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Blockchain as a digital governance tool: a systematic review

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ABSTRACT

This systematic review explores the implementation of blockchain technology as a digital governance tool, focusing specifically on the Peruvian context. In the digital transformation era, blockchain has established itself as an innovative solution to manage and authenticate information. This research focuses on optimizing administrative and governmental processes in Peru, a country where document verification is crucial in legal, financial, educational, and medical procedures. The methodology used follows the problem/population, intervention, comparison, outcome, context (PICOC) model. 56 high-impact articles were selected in Scopus, prioritizing those in the areas of engineering, computer science, and business, and published between 2022 and 2025. The objective was to define the scope and structure of the research questions. These questions address the implementation of blockchain and its applications in digital governance to ensure security and reliability in administrative procedures. Through a comprehensive literature review, we seek to provide a comprehensive view of how blockchain could transform the interaction between citizens and the Peruvian government by automating document verification. In addition, successful cases from other countries and similar sectors will be analyzed, evaluating their feasibility and applicability in the Peruvian context. This approach will allow us to identify both the potential benefits and the challenges and implications associated with the integration of blockchain into government processes in Perú.

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1. INTRODUCTION

The technological advances with the greatest impact in this scenario are blockchain technology, which has transformed the way information is managed and authenticated [1]. As explained below, blockchain helps to establish the foundations of an innovative approach called SECHash, which is dedicated to verifying the authenticity of incoming documents by combining blockchain and optical character recognition (OCR) technologies [2]. This technology has demonstrated its ability to increase effectiveness, transparency and security in various sectors, and its application in government processes is no exception. In the Peruvian context, where government and administrative processes are fundamental to the lives of citizens and the functioning of the country, improving these procedures is of utmost importance [3].

Document verification is a key component in many procedures, whether in the legal, financial, educational or health fields. For these types of documents, the use of blockchain is essential due to its reliable security. As can be seen, blockchain represents a decentralized database, similar to a ledger, shared between peers (peer-to-peer or p2p). This database records information in the form of interconnected blocks, often protected by public-key cryptography methods. Blockchain technology allows new data to be added to a block, making it accessible to all nodes in a decentralized network, unlike the traditional centralized approach. Each block within a blockchain is identified by a hash value, usually generated by the 256-bit SHA256 cryptographic algorithm [4].

Blockchain technology is presented as a solution with the potential to generate significant changes. Its main characteristic, the immutability and decentralized distribution of records, opens the door to the creation of highly secure and reliable document verification systems. By eliminating the need for centralized intermediaries and allowing multiple parties to access and verify information transparently, blockchain can streamline government processes and significantly reduce the possibility of fraud and human error [5]. This research aims to explore in detail the functions and applications of blockchain technology in document verification for government procedures in Perú.

2. METHOD

To conduct this systematic literature review, a search was conducted in the Scopus database using key terms such as "blockchain AND government AND system AND e-government" to identify studies analyzing the application of blockchain in government and e-government systems. To expand coverage, related terms such as "blockchain," "blockchain chain," "p2p," "privacy," and "e-government" were incorporated [6], yielding an initial total of 199 articles. Subsequently, date filters (2022-2025) and accessibility (open access in English or Spanish) were applied, reducing the selection to 87 articles. Finally, after an assessment of relevance and quality, 56 articles were selected to form the basis of the study.

In the context of government administrative procedures in Peru, the implementation of blockchain for document authentication has emerged as an innovative and promising approach. Rather than performing an exhaustive statistical analysis, this research follows a systematic review methodology, excluding meta-analysis and adhering to the guidelines for systematic literature reviews. To define the scope and formulate research questions, the problem/population, intervention, comparison, outcomes, context (PICOC) framework [7] was employed, the breakdown of which is presented in Table 1, along with the associated keywords and terms used for searching sources such as Scopus. The research questions, which integrate the components of PICOC, are fundamental to guide the selection and extraction of relevant data, directing the exploration of key documents for this study.

Table 1. Research questions

Research questions
RQ1: What are the specific documented applications of blockchain in the field of document management in e-government?
RQ2: What are the advantages identified when using blockchain for document management in the context of e-government compared to traditional methods?
RQ3: How blockchain management, verification, and authentication applications have been used in the field of security within electronic government?
RQ4: What is the level of reliability and security of blockchain implementations used in document management within the framework of electronic government?
RQ5: What is the impact of the implementation of blockchain on the efficiency and security of document management in administrative processes in the field of electronic government?

Table 2 presents the PICO elements together with their associated keywords, which were essential for the search for relevant articles. The search equations, based on the selected sources, are detailed in Table 3. During the process of identifying articles in the Scopus database, specific inclusion and exclusion criteria were applied, to select the most relevant articles for the review. This selection approach ensured that only those articles that met the established criteria were included in the study, following a rigorous process based on clear criteria. The details of these criteria are specified in Table 4.

In the context of this systematic review, a standardized method for article inclusion was applied, to assist in the identification of sources and documents relevant to this study. The preferred reporting items for systematic reviews and meta-analyses (PRISMA) approach, as illustrated in Figure 1, was used to select sources that would contribute to the set of articles for further analysis on the topic under discussion. The process began with an initial search for articles using a predefined equation in the Scopus database, which resulted in 190 articles. These sources were reviewed and no duplicates or other reasons for exclusion were

identified. In the second step, a date filter was applied to ensure the relevance and timeliness of the information, limiting the results to articles published between 2022 and 2025. This adjustment reduced the selection to 107 articles that met the temporal criteria. In the third step, to broaden the accessibility of the articles, an additional filter was applied to select only those with open access. This further reduced the list to 70 articles that met the temporal criteria. Finally, after applying the filters and exclusion criteria, we focused on the articles classified as "article" type documents. This final selection process resulted in 56 articles that met all the search criteria and are relevant to our research.

Table 2. Pico elements

PICO	Keywords	Associated keywords
Problem	e-government document management	Public administration, Authentication, Official procedures, e-government
Intervention	Blockchain technology	Blockchain, Decentralized, Registry, p2p
Comparison	Traditional methods	Conventional processes, Manual verification, privacy
Results	Efficiency and authenticity in the use of Blockchain	Effectiveness, Validation, Precision
Context	Electronic government processes	State administration, Bureaucratic procedures

Table 3. Sources and search equations

Source	Search equations
Scopus	TITLE-ABS-KEY (blockchain AND government AND system AND e-governmen OR blockchain OR p2pt OR decentralized AND blockchain) AND PUBYEAR >= 2022 AND PUBYEAR <= 2025 AND (LIMIT-TO (OA, "all")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English"))

Table 4. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
CI1: use of blockchain technology in e-government document management.	**CE1**: exclusion of other types of publication (conference papers, theses, and non-indexed textbooks are not considered).
CI2: methodologies applied to the integration of blockchain in e-government administrative procedures.	**CE2**: exclusion of documents before 2019 (date corresponding to a previous systematic review).
CI3: statistical results with temporal projection on the efficiency of e-government procedures with blockchain.	**CE3**: exclusion of publications in languages other than English.
CI4: successful application of blockchain in document authentication in e-government procedures.	**CE4**: exclusion of Articles that are not open-access

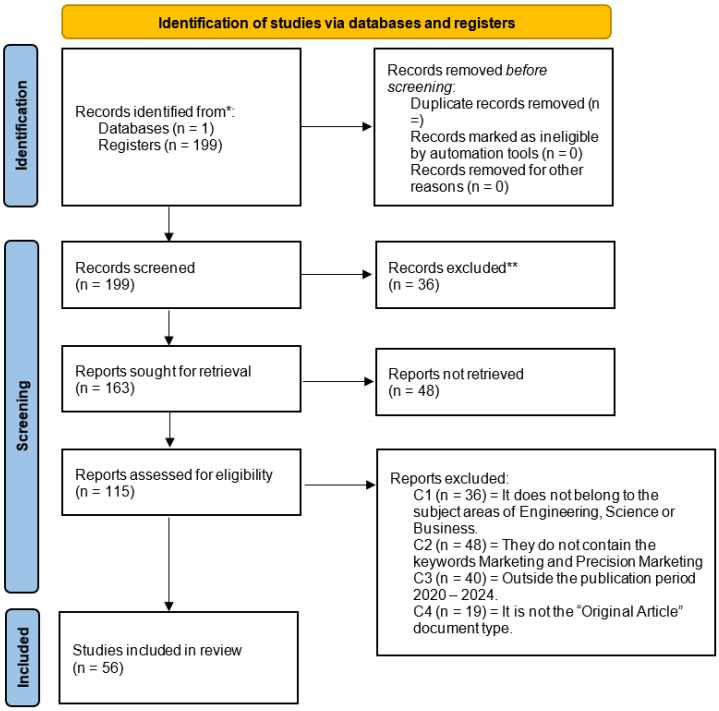

Figure 1. Flowchart of inclusion and exclusion of articles

The infographic represents the systematic review process for studying blockchain in government systems and e-government. Specifically, Figure 2 illustrates the complete flow of article identification, screening, eligibility, and inclusion stages, which are essential to ensure the rigor and validity of the review. Additionally, it highlights the use of the PICOC method, which guided the selection and analysis of the sources used in this research, ensuring alignment with the study objectives.

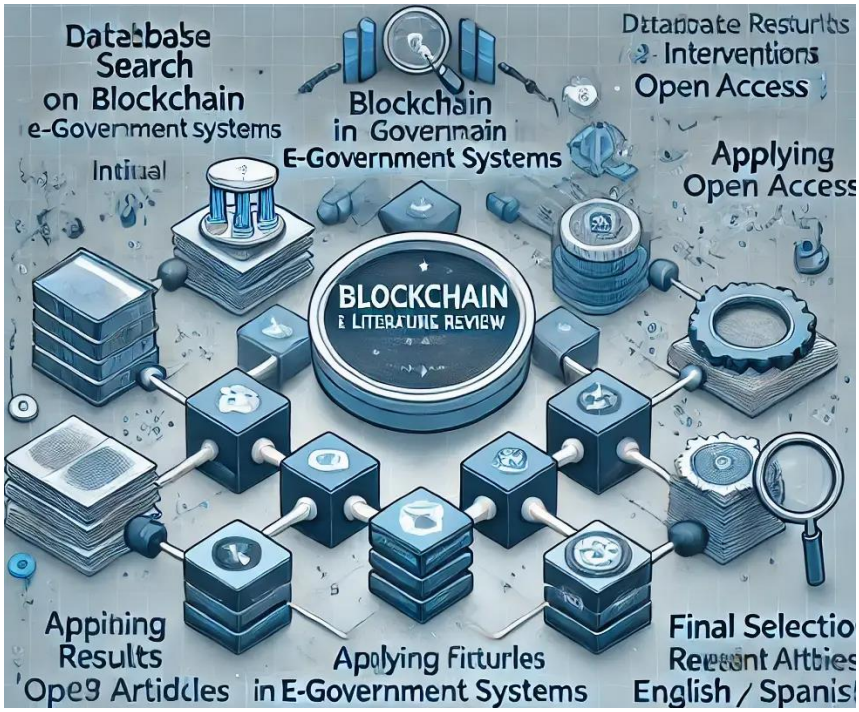

Figure 2. A systematic review process of the study on blockchain in government and e-government systems

3. RESULTS AND DISCUSSION

The systematic literature review reveals several significant findings regarding the use of blockchain technology to improve document and data management in e-government. The results of the selected studies provide detailed answers to the research questions, offering a comprehensive overview of both the advances and challenges in this field. These findings underline the potential of blockchain to revolutionize e-government operations, although challenges remain in terms of implementation and scalability.

In response to RQ1, which seeks to identify specific applications of blockchain in document management within e-government, the studies highlight a variety of use cases. These include incoming invoice management, blockchain-based platforms for sharing official documents, and decentralized solutions for document authentication in government processes [8]–[12]. Furthermore, RQ2, which investigates the advantages of blockchain compared to traditional methods, suggests substantial benefits such as increased efficiency, enhanced document authenticity, and enhanced security in administrative processes [13]–[20]. These findings illustrate how blockchain can address inefficiencies and vulnerabilities that have traditionally plagued government systems. Regarding RQ3, it explores how blockchain management, verification, and authentication applications are employed in e-government security. Studies indicate that blockchain decentralization and cryptography offer a robust framework for improving security, although the need to address interoperability challenges and specific vulnerabilities is acknowledged [21]–[25]. Regarding RQ4, which addresses the level of reliability and security of blockchain implementations, it is highlighted that, in general, these implementations offer a significant level of reliability, but there are challenges such as a lack of standardization and privacy issues. Finally, RQ5 focuses on the impact of blockchain implementation on the efficiency and security of document management in government administrative processes. The results suggest a positive impact in terms of automation, transparency, and improved data integrity [5], [26]–[35], [36]–[44], [45]–[54], [55]. Furthermore, the importance of future research to assess effectiveness in specific contexts and develop standards to improve the reliability of implementations is highlighted. This discussion reflects the complexity and diversity of blockchain implementation in e-government, providing a solid

foundation for future research and development in this ever-evolving field. The discussion can be conducted in several subsections.

3.1. What are the keywords applied in the documentary process for electronic government?

Figure 3 illustrates a network of interconnected nodes representing the various keywords related to document management in the context of e-government. The nodes are linked by lines showing the relationships between these terms, offering insight into how the various concepts are connected. This visualization highlights the most commonly used terms in research, such as "blockchain" and "e-government," highlighting their central role in the field.

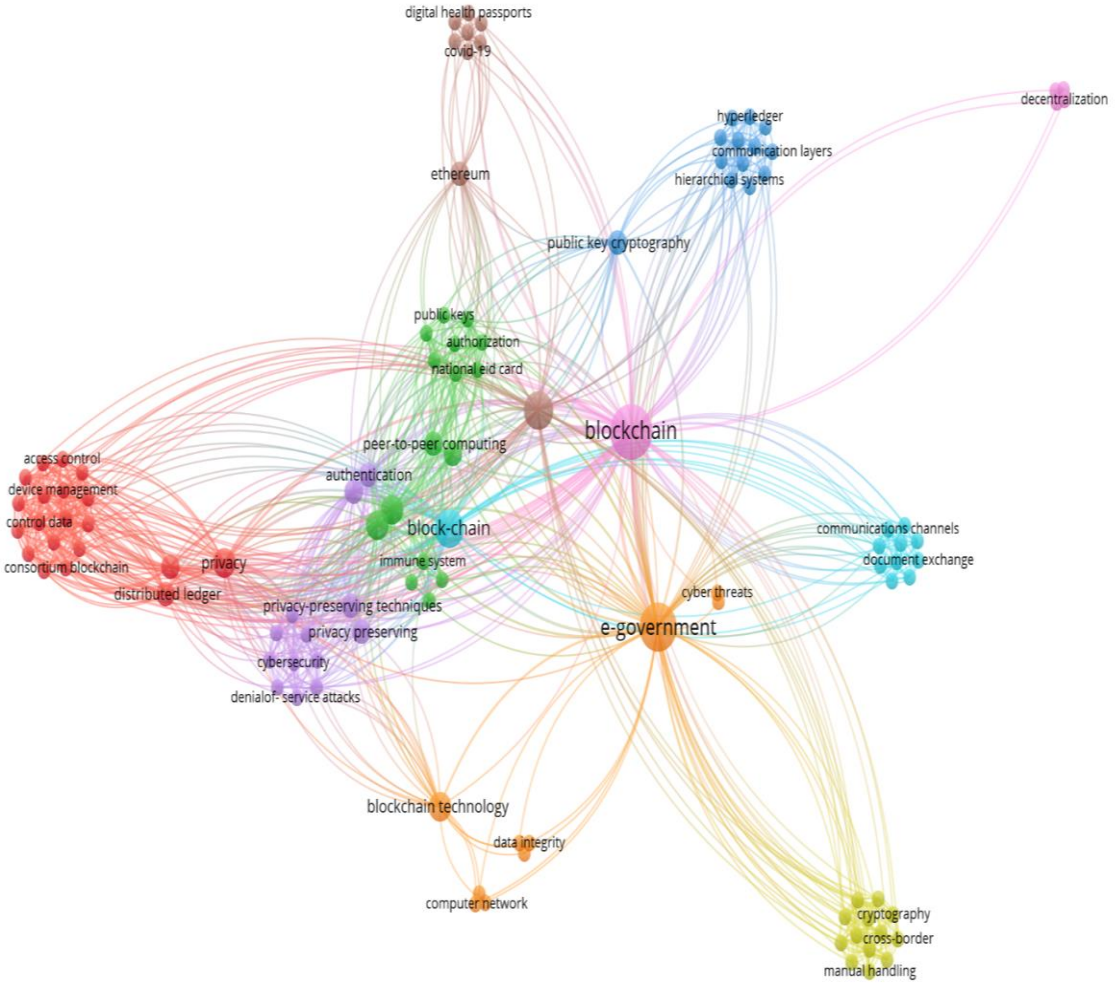

Figure 3. Keywords applied in the documentary process for electronic government

3.2. What are the tools for digital governance?

To answer this question, an analysis of the technologies applied to various aspects of digital government tools was carried out. According to Table 5, blockchain and e-governance are the most discussed topics in the studies, appearing in most of the articles reviewed. This allowed us to identify the customer groups or communities most involved in these discussions.

Table 6 shows the specific documented applications of blockchain in electronic government management. These applications include areas such as digital identity verification, secure voting systems, transparent procurement, and immutable recordkeeping. By implementing blockchain in these domains, governments aim to improve efficiency, reduce corruption, and enhance public trust in digital governance systems.

Table 5. tools for digital governance

Detection techniques	Reference	Qs (%)
Blockchain	[3]–[12], [13]–[22], [23]–[32], [35], [38], [39], [44], [45]	33
Decentralized	[6]–[9], [24], [29]	10
Distributed	[23], [24], [28]	7
E-government	[5], [8]–[17]	14
Government	[5]–[7]	3
Information	[8]–[11]	8
Management	[3]–[5], [9]	12
Networks	[10]	1
Peer to peer	[11], [13]–[15]	14
Platform	[12], [24]–[26], [41]	11
Privacy	[13], [24], [25]	14
Public	[9], [10], [14]	3
Security	[10], [11], [15], [36], [48]–[51]	19
System	[9], [10], [33], [34], [37], [42], [47]	13
Technology	[17], [24], [32], [43]	8

Table 6. Documented specific applications of blockchain

N°	Application	Specific scope
1	SECHash - Inbound invoice management	Management of incoming invoices and the municipalities
2	MediLink - Blockchain-based healthcare platform	Improving access and control of health information
3	Electronic exchange of official documents based on email and blockchain	Facilitate the electronic exchange of official documents
4	Registration of electronic property	Electronic land records management
5	e-health services	E-government in electronic health services, a blockchain-based e-residency system
6	DISP - IoT service platform	Communication and service management system between IoT devices and applications
7	FBCOL - Blockchain-based official letter management	Official letter management
8	The notarial office in E-government	Document management in electronic government includes the issuance and validation of government certificates.
9	Decentralized identity management system (DID)	Decentralized identity management
10	Blockchain-based peer-to-peer transactions in the electronic government system	Transaction system of an e-government system

4. CONCLUSION

In conclusion, the implementation of blockchain technology in the field of e-government for document and data management offers significant advantages over traditional methods. It enhances critical aspects such as data integrity, transparency, security, error reduction, efficiency, accessibility, and distributed storage. These characteristics contribute to the development of more robust, trustworthy, and agile digital government services.

Moreover, blockchain applications for document management, verification, and authentication ensure the integrity and authenticity of official records. They also reinforce transaction security and promote interoperability among various e-government platforms. These benefits help address long-standing issues like document forgery and administrative fraud, thereby increasing citizen confidence in public digital services.

Finally, although blockchain implementations generally provide a high level of reliability due to their immutability and transparency, careful selection and design of solutions remain crucial. Challenges such as cross-chain security, scalability, and data privacy must be addressed to maximize their effectiveness. Nevertheless, when properly implemented, blockchain can significantly enhance the efficiency, transparency, and traceability of administrative processes, support the broader goal of modernizing and digitalize public institutions.

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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

The authors state no conflict of interest.

INFORMED CONSENT

This study did not involve human participants, and informed consent was therefore not required.

ETHICAL APPROVAL

This research did not involve human or animal subjects and did not require ethical approval.

DATA AVAILABILITY

The data supporting the findings of this study were collected through research and are available in the Scopus database and from the corresponding author.

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