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The economic benefit of blockchain-based land registry for South Africa: A systematic literature review

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Background: Despite being a manual system, land registration in South Africa is globally recognised as one of the most reliable and accurate systems because of rigorous verification procedures at the Deeds Office that ensure authenticity and accuracy of the information. However, occasional disputes and errors still occur because of inherent limitations in manual processes. Various countries have adopted blockchain technology to prevent fraud and land disputes because of its decentralised, mutable and auditable features.

Objectives: To explore the potential economic benefits of a blockchain-based land registry in the South African context.

Method: This study uses a Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) approach to systematic literature review (SLR) to identify all empirical evidence that fits the pre-specified inclusion criteria to answer research questions.

Results: The results generated from the final sample of 52 articles indicate that there are six related economic benefits: (1) promoting economic stability, (2) boosting investor confidence, (3) increasing tax revenue, (4) reducing litigation costs, (5) reducing transaction costs and (6) eliminating double spending.

Conclusion: Embracing a blockchain-based land registry as a socio-technical system presents a significant opportunity for South Africa to modernise its land administration processes. By leveraging the identified economic benefits, stakeholders can pave a way for a more efficient, transparent and trustworthy system that not only enhances property rights but also stimulates property growth across the country, thus reducing the financial burden on government and taxpayers, which can free up resources for other economic development projects.

Contribution: The knowledge gained through the application of an SLR and the adoption of GST will contribute towards methodological and theoretical development.

Keywords: blockchain technology; blockchain core features; blockchain-based land registry; economic benefits; general systems theory; land administration system; South Africa; systematic literature review.

Introduction

The South African economy has not performed well over the last few years, and the coronavirus disease 2019 (COVID-19) pandemic compounded existing vulnerabilities, thus enhancing underperformance relative to its peers (Faku 2024; Gumede 2023). Additionally, load-shedding, social unrest, riots because of service delivery protests and taxi strikes on businesses and the economy at large create further negative impacts on the economy. For example, the City of Cape Town suffered approximately R5bn loss to the economy as a result of the taxi violence strike in August 2023 (Hirsch 2023). Load-shedding had a negative impact of 2.1% on quarterly gross domestic product (GDP) in the third quarter of 2022, with agriculture, forestry, and fishing being impacted the most (Investec 2023). Despite these challenges, in the second quarter of 2022, the Real Estate, Finance and Business sector displayed a growth of 1.9% making it the second largest positive economic contributor (Faku 2024; Statistics South Africa 2022). While the South African economy is not the focus of this study, it is imperative to highlight the significant importance of this sector concerning the country's economic indicators to better understand the phenomenon under investigation. This is because of the real estate's vital contribution towards economic and social development globally (Baptista, Januario & Cruz 2023).

It is confirmed that the real estate sector accounted for approximately 60% of the world's wealth, amounting to more than $200 trillion, constituted 36% of final energy demand in 2017, and was

responsible for nearly 40% of energy-related carbon dioxide emissions globally (Saari, Vimpari & Junnila 2021; Savills 2016; United Nations Environment Programme 2018). As an economic benefit, registered titles are valuable assets of a country that foster property investment (though not necessarily through bank mortgage financing) and boost the confidence of businesses and individuals to participate in the country's economic development (Barry & Whittal 2016; UNECE 2005). Any change in the real estate markets as a result of changes in the land administration system may have an impact, whether positive or negative, on overall economic indicators such as GDP, employment and consumer spending (Shuaib et al. 2022; World Bank 2023). This can be attributed to several factors, including an effective land registration system that facilitates better access to formal credit, increase in land values, higher investments and reduction in poverty by providing secure tenure (Shuaib et al. 2022; UNECE 2012; World Bank 2023).

For much of its history, South Africans have long been searching for creative ways to stimulate the economy and ensure economic growth on an ongoing basis, and this includes their endeavour to implement a real, feasible and fair programme of land registration (Radloff 1996). Although land registration in South Africa is widely recognised as one of the most reliable and accurate systems globally (E Lombard Attorney 2020), it is essential to note that, despite the stringent processes of verification of the submitted information to the Deeds Office to ensure authenticity and accuracy of the information, occasional disputes and errors still occur (Snymans Inc Attorneys 2020). These discrepancies can prove to be costly and time-consuming for both the customer and government to rectify in terms of section 4(1)(b) of the *Deeds Registration Act 47 of 1937*. The South African government has already initiated the electronic deeds registration through the enactment of the *Electronic Deeds Registration Systems Act 19 of 2019* (e-DRSA), and blockchain can be used to facilitate the implementation of this legislation and policy. Blockchain-based land registration systems can increase processing efficiency, prevent fraud in property exchange, add security levels, improve accountability and enhance transparency (Faku 2024; Mendi et al. 2020). Consequently, this leads to a reduction in time and costs associated with land registration transactions, streamlining the property transfer process and making it more accessible to all those who reside in South Africa, thus contributing to the overall economic growth.

Amadi-Echendu, Phillips and Chodokufa (2014) pointed out that South Africa has a unique conveyancing system, which incorporates aspects of both positive and negative systems within its land registration framework. In other words, while property registration is essential for transferring land ownership in the country, it does not provide a warranty of the title itself (Hogg 1918:53). This is primarily because the law does not guarantee ownership of land and other real rights (Shange 2010:1). Stack (2018) confirmed that blockchain stands at the intersection of technology, economics, monetary regulation and policy, and very few possess a comprehensive understanding of the separate disciplines and fully grasp the intricate issues that converge at the intersection of these distinct domains. However, there is insufficient information in the published research that seeks to clarify the economic benefits of using blockchain technology as a platform for land registration, specifically within the South African context. Consequently, this study seeks to gather and analyse existing literature in the field to uncover key lessons, trends and patterns that could inform how South Africa might harness the economic benefits of blockchain-based land registration.

The study addresses the following three research questions:

- **RQ1:** How can general systems theory (GST) provide a framework for understanding the application of blockchain technology in land registration as an integrated system?
- **RQ2:** In what ways can various aspects of a blockchain-based land registration system contribute to the country's economy?
- **RQ3:** What economic benefits of a blockchain-based land registration system, as evidenced from pilot programmes, can be anticipated for South Africa?

In addition, the findings of this study offer valuable insights that have the potential to revolutionise South Africa's real estate industry and assist the government in devising solutions that not only yield a return on investment but also make a substantial contribution towards the sector and extend to the overall economic growth. While the study focuses on South Africa as a case, the results will be of particular interest for developing countries, particularly in the sub-Saharan African region, because of the limited literature on the actual application of blockchain technology in support of land acquisition in the region (Ameyaw & De Vries 2021).

The following section outlines the methods employed to determine the research design and the eligibility criteria for selecting papers. It presents data sources and the full search strategy, as well as details on the screening and the selection process, the quality assessment of the review and the thematic content analysis.

Research methods and design

This study employs a systematic literature review (SLR) to explore the economic benefits of using blockchain-based land registry through the lens of GST. A systematic review aims to identify all empirical evidence that fits the pre-specified inclusion criteria to answer a particular research question or hypothesis (Snyder 2019). The SLR draws on a range of sources to inform the research, including case studies and academic articles aimed at examining the economic benefits of blockchain-based land registration system. For example, Agbo, Mahmoud and Eklund (2019)

adopted SLR to validate the cutting-edge blockchain application in health care and created a map of all relevant research using the systematic mapping study process. In another example, Fedorova and Skobleva (2020) used SLR to critically analyse the opportunities and restrictions of the application of blockchain to higher education with the aim of identifying its impact on the development of the Russian educational system.

Eligibility criteria for the selection of papers

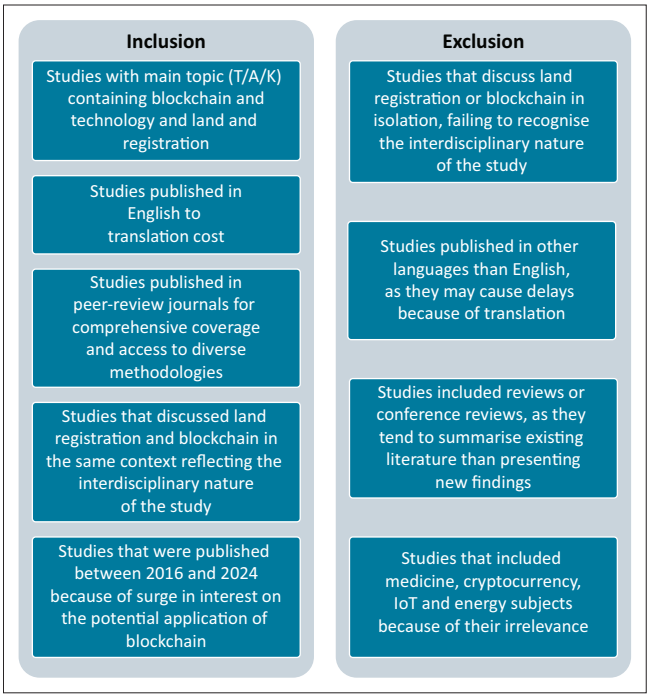
The eligibility criteria involved identifying original empirical research published between 2016 and 2023 about blockchain and land administration or registration or real estate. The year 2016 was selected as the starting point because of the increasing momentum and a surge in interest on the potential applications of blockchain technology in land administration, with several pilot projects and proof-of-concept studies being conducted globally. The search consisted of the work of full-length peer-reviewed journals and conference papers published in English. As blockchain has gained attention in businesses and outside academia, grey literature was also included in the search. Within the context of this study, grey literature entailed blogs and commentary on legislative changes written by legal practitioners actively engaged in land registration processes, whose insights were considered valuable. Studies of any research design and methodology within any geographical context were also eligible for inclusion. Studies that focused on blockchain technology and land administration or registration in a fragmented manner were excluded and so were the viewpoints and commentaries without empirical findings. Studies of other disciplines such as cryptocurrency, Internet of Things (IoT), medicine and energy were excluded as were those published in languages other than English. Figure 1 demonstrates the inclusion and exclusion criteria used to inform the literature search. Lecture notes were also excluded from the search.

Data sources and search strategy

The search strategy for finding peer-reviewed journals and conference papers included the selection of the databases, namely, Mendeley, Scopus, ProQuest, Science Direct, Google Scholar and Research Gate, because of their accessibility via the University of South Africa's (UNISA) library, which provided extensive coverage of peer-reviewed journals. These databases were selected because of their ability to provide technical insights into blockchain-based land registration. This assertion is reinforced by the fact that other researchers in the fields of technology and land registration also used similar databases for literature search (Ansah et al. 2023; Saari et al. 2022). Internet sources, presentation slides and previous systematic reviews were used to guide an electronic database search strategy. To refine the search and exclude irrelevant remarks, the search strategy used Boolean operators such as 'AND', 'OR' and 'NOT' along with the quotation marks in some of the databases. As such, the title/abstract/keyword (T/A/K) containing search terms such as 'land registration' OR 'land administration' OR 'real estate' OR 'property registration' NOT 'land management' AND 'blockchain' OR 'block-chain' OR 'block chain' OR 'smart contracts' were used to retrieve academic articles across different databases. Three rounds of searches were run from 22–24 March 2023, 6–17 November 2023 and 3–4 December 2023 to capture the relevant studies recently and since the initial search. The basic grouping of words consisted of blockchain technology OR smart contracts AND land registration OR real estate AND blockchain-based land registration.

Screening and selection of relevant articles

In this study, the SLR followed a well-established four-step process flow included in Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Full-text articles were retrieved from relevant databases and exported in Research Information Systems (RIS) format to Zotero, a reference management software and then exported to the library. A new review was created on Rayyan AI, a research collaboration platform for SLR, involving a single reviewer because of resource constraints. The review included a total of 258 references, which were sourced from various databases. To be specific, 178 were obtained from Mendeley, 44 were from Scopus, 25 were from Science Direct and 11 were from ProQuest, and they were successfully uploaded onto the software. During data review, 123 duplicates were detected, and subsequently, 24 references were resolved and 99 were deleted. The screening and reviewing process continued with 159 records, out of which 99 were deemed



IoT, Internet of Things.

FIGURE 1: Inclusion and/or exclusion criteria of the articles for the review.

irrelevant for reasons such as incorrect publication type and unsuitable background article, leaving 60 reports that sought retrieval. Discrepancies were discussed between reviewers, and no disagreements occurred. Among these, 22 reports were inaccessible in PDF format, resulting in their exclusion. Eventually, 38 articles were assessed for eligibility, all of which met the criteria and were consequently included in the review, as illustrated in Figure 2. During the review and beyond the initial database search, backward and forward citation tracking was used to explore older and the most recent articles related to the topic, and this approach resulted in 14 additional studies added for analysis. Appendix 1 Table 1-A1 consists of a list of articles that were included in the study for review.

Quality of the review

A high-quality review is complete and focuses on concepts. A complete review covers relevant literature on the topic and is not confined to one research methodology, one set of journals or one geographic region (Webster & Watson 2002). To guarantee and provide a high-quality review, this research describes a process for identification and inclusion of articles in a vigorous and detailed manner with the aim of encouraging an interested reader to replicate the procedure (Palmatier, Houston & Hulland 2018). Furthermore, the review follows the PRISMA 2020 guidelines outlined in the checklist to ensure the key aspects of the review are well documented to enhance transparency and replicability.

Thematic content analysis

Thematic content analysis was conducted using the ATLAS.ti qualitative analysis software version 23.3 to facilitate the process of data coding. This step of the review began with data preparation and organisation, which included creating a new project on ATLAS.ti and uploading 52 documents from the desktop onto the software. Details pertaining to each article, including the topic, author and abstract, were included in the comment section of each document for ease of reference. Articles were further grouped and organised by the research methods chosen by the authors. This was followed by data familiarisation and immersion, which consisted of repeated reading and the analysis of articles, segmenting data into quotations by highlighting interesting passages of texts related to the research questions. Subsequently, preliminary codes were developed and assigned to the most frequently occurring words and phrases. Memos were simultaneously created to note the author's thoughts and ideas generated from the articles, and these were linked to quotations and codes. The coded segments were further reviewed to identify preliminary themes from the emerged data based on recurring concepts appearing across multiple coded segments. Furthermore, code document analysis was performed to show the frequency of codes across document groups based on word count, as illustrated in Table 1.

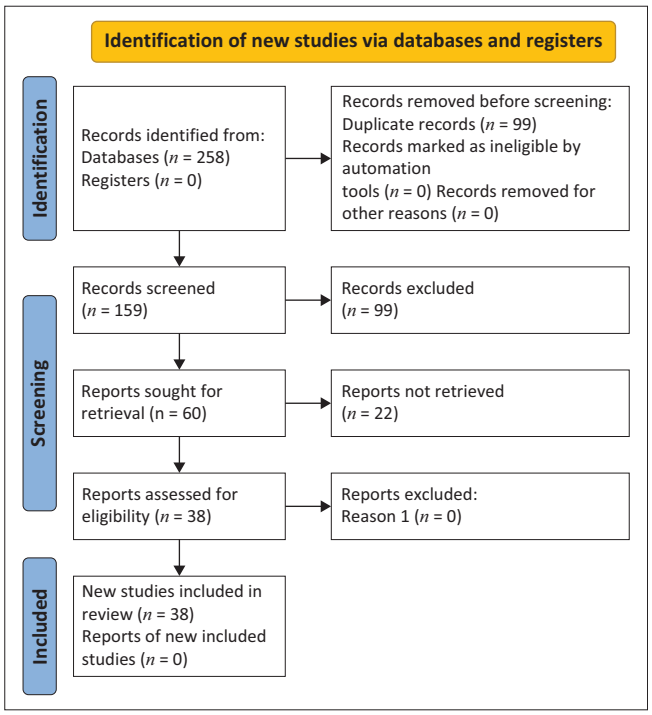


FIGURE 2: Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram with summary of literature.

Preliminary themes were reviewed and refined using data visualisation such as word clouds, word list and concepts for conceptual coding. This iterative approach led to the identification of common themes, discarding of irrelevant ones and merging of similar themes for a more streamlined and coherent analysis. Figure 3 is a word cloud illustrating the most commonly occurring words as 'blockchain', 'technology', 'land', 'property', 'real estate', 'system', 'transactions', 'data', 'administration' 'property', 'information', 'registration', 'process' and 'smart contracts' with the highest frequency. The word cloud was used to provide a snapshot of the commonly used phrases, which highlight the key topics and concepts that recur throughout the study and reflect the core themes and focus areas of the reviewed literature.

Table 2 presents the primary themes along with their associated coded segments identified from the code document analysis, while highlighting the emerging trends and patterns that inform the discussion of the results that are coming further (cf.) down. Five key themes emerged, namely, 'System Organisation', 'Blockchain Core Features', 'Stakeholder Coordination', 'Process Effectiveness' and 'System Goals'. The themes and the codes identified are presented further below as a conceptual framework to interpret data relating to the economic benefits of the blockchain-based land registration system. This framework draws on findings from a range of studies analysing both pilot projects and full-scale implementations of blockchain in land registration processes.

Ethical considerations

Ethical clearance to conduct this study was obtained from the University of South Africa's College of Economic and Management Sciences (CRERC Ref. No.4442).

TABLE 1: Code document analysis with code groups and document groups.

Theme	Case studies (Gr = 942; GS = 9)	Frameworks (Gr = 2421; GS = 14)	Literature survey (Gr = 1145; GS = 8)	Systematic literature reviews (Gr = 1167; GS = 7)	Total
Accuracy of records (Gr = 46; GS = 11)	26	12	4	4	46
BCT core features (Gr = 1040; GS = 9)	188	469	91	292	1040
Cost of services (Gr = 1058; GS = 13)	165	482	111	300	1058
Customer satisfaction (Gr = 1004; GS = 11)	155	465	93	291	1004
Economic factors (Gr = 1027; GS = 18)	172	465	95	295	1027
Information (Gr = 38; GS = 30)	20	12	5	1	38
Integrity and security (Gr = 1018; GS = 11)	155	470	99	294	1018
Land registration system (Gr = 151; GS = 3)	28	61	30	32	151
Latency (Gr = 1024; GS = 23)	167	467	98	292	1024
Not in a group (Gr = 5675; GS = 868)	942	2421	1145	1167	5675
Research gap (Gr = 9; GS = 5)	0	1	1	7	9
Stakeholders (Gr = 105; GS = 30)	99	1	1	4	105
System integration (Gr = 1070; GS = 26)	171	485	113	301	1070
Throughput (Gr = 1001; GS = 6)	154	463	93	291	1001
Timeliness (Gr = 167; GS = 5)	29	68	30	40	167
Total	**2471**	**6342**	**2009**	**3611**	**14 433**

Gr, code groups; GS, document groups.

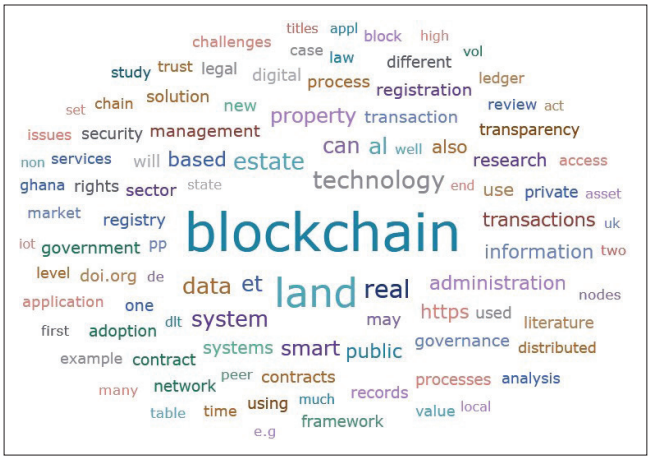


FIGURE 3: Word cloud of the most frequent words.

Results

This section provides an in-depth analysis of literature, using the framework of GST to categorise, organise, analyse and determine the economic benefits of blockchain-based land registration in South Africa. The electronic search identified a total of 258 references, where 123 duplicates were automatically recognised by Rayyan AI. A total of 159 records were screened with 99 deemed irrelevant; 60 articles were assessed for eligibility with 22 articles that did not meet the eligibility criteria excluded; 14 additional articles were obtained through backward and forward citation, resulting in 52 studies altogether. The most frequently used words in literature are demonstrated in Table 2. Figure 4 demonstrates how the topic has gained global attention over the past 6 years, particularly in the year 2021. The geographical locations of the principal authors include 25 countries, with India emerging as the predominant contributor, as illustrated in Figure 4. South Africa is notable among the countries that have contributed minimally to the topic, with only two journal articles published in 2021 and 2023. However, it is important to note that one of the articles adopted GST as the theoretical foundation underpinning its content.

TABLE 2: Themes, sub-themes and emerging trends.

Themes	Sub-themes	Key codes	Emerging trend and/or pattern
System organisation	Blockchain-based Land Registration System	Implementation, Integration, Dependability, Conveyancing Process, Conventional System, Complexity	Integrating blockchain technology within complex land registration legacy systems; improving dependability and process flow; overcoming traditional conveyancing challenges
Blockchain core features	Interoperability	Information Accessibility, Information Review	Blockchain's core features (immutability, transparency, automation) at the centre of economic benefits such as cost-reduction, fraud prevention and trust enhancement
	Automation	Digital Technologies, Digitalisation, Immutability	
	Data Management	Traceability, Security, Transparency, Integrity	
Stakeholder coordination	Benefits	Confidence, Confidentiality, Corruption	Emphasis on improved stakeholder trust and preventing corruption, minimising risk, fostering secure and reliable property transactions
Process effectiveness	Throughput	Productivity, Decision-making Process	Improved speed and accuracy of property transactions, reducing delays and operational costs, leading to increased economic efficiency
	Timeliness	Efficiency	
System goals	Outputs	Cost-reduction, Fraud Prevention, Automated Process, Investment Opportunities	Expected outcomes include cost savings, fraud mitigation, process automation, attraction of investments

Single-authored documents constitute a mere 15% of the publications, which is extremely low, signifying the interdisciplinary and complex nature of the field and emphasising the necessity for collaboration among various scholars. To further provide insights into research impact and notwithstanding the limitations of using the average number of citations from a list of authors, it is worth reporting that the average number of citations per document is 26.5 times, indicating significant research impact within this field. Table 3 reveals that the literature primarily comes from journal articles, constituting 73%, while articles that were published during conference proceedings make up 25% of the source of information, with 2% from other sources. The primary data originate

predominantly from Scopus, accounting for 44%, followed by Google Scholar at 35%, Science Direct at 19% and Research Gate at 2% of the data sources, as depicted in Table 3.

Articles were further categorised based on the study methods (see Figure 5) to examine how data were collected. The aim of this category was to provide valuable insights into the predominant research methods in this field to guide future research. The results show that studies employing literature surveys constituted 31% of the review, indicating a reliance on existing literature rather than new empirical data. Systematic literature reviews accounted for 15%, contributing to a comprehensive synthesis of existing literature on the topic. Additionally, case studies also constituted 15%, highlighting the use of practical examples in this field across 18 countries (see Figure 5).

The data in Table 4 highlight the top five authors based on citation count, indicating the influence of both the articles and the authors within the field. It comes as no surprise that the most cited author hails from India, aligning with what has been mentioned in preceding sections about the country emerging as the dominant contributor within this field. Furthermore, the research in this field was still in its infancy between the years 2018 and 2021, which explains the high number of citations for these authors.

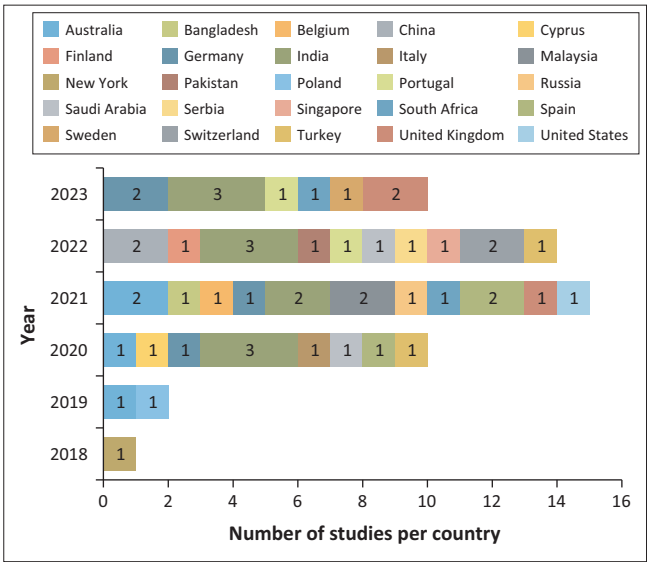


FIGURE 4: Literature by publishing year and country of origin (N = 52).

Discussion

This section discusses the results and addresses the research questions. Figure 6 presents a conceptual framework derived from themes and codes relevant to the research to provide a better understanding of the economic benefits associated with a blockchain-based land registration system. The proposed framework illustrates the core features of blockchain technology that can be leveraged to enhance process efficiency within land registration systems. It proposes that a blockchain-based land registration system be viewed as a socio-technical system because of its involvement of multiple stakeholders. Drawing inspiration from success stories in various countries, the framework outlines the importance of continuously engaging stakeholders, educating them and integrating their knowledge into decision-making throughout the implementation process. In alignment with literature constructs outlining the economic

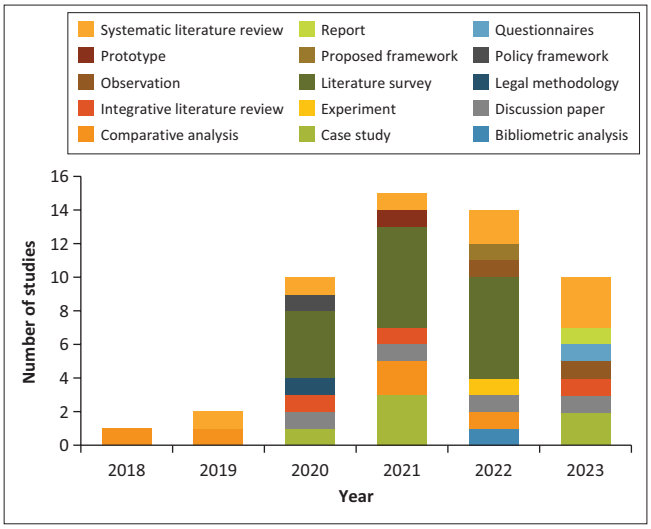


FIGURE 5: Literature by publishing year and study type.

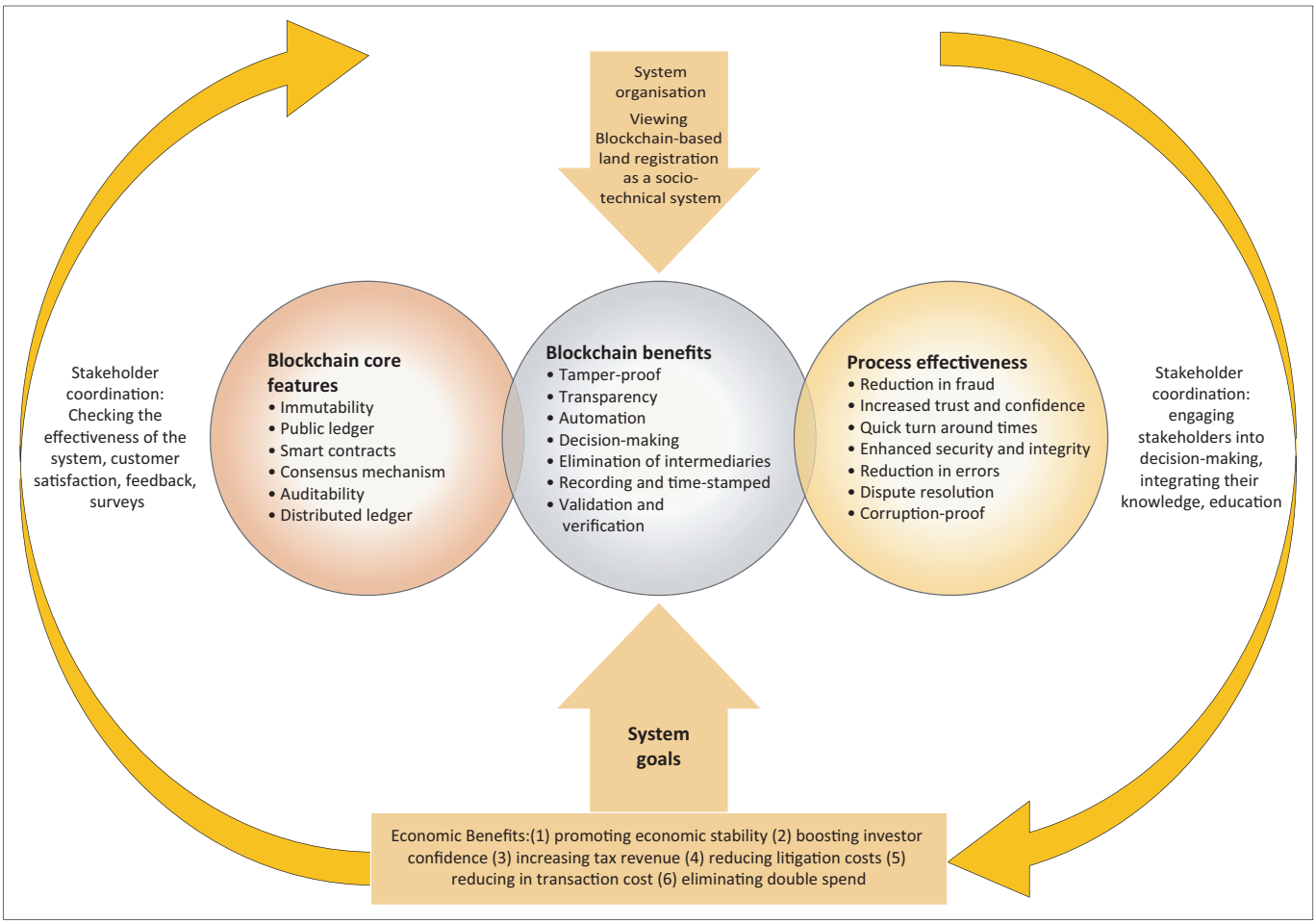
TABLE 4: Top authors in the field by citation.

Authors	Publication type	Year of publication	Country	Cited
Thakur et al.	Journal Article	2020	India	225
Tan et al.	Journal Article	2021	Belgium	115
Mora et al.	Journal Article	2021	Spain	81
Benbunanfich and Castellanos	Conference Paper	2018	New York	72
Garcia-Teruel and Simon-Moreno	Journal Article	2021	Spain	72

Note: Please see the full reference list of this article, Faku, N. & Amadi- Echendu, A., 2025, 'The economic benefit of blockchain-based land registry for South Africa: A systematic literature review', *South African Journal of Information Management* 28(1), a2002. https://doi.org/10.4102/sajim.v28i1.2002, for more information.

TABLE 3: Publication type and document source.

Publication year	Publication type				Document source				
	Conference paper	Journal article	Review article	Grand total	Google scholar	Research gate	Science direct	Scopus	Grand total
2018	1	-	-	1	1	-	-	-	1
2019		2	-	2	-	-	1	1	2
2020	2	8	-	10	3	-	1	6	10
2021	5	10	-	15	7	-	6	2	15
2022	4	9	1	14	5	1	-	8	14
2023	1	9	-	10	2	-	2	6	10
Grand total	**13**	**38**	**1**	**52**	**18**	**1**	**10**	**23**	**52**



Source: Faku, N., 2024, 'Exploring the economic benefits of blockchain-based land registry for South Africa through the lens of general systems theory: A systematic literature review', in *Work-in-Progress Booklet*, pp. 6–11, viewed 10 December 2024, from www.internationalbusinessconference.com

FIGURE 6: A conceptual framework illustrating factors to be considered for the economic benefits of a blockchain-based land registration system.

benefits, the framework suggests that these benefits be viewed as system goals. It further recommends that to realise these goals, the system should be continuously monitored, and feedback from stakeholders should be obtained to measure the effectiveness of the system.

System organisation and stakeholder coordination

To address the RQ 1 'how can GST provide a framework for understanding the application of blockchain technology in land registration as an integrated system?', the review examines two themes identified in the literature: system organisation and stakeholder organisation. Mele, Pels and Polese (2010) addressed organisations as socio-technical systems, underlining the two main components of the firm as seen as a system: a social component (people) and a technical component (technology and machines). From this perspective, a land registration system is a social component of socio-technical systems because of the social relationship between members of the community with respect to land, which is an important element of consideration in any land administration (Ameyaw & De Vries 2023). On the contrary, the technical component can be attributed to blockchain technology because of its technical features necessary to solve the double-spending problem in the absence of trusted intermediaries (Ooi, Peng & Soh 2022). This is because blockchain provides a shared ledger technology that allows any participant in the network to see the one system of records (Panda et al. 2021). This is particularly applicable in the context of a blockchain-based land registration system, where the technical component represented by blockchain can provide data security and trust for the land registration system (Ansah 2023).

The organisation is seen as a system built by energetic input–output where the energy coming from the output reactivates the system (Mele et al. 2010). This concept of organisation is exemplified through the interconnection and interrelation of blocks via a hash function (Ali et al. 2020; Subedha et al. 2023; Tahar, Mendy & Ouya 2022). This process ensures that each block contains a reference to the preceding block, creating a secure and permanent record of transactions among multiple parties (Ali et al. 2020; Mendi 2020; Yadav & Kushwaba 2021). In this perspective, blockchain is considered as a system that can actively monitor the state of land, even when it is operationally inaccessible, by verifying the consistency of its own operations through a binary scheme which can record agreement or non-agreement (Luhmann 1986).

For competition and coordination to be combined, and for order to emerge, as well as for effective, efficient and equitable systems of human activity to evolve, a new organisational concept that entails the whole not controlling the parts, and none of the parts controlling the whole, is required (Hock is cited in Laszlo & Krippner 1998). This concept aligns with the decentralised nature of blockchain technology where the need for multiple intermediaries is eliminated, meaning no single party has complete control, allowing for a reduction in costs and increased transparency as all transactions can be made publicly available (Florentino & Bartolucci 2021). This is essentially important for socio-economic activities in the digital age, in which the right to data can be directly translated into business advantages (Du et al. 2023). A practical example of system organisation can be observed in the case of Georgia. Shang and Price (2019) argued that the success of the Georgia project stemmed from educating stakeholders about blockchain technology and the challenges it can address, including data quality. However, while blockchain technology possesses inherent features to enhance trust and transparency, the initial data entry still depends on human actors outside the system, and thus, blockchain cannot prevent fraud and incorrect data on first entry if the officials are corrupt (Lemieux 2017 is cited in Ansah et al. 2023).

Blockchain core features

This section of the review discusses the theme 'blockchain core features' to address RQ 2: 'how can various aspects of the blockchain-based land registration system influence the country's economic indicators'? Ooi et al. (2022) described the core features of blockchain as those necessary to solve the double-spending problem in the absence of intermediaries. Data security and trust are at the core of every data management system, and blockchain's various characteristics play a crucial role in achieving this goal (Makala & Anand 2018; Saari et al. 2022).

The immutability feature of blockchain is observed in various countries by several authors. For example, Singh (2020) illustrated the landscape in India where nearly 66% of the court cases are related to land disputes, resulting in substantial litigation costs amounting to Rs.58 000 crore encompassing both civil and criminal proceedings. This is because the existing land records available in the country are not clear, poorly administered and, often, do not reflect the ground reality, and maintenance and availability of information are critical challenges faced by the government (Thakur et al. 2020). Consequently, India sought to ensure immutability of land data by employing the SHA256 cryptographic hash function and digital signatures to secure transactions between buyers and sellers (Zein & Twinomurinzi 2023). Furthermore, the digitisation of land registration can help boost the country's GDP by as much as 1.3% (Singh 2020).

However, in Sweden, security provisions built into legacy systems have prevented further digitisation of the land transfer process, for example, by imposing restrictions through firewalls and limits on network connections. Consequently, while some institutional actors (e.g. realtors, banks and government agencies) could connect their systems to databases, individual buyers and sellers were disadvantaged and could not (McMurren, Young & Verhuist 2018).

Ghana, as highlighted by Mintah et al. (2020), experienced problems with skin land acquisition and title registration that emanated from the issuance of allocation notes, payment of kola money and use of physical ledger to document land transactions. The authors proposed a framework that would be a public register, arguing that information on all transactions on a specific parcel of land could be available to the public in real time, thus enhancing transparency and resolving the issue of encroachments and indeterminate land boundaries. Hence, stakeholders can determine rightful owners of land parcels before initiating transactions (Mintah et al. 2020).

Enhancing process effectiveness

Using the theme 'process effectiveness', the review seeks to address RQ 3: 'what economic benefits of a blockchain-based land registration system, as identified from pilot programmes, can be anticipated for South Africa?'. Process effectiveness can be observed in the case of the Republic of Georgia where the transfer of land ownership suffered from significant challenges, including low efficiency and criminality in the form of corruption and bribery (Adil 2022). The adoption of blockchain in Georgia's land registration resulted in process efficiency as it takes only one day to register land with registry cost amounting to a mere 0.1% of the property value (Shang & Price 2019). Blockchain has smoothed the problematic, time-consuming processes that were at risk of failure; it has made humans more powerful towards the implementation of transparency and accountability and in maintaining trust and security (Khalid et al. 2022).

Similarly, the United Arab of Emirates (UAE) faced challenges in traditional land registry management, leading to inefficiencies and delays in property transactions (Zein & Twinomurinzi 2023). Dubai's strategic goal was to record all government transactions on blockchain, anticipating an estimated EUR1.2 billion saving per annum (Themistocleous 2018). Additionally, in 2016, a blockchain solution that records property history from end to end was designed to streamline processes through smart contracts and provide real-time traceability for each transaction (Zein & Twinomurinzi 2023).

In Sweden, the volume of documentation required in land transfer processes and the amount of duplication of data entry increase the risk of error, and between 4% and 7% of applications need to be resubmitted because of errors

(McMurren et al. 2018). The intent for implementing blockchain into land registration was to reduce the time between the signing of a contract to purchase and the registration of the property title from 4 months to a few days; this was to be achieved through the elimination of steps in the process and by reducing delays brought about by mail and the need for repeated checks and physical signatures (McMurren et al. 2018). Rodima-Taylor (2021:144) reported that in 2018, the Ministry of Lands and Natural Resources in Ghana announced a partnership with the American technology and consulting company IBM to explore blockchain technology in the land sector and in other public institutions, for improved transparency and efficient service delivery.

Achieving system goals

Blockchain has the potential to help governments maintain their registers in an immutable and tamper-proof manner and increase the resilience of such registers generally ensuring the integrity of government records and services leading to a more powerful e-Government ecosystem, with reduced fraud, corruption, errors, possible cyber-attacks and paper-intensive administrative processes (Sladic et al. 2021). Literature reports developing countries as being dominated by fraud and corruption in their land registries (Saari et al. 2022). For example, the situation of Honduras where lack of a comprehensive country-wide land registry with valid and complete records, as well as political resistance to changing the status quo, put a stop to the blockchain project (Benbunan-Fich & Castellanos 2018).

Given that corruption often stems from manipulation, ambiguity and uncertainty of information processed, the decentralised, immutable and transparent features of blockchain technology make it particularly valuable for mitigating corrupt behaviour in different contexts (Gillpatrick, Boga & Aldanmaz 2022). Blockchain is unusual in that it is a social technology, designed to govern the behaviour of groups of people through social and financial incentives and therefore inherently political in a way that few other technologies are (Graglia & Mellon 2018). Consequently, author(s) in press proposes that a holistic view be adopted where various inputs (such as information, processes, finance and systems) from all stakeholders (including banks, conveyancers, central bank, deeds office, etc.) converge to produce a single output, which is property registration. As a result, as the author adds, cross-functional efficiencies and effectiveness will be realised.

On the contrary, developed countries such as the United States and the United Kingdom view blockchain for title recording system as the future for the maintenance of title records that can offer a solution in terms of the current recording system (Spielman 2016 is cited in Mata et al. 2022).

In conclusion, the conceptual framework provides a holistic overview of a blockchain-based land registration system as a socio-technical system. Central to the framework is a strategic use of blockchain key features and their benefits that have the potential to enhance process effectiveness. The framework suggests that the country should prioritise the economic benefits of a blockchain-based land registration as its primary system goals. Additionally, the framework highlights the crucial role of ongoing stakeholders' coordination and engagement within a continuous feedback cycle to ensure effective implementation of the system.

Recommendations for future research

Blockchain technology must overcome several challenges to be considered as reliable, legal and secure as the current real estate conveyancing system (Garcia-Teruel 2019). Literature has continued to highlight challenges in blockchain adoption, including implementation complexities, legal uncertainties and technical issues (Saari et al. 2022:14). Zein and Twinomurinzi (2023) suggested that addressing these socio-technical challenges is necessary for the successful implementation of blockchain, particularly in low-income countries. In the context of South Africa, attempts to implement technological innovation, modern systems and updates to operations to improve efficiency, quality and accuracy have encountered many challenges and costly delays (Williams-Wynn 2021).

The South African government has taken an initiative towards the electronic deed registration with the enactment of the e-DRSA that seeks to regulate the functions and laws related to title deed transfer, as well as the successful registration of title deeds. Consequently, the implementation of a blockchain-based land registration in South Africa necessitates careful consideration of several crucial factors despite its undeniable benefits such as immutability, high level of security and transparency. Future research should therefore assess the legal implications of integrating blockchain technology into a land registration system, specifically on e-DRSA, and examine its compatibility with existing infrastructure to ensure that the socio-technical challenges are addressed for economic benefits to be realised.

Strengths and limitations of this review

This study addresses the theoretical and geographical gap within the existing literature of blockchain technology and a land registration system using an SLR. It contributes to the broader blockchain research in land registration within the South African context and is underpinned by the theoretical foundations. However, the results and implications of this review should be examined taking into consideration its limitations. There are two limitations to this review that are worth noting. Firstly, the scope of the review is limited to the economic benefits of blockchain technology in the land registration system. Consequently, the challenges and risks associated with the applications of blockchain technology in the land registration system fall outside the scope of this review. Secondly, to stay within the defined scope, the literature search was only restricted to land registration and did not encompass land administration functions such as the cadastre system.

Conclusion

The study focused on exploring the economic benefits of using a blockchain-based land registration system in South Africa. Using an SLR and adopting the GST as the theoretical framework, the study identified the impact of blockchain technology on a land registration system across various economies. A systematic analysis of 52 articles revealed six related economic benefits: (1) promoting economic stability, (2) boosting investor confidence, (3) increasing tax revenue, (4) reducing litigation costs, (5) reducing transaction costs and (6) eliminating double spending associated with using blockchain technology in the land registration system.

The identified economic benefits of a blockchain-based land registration system could help guide the South African government and other relevant stakeholders to devise a solution that will not only yield a return on investment but will make a substantial contribution towards the real estate sector and extend to the overall economic growth.

As a decentralised, distributed, open digital ledger was used for transaction logs through several computers to prevent changes from being made retrospectively without disturbing all blocks behind them and the network's consensus, blockchain can prevent fraud and land disputes (William et al. 2022). Implementing a blockchain-based land registration system in South Africa can be cost-effective compared to traditional land registry systems, thus reducing the financial burden on government and taxpayers, which can free up resources for other economic development projects. As a result of its transparency by providing a tamper-proof and publicly accessible record of land ownership (Vayadande et al. 2022), blockchain technology can reduce corruption and increase trust, which in turn can attract foreign investment.

In conclusion, embracing blockchain technology for land registration presents an opportunity for South Africa to modernise its land administration processes. By leveraging the identified economic benefits, stakeholders can pave a way for a more efficient, transparent and trustworthy system that not only enhances property rights but also stimulates property growth across the country.

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Authors' contributions

N.F. led the conceptualisation, design, literature search, synthesis of findings, initial drafting of the manuscript and interpretation of results. A.A-.E. supervised the project and provided critical feedback. Both authors contributed to discussions, reviewed drafts and approved the final manuscript.

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Data availability

Data sharing is not applicable to this manuscript as it is a systematic literature review. The literature reviewed is publicly available and can be accessed through various academic databases and journals.

Disclaimer

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Appendix 1

TABLE 1-A1: List of studies included in the systematic literature review.

Number	Author(s)	Topic	Type	Year	Cited	Country
1	Bennett et al.	Transformations, transitions, or tall tales? A global review of the uptake and impact of NoSQL, blockchain, and big data analytics on the land administration sector	Journal Article	2019	60	Australia
2	Thakur et al.	Land records on blockchain for implementation of land titling in India	Journal Article	2020	225	India
3	Razali et al.	Blockchain system architecture for land registration	Conference Paper	2021	0	Malaysia
4	Nasarre-Aznar	Collaborative housing and blockchain	Conference Paper	2018	72	Spain
5	Gillpatrick et al.	How can blockchain contribute to developing country economies? A literature review on application areas	Journal Article	2022	21	Turkey
6	Konashevych	Constraints and benefits of the blockchain use for real estate and property rights	Journal Article	2020	77	Italy
7	Kaczorowska	Blockchain-based land registration: Possibilities and challenges	Journal Article	2019	54	Poland
8	Mendi et al.	A new approach to land registry system in Turkey: Blockchain-based system proposal	Journal Article	2020	8	Turkey
9	Subedha et al.	A novel strategy for streamlining land registration using Ethereum blockchain	Journal Article	2023	0	India
10	Tahar et al.	A proof of concept of the integration of blockchain with an ISO 19152:2012 based land administration system	Conference Paper	2022	1	China
11	Ali et al.	A Transparent and Trusted Property RegistrationSystem on Permissioned Blockchain	Conference Paper	2020	33	Saudi Arabia
12	Yadav et al.	A scalable trust based consensus mechanism for secure and tamper free property transaction mechanism using DLT	Journal Article	2022	15	India
13	Ansah et al.	A systematic review of the institutional success factors for blockchain-based land administration	Journal Article	2023	7	Germany
14	Ameyaw and De Vries	Blockchain technology adaptation for land administration services: The importance of socio-cultural elements	Journal Article	2023	8	Germany
15	Gutierrez and Xu	Blockchain and smart contracts to secure property transactions in smart cities	Journal Article	2022	14	China
16	Mulligan et al.	Blockchain for sustainability: A systematic literature review for policy impact	Journal Article	2023	3	United Kingdom
17	Tan et al.	Blockchain governance in the public sector: A conceptual framework for public management	Journal Article	2022	109	Belgium
18	Saari et al.	Blockchain in real estate: Recent developments and empirical applications	Journal Article	2022	26	Finland
19	Ooi et al.	Blockchain land transfers: Technology, promises, and perils	Journal Article	2022	10	Singapore
20	Mintah	Blockchain on stool land acquisition: Lessons from Ghana for strengthening land tenure security other than titling	Journal Article	2021	19	Australia
21	Mora et al.	Blockchain technologies to address smart city and society challenges	Journal Article	2021	75	Spain
22	Yapicioglu and Leshinsky	Blockchain as a tool for land rights: ownership of land in Cyprus	Journal Article	2020	31	Cyprus
23	Aborujilah et al.	Blockchain-based adoption framework for authentic land registry system in Malaysia	Journal Article	2021	11	Malaysia
24	Florentino and Bartolluci	Blockchain-based smart contracts as new governance tools for the sharing economy	Journal Article	2021	46	United Kingdom
25	Zein and Twinomurinzi	Blockchain technology in land registration: A systematic literature review	Journal Article	2023	0	South Africa
26	Saari et al.	Blockchain's grand promise for the real estate sector: A systematic review	Journal Article	2022	12	Switzerland
27	Vayadande et al.	Blockchain-based land record system	Conference Paper	2022	5	India
28	Ppaskiri et al.	Digital land management technologies	Conference Paper	2021	3	Russia
29	Yadav and Kushwaha	Digitization of land record through blockchain-based consensus algorithm	Journal Article	2022	26	India
30	Taylor	Digitalizing land administration: The geographies and temporalities of infrastructural promise	Journal Article	2021	32	United States
31	Soner et al.	Exploring blockchain and smart contract technology for reliable and secure land registration and record management	Conference Paper	2021	30	India
32	Shuaib et al.	Identity model for blockchain-based land registry system: A comparison	Review Article	2022	78	Saudi Arabia
33	Langaliya and Gohil	Innovative and secure decentralized approach to process real estate transactions by utilizing private blockchain	Conference Paper	2023	0	India
34	Veeramant and Jaganathan	Land registration: use-case of e-governance using blockchain technology	Journal Article	2020	28	India
35	Khalid et al.	Blockchain-based land registration system: A conceptual framework	Research Article	2022	38	Pakistan
36	Janbandhu et al.	Land registration and transfer of entitlement using blockchain	Journal Article	2023	1	India
37	Biswas et al.	LandChain: A blockchain based secured land registration system	Conference Paper	2021	16	Bangladesh
38	Garcia-Teruel	Legal challenges and opportunities of blockchain technology in the real estate sector	Journal Article	2020	128	Spain
39	Mata et al.	Blockchain technology for improving land registration system in an emerging economy	Research Article	2022	0	Portugal
40	Shahaab et al.	Public service operational efficiency and blockchain – A case study of Companies House, UK	Journal Article	2023	21	United Kingdom

Table 1-A1 continues on the next page →

TABLE 1-A1 (Continues...): List of studies included in the systematic literature review.

Number	Author(s)	Topic	Type	Year	Cited	Country
41	Singh	Role of blockchain technology in digitization of land records in Indian scenario	Conference Paper	2020	21	India
42	Mintah et al.	Skin lands in Ghana and application of blockchain technology for acquisition and title registration	Journal Article	2020	32	Australia
43	Stefanovic et al.	Smart contract application for managing land administration system transactions	Manuscript	2022	13	Serbia
44	Baptista et al.	Social and financial sustainability of real estate investment: Evaluating public perceptions towards blockchain technology	Journal Article	2023	0	Switzerland
45	Jagadish and Vege	Efficient approach for land registration using blockchain technology	Research Article	2022	0	India
46	Racetin et al.	Blockchain-based land management for sustainable development	Research Article	2022	8	Switzerland
47	Garcia-Teruel and Simon-Moreno	The digital tokenization of property rights: A comparative perspective	Journal Article	2021	72	Spain
48	Bagloee et al.	Blockchain: The operating system of smart cities	Journal Article	2021	54	Australia
49	Ameyaw and De Vries	Toward smart land management: Land acquisition and the associated challenges in Ghana. A look into a blockchain digital land registry for prospects	Journal Article	2021	39	Germany
50	Author(s) in press	Author(s) in press	Journal Article	2021	3	South Africa
51	Ameyaw and De Vries	Author(s) in press	Author(s) in press	2023	5	Germany
52	Adil	The (Georgian) blockchain-based solution to the developing world's problem of Byzantine faults in land registers	Journal Article	2022	0	United Kingdom

Note: Please see the full reference list of this article, Faku, N. & Amadi- Echendu, A., 2025, 'The economic benefit of blockchain-based land registry for South Africa: A systematic literature review', *South African Journal of Information Management* 28(1), a2002. https://doi.org/10.4102/sajim.v28i1.2002, for more information.