates a comprehensive understanding of a research area, mapping its boundaries, identifying influential authors, and uncovering new directions for future studies [26]. This method helps disseminate research trends, collaboration networks, and key topics related to blockchain. The bibliometric approach offers a systematic and quantitative means to analyze the blockchain research landscape, helping to understand its potential, challenges, and development directions.

Figure 1 illustrates the workflow for data collection and analysis in four steps. The first step is identification, the process involves selecting the Scopus database, which is highly suitable for bibliometric analysis due to its wide scope, covering various publishers and disciplines [27]. The database was filtered using titles, abstracts, and keywords with the query:

> (TITLE-ABS-KEY ((“blockchain” OR “block-chain” OR “distributed ledger”) AND (“public sector” OR “public service” OR “public administration”) AND (“E-government” OR “government” OR “governmental” OR “governance”))

The second step, screening, retrieved 318 documents based on the predefined query (December 25, 2024). The third step, eligibility, applied duration, language, and content criteria to refine the dataset. Publications from 2019–2024 were selected, excluding 25 non-period documents and 8 non-English ones to ensure content relevance. A manual content review then refined the dataset for more effective bibliometric analysis. The final step, inclusion, produced 255 eligible documents for analysis using Biblioshiny software to visualize the data.

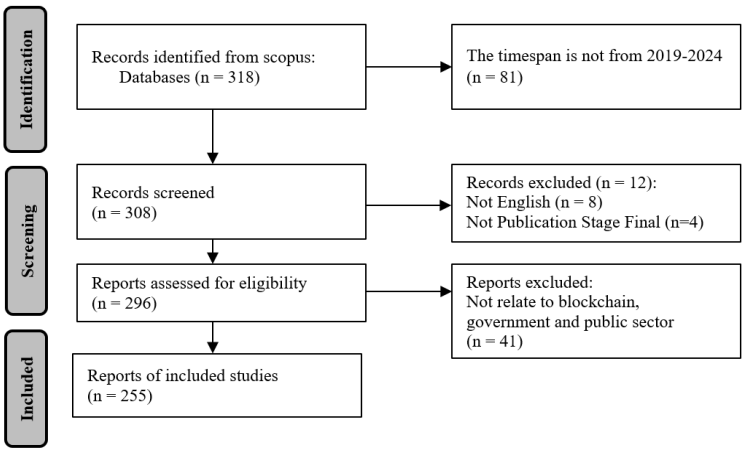

Figure 1. Scopus data collection workflow

4. RESULTS AND ANALYSIS

The analysis process employed Biblioshiny software, which provided in-depth insights into research trends in blockchain for E-governance. The findings cover developments in research focus, contributions by individuals and institutions, and relevant themes for further exploration. This analysis is instrumental in designing more targeted and strategic follow-up research.

Figure 2 presents the descriptive statistics of the bibliometric dataset used in this study. A total of 255 documents from 180 sources were analyzed over the 2019–2024 period, showing an annual growth rate of 15.36%, which indicates increasing research interest in blockchain for E-governance. The dataset involved 666 authors with 16.86% international co-authorship, reflecting moderate global collaboration. On average, each document had 2.89 co-authors and received 9.44 citations, demonstrating active scholarly engagement. Additionally, 610 authors’ keywords and 10,130 references were identified, with an average document age of 2.07 years, highlighting the novelty and growing academic relevance of this research area.

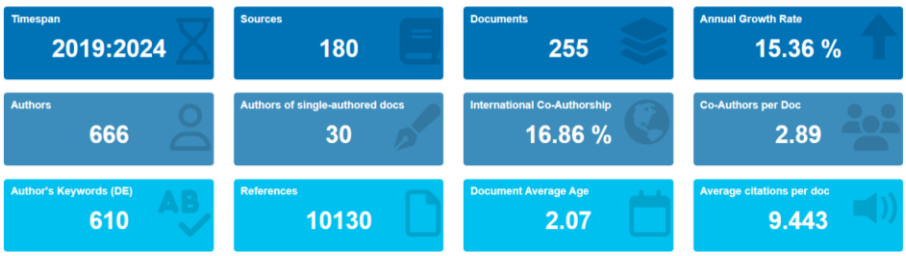

Figure 2. Descriptive summary of the bibliometric dataset (generated using Biblioshiny)

4.1. Document by year

Figure 3 presents the distribution of publications on blockchain technology in public sector E-governance from 2019 to 2024. As shown in the figure, interest in blockchain technology began to grow in 2019 with 23 articles. This number increased to 25 articles in 2020, followed by a significant rise to 46 articles in 2021, and further to 61 articles in 2022. However, the number of articles declined to 53 in 2023 and 47 in 2024. Although publications have declined since 2023, the overall trend from 2019 to 2024 shows a clear increase compared to the beginning of the period, emphasizing the growing importance of blockchain technology in public sector E-governance. This pattern underscores blockchain's role as a key driver of digital transformation in the public sector, reflecting dynamic research activity and evolving interest in its applications during the 2019–2024 period.

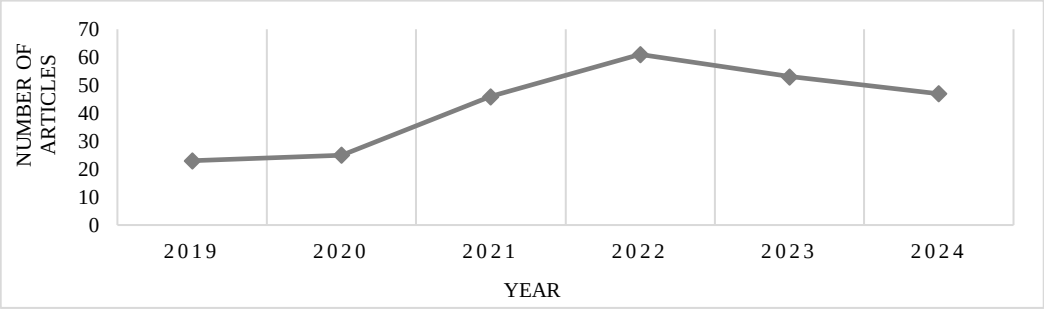

Figure 3. Number of publications per year

4.2. Distribution of research topics

The analyzed dataset consists of 255 articles authored by 666 researchers. As shown in Figure 4, the dataset comprises single-country publications (SCP), multi-country publications (MCP), and the MCP ratio, which represents the proportion of collaborative publications relative to the total number of studies. In databases such as Scopus, "SCP" designates works where all contributing authors are affiliated with institutions within the same country [28]. The MCP ratio reflects the degree of global collaboration by each country.

Figure 4 illustrates the distribution of publications by country, distinguishing between SCP and MCP, which represent international collaborations. China and India lead with the highest number of publications, indicating strong research activity and government interest in blockchain for E-governance. The United Kingdom, the United States, and Spain also show notable contributions, reflecting active involvement from both developed and emerging economies. Countries such as Germany, Brazil, and Belgium demonstrate balanced participation between domestic and international collaborations, while smaller contributors like Kazakhstan, Oman, and the United Arab Emirates primarily engage through collaborative research. Overall, the figure highlights the global nature of blockchain research in E-governance, with significant cross-country partnerships enhancing knowledge exchange and innovation.

Countries exhibiting a balanced mix of SCP and MCP, such as Germany, Brazil, and Belgium, demonstrate the integration of strong domestic research capacity with targeted national initiatives and pilot programs. Germany, for instance, has implemented a robust national blockchain strategy supported by coordinated policy frameworks that stimulate domestic research groups and applied pilots while fostering international partnerships. German studies explore the relationship between blockchain technology and New Public Governance (NPG), emphasizing flexibility and decentralized service execution [29]. Similarly, Brazil's public-permissioned blockchain initiatives have generated significant local outputs and facilitated cross-border collaborations, even though the country faces regulatory barriers concerning smart contract trade [30]. Belgium also demonstrates this dual dynamic through coordinated national initiatives and strong university–industry collaborations, exemplified by credential verification projects between universities in Italy and Belgium, which explore the challenges of implementing the European Blockchain Services Infrastructure (EBSI) and self-sovereign identity (SSI) systems for academic credential verification [31].

In contrast, smaller or emerging research contributors such as Kazakhstan, Oman, and the UAE often rely primarily on MCP, as international collaboration offers access to expertise, infrastructure, and funding that may be limited domestically. This approach enables these countries to engage in high-impact, policy-relevant studies within the global blockchain and E-governance domain. Overall, nations with established policy frameworks and research ecosystems tend to sustain both domestic and international research productivity, while those still developing research capacity increasingly depend on international

cooperation, and collaborative networks collectively shape global contributions to blockchain and E-governance research.

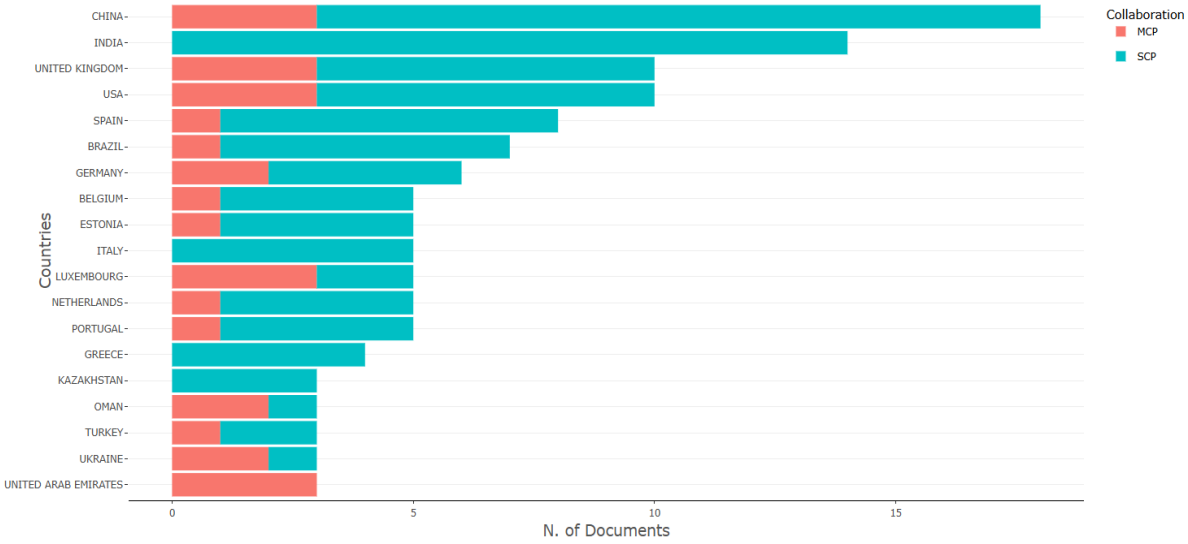

Figure 4. Top 10 countries by contribution (generated using Biblioshiny)

4.3. Relevant publications

Table 1 presents the top publication sources contributing to blockchain research in E-governance within the public sector between 2019 and 2024. The ACM International Conference Proceedings Series leads with 16 publications, followed by the lecture notes in computer science (LNCS) with 10 papers, and both lecture notes in business information processing and lecture notes in networks and systems with 7 publications each. Meanwhile, high-impact journals such as Government Information Quarterly and Public Administration and Information Technology have a smaller but notable presence, indicating that research on blockchain in E-governance has begun to gain recognition in mainstream governance and public administration outlets. Other multidisciplinary venues such as Sustainability (Switzerland), AIP Conference Proceedings, and IEEE Access demonstrate the field's growing diversity and technological orientation.

The publication trends align closely with the patterns observed in the "Top Countries by Contribution" analysis. Leading countries such as China, India, the United States, and the United Kingdom, which dominate blockchain research output. These nations host major international conferences and research collaborations that often produce proceedings in ACM and Springer's LNCS series, reinforcing their visibility and influence in the field. In contrast, European countries such as Germany, Belgium, and the Netherlands show a more balanced output between conference proceedings and academic journals, particularly in Government Information Quarterly, indicating a stronger linkage between technological implementation and public policy studies [32], [33]. Consequently, the convergence between dominant publication sources and leading contributing countries highlights both the technological and institutional maturity of blockchain research in E-governance.

Table 1. The most relevant sources

No.	Source	Articles
1	ACM international conference proceeding series	16
2	Lecture notes in computer science (including subseries lecture notes in artificial intelligence and bioinformatics)	10
3	Lecture notes in business information processing	7
4	Lecture notes in networks and systems	7
5	Government information quarterly	4
6	Public administration and information technology	4
7	Sustainability (Switzerland)	4
8	AIP conference proceedings	3
9	CEUR workshop proceedings	3
10	IEEE access	3

4.4. Thematic evolution

A thematic map in bibliometric analysis visually represents the distribution of topics or key themes in a research field based on bibliometric data. The thematic map aims to identify trends, interrelationships among themes, and dominant or emerging areas in the scientific literature.

The thematic map visualizes Figure 5, the conceptual structure of blockchain-related research in E-governance, categorized into four quadrants based on development degree (density) and relevance degree (centrality). The upper-right quadrant (motor themes) includes highly developed and central topics such as blockchain, authentication, information management, and smart city, indicating these are the driving forces of current E-governance innovation. These themes are strongly aligned with the increasing adoption of blockchain in public administration and urban governance to enhance transparency, efficiency, and trust. The lower-right quadrant (basic themes) contains foundational but less specialized topics, including decision making, IoT, digital technologies, and information systems. These represent the technological infrastructure supporting blockchain implementation and reflect the broader digital transformation agenda across the public sector. In the upper-left quadrant (niche themes), topics like governance models, digital government, and procurement process suggest specialized and evolving areas of interest.

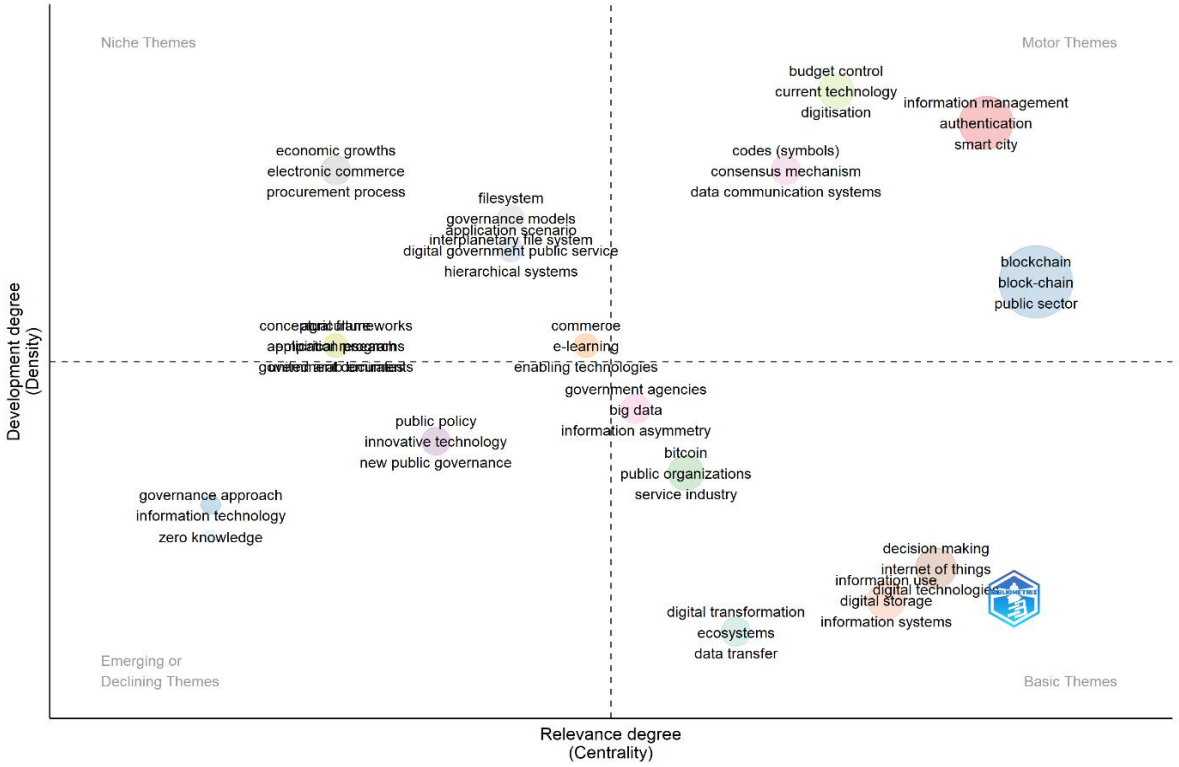

Figure 5. Thematic map of blockchain research in E-governance 2019–2024 (generated using Biblioshiny)

These are often explored in regional or country-specific studies, particularly from European nations such as Germany, Belgium, and Estonia. E-government systems are well-established and academic contributions are frequently disseminated through conference proceedings like the LNCS and ACM International Conference Proceedings Series. The lower-left quadrant (emerging or declining themes) includes governance approach, information technology, and zero knowledge, reflecting nascent or less mature research streams that may gain relevance as blockchain applications in governance evolve.

Figure 6, titled tree map of blockchain research in E-governance, visualizes the frequency and relative importance of keywords appearing in E-governance publications on blockchain from 2019 to 2024. The most dominant keywords, blockchain (17%) and block-chain (13%), indicate the centrality of blockchain technology as both a conceptual and technical foundation of the research domain. Following these, public sector (9%), E-government (9%), public administration (7%), and transparency (5%) appear as major clusters, highlighting the strong focus on governance transformation, administrative efficiency, and trust-building through technological innovation.

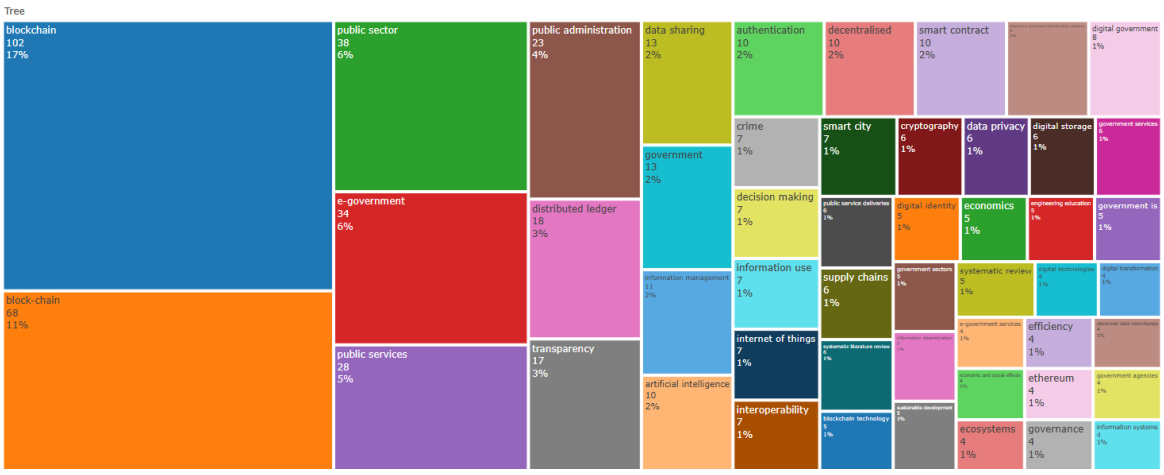

Figure 6. Tree map of blockchain research in E-governance (generated using Biblioshiny)

5. DISCUSSIONS

The discussion explores the evolution of research focus and the underlying goals and implications of blockchain adoption in E-governance, highlighting how scholarly attention has shifted from conceptual exploration toward practical implementation and policy-oriented innovation.

5.1. Evolution of research focus

The evolution of blockchain research in E-governance from 2019 to 2024 reflects a clear transition from conceptual exploration to practical implementation. During the exploratory phase (2019–2020), studies primarily focused on establishing theoretical foundations. Table 2 illustrates the progressive development of blockchain research in E-governance from theoretical exploration to practical implementation.

Table 2. Evolution of research focus on blockchain in E-governance (2019–2024)

Phase	Dominant focus	Key themes/Keywords	Research characteristics	Collaboration pattern	Representative countries
Exploratory phase (2019-2020)	Conceptual foundations of blockchain in governance	"blockchain", "transparency", "security", "trust", "distributed ledger"	Theoretical discussions and framework proposals; focus on potential benefits for public administration	SCP-dominant	Germany, Brazil
Integration phase (2021-2022)	Technological integration and system design	"IoT", "smart contract", "information management", "digital transformation"	Increased interdisciplinary studies; technical experiments for process automation and authentication	Rising MCP collaborations	Belgium, Italy, India
Implementation phase (2023-2024)	Practical adoption and sectoral applications	"e-voting", "taxation", "land registration", "academic records", "intellectual property"	Applied research and case studies; cross-country collaboration (China, India, UK)	Balanced SCP–MCP	Germany, UK, UAE

The evolution in of blockchain research in E-governance shows a progressive shift from conceptual exploration to applied implementation, accompanied by an increasing trend toward international collaboration MCP. Countries with established policy and research frameworks (e.g., Germany, Belgium, UK) demonstrate balanced participation between domestic and international initiatives, while emerging contributors (e.g., UAE, Kazakhstan) leverage collaborations to strengthen capacity and visibility. This co-evolution of research focus and collaboration networks underscores blockchain's transition from a theoretical innovation to a strategic instrument for digital governance transformation.

The treemap visualization further reinforces these findings by highlighting dominant keyword clusters such as blockchain, E-government, public sector, transparency, and data sharing. These keywords represent the core discourse that defines and shapes the development of research in this field. Supporting terms like smart contracts, distributed ledger, and AI indicate a convergence between blockchain and intelligent digital ecosystems. This evolution signifies a shift from isolated technological experimentation to a systemic governance paradigm, emphasizing accountability, trust, and data-driven decision-making.

5.2. Research goals and implications

Government data transparency initiatives have significant potential to drive digital transformation in the public sector, it supported by effective data usage strategies [34]. The bibliometric analysis reveals that the primary goal of blockchain research in the public sector is to advance digital governance through transparency, efficiency, and trust. The thematic map demonstrates how these objectives are operationalized through the interaction of four thematic quadrants: motor, basic, niche, and emerging, each representing different levels of technological maturity and institutional integration in blockchain-based E-governance.

Table 3 classifies blockchain research themes according to their strategic importance and development maturity. The motor themes, characterized by high development and centrality, represent the most dominant and strategic implementations of blockchain in E-governance. These themes closely align with applications like e-voting and taxation, which aim to enhance public accountability through transparent and tamper-resistant systems. In e-voting, blockchain provides immutable and verifiable records, enabling secure digital authentication via time-stamped smart contracts that eliminate third-party interference. Similarly, in tax administration, blockchain ensures data immutability and transparency, supports automated compliance monitoring, and facilitates interoperability between public and private databases. These implementations demonstrate how blockchain reinforces trust and integrity in critical governance functions, addressing long-standing challenges of fraud, inefficiency, and data manipulation in public management.

Table 3. Thematic quadrants and application domains of blockchain in E-governance

Thematic quadrant	Focus and role	Representative public sector applications	Key contributions/Implications
Motor themes	Central, well-developed, and strategic drivers of E-governance innovation	E-voting [35], [36] Tax administration [37], [38]	Enhance transparency, security, and trust in governance; automate verification and compliance; reduce administrative inefficiency.
Basic themes	Foundational technologies and policy enablers supporting blockchain integration	Smart cities [39], [40] Academic sector [41], [42], [32]	Support interoperability and data-driven governance; improve administrative efficiency; enable digital transformation of public services.
Niche themes	Specialized and sector-specific applications responding to contextual challenges	Land registration [43], [44] Intellectual property [45], [46]	Ensure legal certainty, ownership transparency, and anti-corruption mechanisms; promote digital innovation ecosystems.
Emerging themes	Future-oriented areas emphasizing privacy, decentralization, and ethical trust	Decentralized governance models [47], [48] Zero-knowledge systems [49], [50]	Strengthen privacy protection and algorithmic accountability; prepare for next-generation digital public infrastructure.

The basic themes function as the technological and policy foundations for blockchain integration in the public sector. Themes such as IoT and digital transformation illustrate how blockchain supports the broader digitalization agenda of government institutions. The academic sector serves as a key example of this foundational application, where blockchain enables administrative automation, transparent verification of credentials, and interoperability across educational institutions. Similarly, smart city initiatives utilize blockchain–IoT integration to support secure data exchange, predictive analytics, and data-driven decision-making. These advancements emphasize blockchain's pivotal role in enhancing administrative efficiency and interconnectivity within digital governance ecosystems.

In contrast, niche themes capture specialized and sector-specific applications of blockchain in governance. These themes, such as procurement processes and economic management, are often studied within specific regulatory or regional contexts. For instance, in land registration systems, blockchain addresses issues of corruption, forgery, and bureaucratic inefficiency by creating transparent and immutable property records. The integration of blockchain with AI and IoT further enhances real-time monitoring and enables predictive policy analysis. In intellectual property (IP), blockchain supports tokenized ecosystems that enhance ownership protection, streamline licensing, and prevent digital piracy through asymmetric cryptography and consensus mechanisms. Such applications highlight blockchain's role in ensuring legal certainty and public trust in areas where documentation and ownership verification are critical.

The emerging themes include zero-knowledge proof and decentralized governance models. Represent future research frontiers focusing on privacy protection, interoperability, and ethical governance. These themes signify a shift from centralized administrative structures toward decentralized, citizen-centric models that enhance both transparency and privacy. Future studies are expected to explore how algorithmic trust, zero-knowledge systems, and digital identity frameworks can support sustainable E-governance reforms.

Overall, the thematic distribution underscores that blockchain research in E-governance is progressing toward the development of a coherent and adaptive governance model, integrating institutional capacity, technological innovation, and citizen engagement. This transition from foundational studies to applied policy frameworks reflects the maturing state of blockchain research, emphasizing its strategic potential in achieving responsive, accountable, and data-driven public services.

6. CONCLUSION

This study offers a comprehensive synthesis of the global research landscape on blockchain technology in E-governance from 2019 to 2024, revealing its evolution from a technological innovation to a governance enabler that fosters transparency, accountability, and citizen trust. Technologically advanced nations, particularly China, India, and the United Kingdom, dominate scientific production, as confirmed by the bibliometric and thematic analyses. Their policy-driven digital strategies have played a pivotal role in shaping the direction and pace of blockchain adoption in public administration. Research trends also demonstrate growing interdisciplinary integration between computer science, information systems, and public policy, reflecting an interdisciplinary shift toward socio-technical and governance-centered approaches.

The findings offer important theoretical and practical contributions. Theoretically, the study maps the conceptual evolution and intellectual structure of blockchain research in E-governance, serving as a foundation for future scholarly inquiry. Practically, it offers actionable insights for policymakers and practitioners to design secure, transparent, and citizen-centric governance frameworks that align technological innovation with principles of accountability, efficiency, and data integrity.

Despite progress, research gaps remain, including geographical disparities, limited empirical validation, and the lack of institutional evaluation frameworks. Future studies should analyze blockchain implementation in public governance across three dimensions: technical (technology roadmaps, interoperability, AI/IoT integration), policy-regulatory (standards, legal frameworks, cross-border data protection), and social-institutional (innovation readiness, citizen trust, ethics, institutional adaptation). Integrating these dimensions can guide effective, transparent, and citizen-centric governance.In conclusion, blockchain in E-governance is evolving toward a mature and globally collaborative research phase, where technological, ethical, and policy dimensions converge. Strengthening this alignment between innovation and institutional transformation is essential to achieve efficient, trustworthy, and equitable public governance in the digital era.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

DATA AVAILABILITY

Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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