

Digital Transformation of Land Governance: Implementing Electronic Land Administration Systems for Sustainable Land Administration – A Systematic Literature Review

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Abstract

The rapid advancement of digital technologies has intensified the transformation of public sector governance, particularly in modernizing land administration systems that support sustainable land governance. However, many land administration institutions still operate through fragmented records, manual procedures and disconnected information systems, limiting transparency, operational efficiency and effective land information management. Within the context of digital transformation governance, Electronic Land Administration Systems (eLAS) have emerged as integrated digital platforms that combine land registry databases, cadastral records and geospatial information systems to enhance information system integration and digital service delivery. This study aims to examine the implementation of eLAS from a technology management perspective, focusing on technology adoption, institutional capability and governance readiness in digital land administration. A Systematic Literature Review (SLR) was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol using peer-reviewed publications retrieved from major databases including Scopus, Web of Science and IEEE Xplore. After applying defined inclusion criteria, 24 relevant studies published between 2022 and 2024 were analyzed using thematic analysis. The findings indicate that successful eLAS implementation depends on three interrelated factors: integrated land data management, supportive regulatory frameworks and strong institutional capability for managing digital transformation initiatives. Overall, the study highlights that effective digital transformation governance and strategic technology management are critical for advancing electronic land administration systems and achieving sustainable land administration.

1. Introduction

The rapid advancement of digital technologies has significantly transformed public sector governance, particularly in domains that rely heavily on information management and institutional coordination such as land administration. Digital transformation has become a strategic priority for governments seeking to improve administrative efficiency, transparency and service delivery through the integration of advanced information technologies and data-driven decision-making processes (Bennett et al., 2024; Chehrehbargh et al., 2024). Within this context, the modernization of land administration systems has attracted increasing scholarly and policy attention because reliable land information management is fundamental to economic development, urban planning and sustainable land governance (Williamson et al., 2010; United Nations, 2015). However, many land administration institutions continue to rely on fragmented records, manual procedures and disconnected information systems, which constrain transparency, reduce operational efficiency and limit accessibility to land-related information (Heriz & Boubakeur, 2022; Nyangweso & Gede, 2022).

In response to these limitations, governments worldwide are increasingly adopting digital technologies to modernize land administration infrastructures. Electronic Land Administration Systems (eLAS) represent a key innovation in this digital transformation process by integrating land registry databases, cadastral records and geospatial information technologies into unified digital platforms (Azadi et al., 2023; Chehrehbargh et al., 2024). From a technology and innovation management perspective, eLAS can be viewed as an information system integration initiative that enables institutions to manage land-related data more efficiently while supporting transparent land governance and improved service delivery. The adoption of such systems reflects broader trends in digital transformation governance, where public institutions leverage digital technologies to enhance administrative capabilities and create more responsive governance structures (Bennett et al., 2024; Nwafor et al., 2022).

Despite the growing recognition of digital land administration, the implementation of eLAS remains a complex technological and organizational challenge. Previous studies indicate that successful digital transformation in land governance depends not only on technological infrastructure but also on institutional capability, regulatory readiness and effective information system integration across multiple agencies (Ganason, 2022; Hamamurad et al., 2022). Land information is frequently stored across separate institutions using different data standards and administrative procedures, which creates barriers to interoperability and system integration. In addition, many legal frameworks governing land administration were originally designed for paper-based processes and may not adequately support digital land records or electronic transactions (Permadi, 2023; Azadi et al., 2023). These challenges highlight that the implementation of eLAS should be understood as a multidimensional digital transformation initiative involving technology adoption, institutional governance and regulatory modernization.

From the perspective of technology and innovation management, digital transformation initiatives such as eLAS require coordinated strategies that align technological innovation with organizational capability and policy frameworks. Technology adoption in public institutions is influenced by factors including institutional readiness, leadership commitment, regulatory support and the ability to integrate complex information systems into existing administrative structures (Bennett et al., 2024; Chehrehbargh et al., 2024). Consequently, understanding how electronic land administration systems are implemented and managed is essential for improving digital governance strategies and ensuring sustainable land administration outcomes.

Although a growing body of literature has examined digital land administration technologies, existing studies are often fragmented across different disciplines including geospatial information science, land governance and information systems. Many studies focus on specific technological solutions such as blockchain-based land registries or spatial data infrastructures, while fewer studies synthesize broader insights regarding the technological, institutional and governance factors influencing the adoption of electronic land administration systems (Alam et al., 2022; Racetin et al., 2022). This fragmentation highlights the need for a comprehensive synthesis of existing research that examines eLAS implementation from a technology management perspective. Therefore, this study conducts a Systematic Literature Review (SLR) to examine the implementation of eLAS within the broader context of digital transformation governance. By synthesizing findings from recent scholarly publications, the study aims to identify key technological, institutional and regulatory factors influencing the adoption and management of digital land administration systems. The findings contribute to the growing body of knowledge on digital governance and technology management by providing insights into how information system integration and institutional capability can support the effective implementation of electronic land administration systems and promote sustainable land governance.

2. Literature Review

This literature review examines the scholarly foundations underlying the digital transformation of land governance and the implementation of eLAS. As governments increasingly adopt digital platforms to modernize land administration processes, understanding the theoretical and technological dimensions that shape these transformations has become increasingly important (Vial, 2019; Bennett et al., 2024). The growing adoption of

digital technologies has transformed how governments manage land information and deliver public services. In land governance, this transformation has encouraged the shift from fragmented and paper-based systems toward integrated digital land administration platforms. Although many studies acknowledge the importance of Electronic Land Administration Systems (eLAS), the literature remains fragmented across technological, governance and institutional perspectives. Existing discussions often emphasize technological capabilities without sufficiently examining how governance structures, organizational readiness and regulatory frameworks shape implementation outcomes. Therefore, a more integrated understanding of eLAS implementation is necessary to explain how digital transformation can effectively support sustainable land administration.

2.1 Land Administration and Sustainable Land Governance

Land administration systems (LAS) function as the institutional mechanism for managing land tenure, land value, land use and land development. These systems support land ownership registration, land transactions and land information management, which are essential for economic growth and governance stability (Williamson et al., 2010). Effective land administration also contributes to social equity and environmental sustainability because reliable land information supports planning, taxation and resource management.

The growing global emphasis on sustainable development has increased attention toward sustainable land governance. International initiatives such as the Sustainable Development Goals (SDGs) recognize secure land tenure, transparent governance and equitable access to land resources as critical development priorities (United Nations, 2015). In this context, land administration is no longer viewed as merely an administrative function. Instead, it is increasingly understood as a governance instrument that shapes socio-economic development and public trust. This governance perspective is fundamental to addressing the improvement of land information management and advancing sustainable land governance (RQ3), as it evaluates how the systematic management of land tenure and value through digital platforms directly translates into sustainable administrative outcomes.

Despite this importance, many traditional land administration systems remain inefficient and fragmented. Existing studies frequently report that land records are still managed through paper-based procedures and isolated databases that limit transparency, efficiency and accessibility (Heriz & Boubakeur, 2022; Nyangweso & Gede, 2022). These limitations reduce the reliability of land information and often contribute to delays, overlapping records and weak institutional coordination. While previous studies acknowledge these operational weaknesses, many discussions remain descriptive and focus primarily on technical modernization rather than governance transformation.

Recent literature increasingly argues that sustainable land governance requires more than digitizing land records. Effective modernization also depends on institutional coordination, governance capability and strategic policy alignment (Azadi et al., 2023; Chehrehbargh et al., 2024). This argument is important because technological innovation alone cannot resolve structural governance weaknesses within land administration institutions. For example, introducing digital platforms without improving institutional interoperability may simply transfer fragmented paper-based systems into fragmented digital systems.

Furthermore, much of the literature discusses sustainable land governance from either a technological perspective or a policy perspective, with limited integration between the two. Studies often emphasize technological infrastructure while paying less attention to organizational adaptation, governance readiness and long-term institutional sustainability. As a result, the relationship between digital transformation and sustainable land governance remains insufficiently explained within current research.

This gap suggests the need for a more integrated perspective that connects digital transformation, institutional governance and sustainable land administration outcomes. Therefore, understanding land administration within the broader context of governance modernization is essential for explaining how electronic land administration systems can contribute to sustainable land governance. Consequently, this section establishes the conceptual link between institutional modernization and sustainable governance, providing the necessary context to assess the long-term impacts required. It will answer the question of, how do electronic land administration systems contribute to improving land information management and advancing sustainable land governance? (RQ3).

2.2 Digital Transformation and Information System Integration in Land Administration

Digital transformation refers to the strategic integration of digital technologies into organizational processes to improve operational efficiency, information management and service delivery (Vial, 2019). Within land administration, digital transformation involves shifting from fragmented manual systems toward integrated digital platforms capable of managing cadastral, legal and spatial land information more effectively (Bennett et al., 2024).

In relation to technological innovation (RQ1), these integrated infrastructures represent the core 'Digital Transformation Strategies' that enable the transition from siloed databases to unified, interoperable land governance environments.

Electronic Land Administration Systems (eLAS) represent one of the most significant outcomes of this transformation. These systems integrate land registries, cadastral databases and geospatial technologies into interconnected digital infrastructures that support land governance processes. Existing studies consistently report that integrated digital systems improve data accessibility, accelerate land transactions and strengthen transparency in land administration (Rajabifard et al., 2019; Bobikova et al., 2022). Figure 1, show the evolution of modern land administration system.

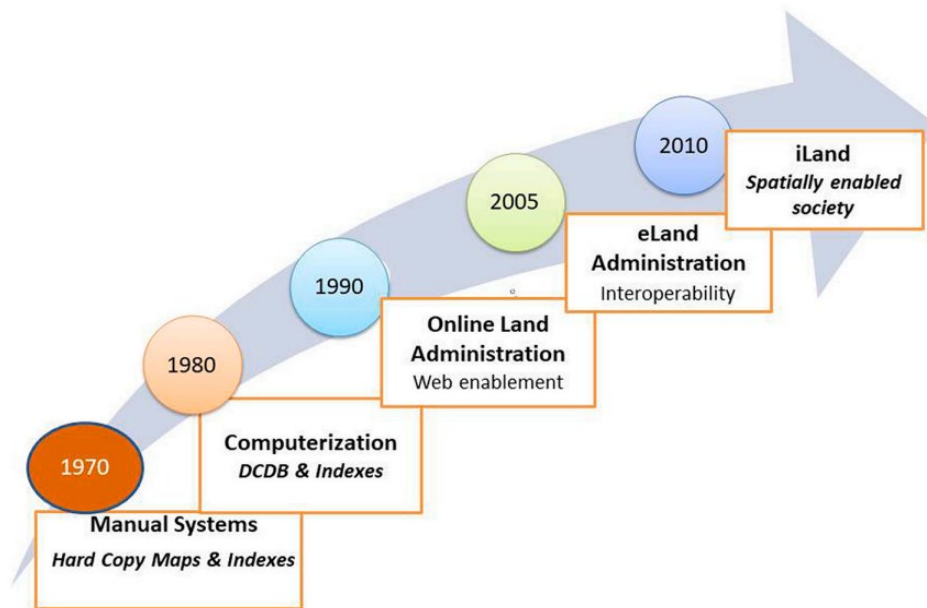


Fig. 1 Evolution of modern land administration system (Adam, A. G. 2023)

However, the literature often presents digital transformation as a technological process rather than an organizational transformation process. Many studies focus heavily on technological tools such as Geographic Information Systems (GIS), blockchain platforms and cloud-based infrastructures while paying less attention to governance coordination and institutional integration. This narrow focus creates an overly optimistic assumption that technological adoption automatically improves governance performance.

In reality, successful information system integration depends on multiple organizational and institutional factors. Land information is frequently distributed across separate agencies that operate using different administrative procedures and incompatible data standards (Hamamurad et al., 2022). As a result, interoperability challenges remain one of the major barriers to digital transformation in land administration. These challenges are not purely technical because they also involve institutional resistance, weak governance coordination and inconsistent regulatory frameworks.

Recent studies increasingly promote emerging technologies such as blockchain as solutions for improving land administration transparency and security (Alam et al., 2022; Racetin et al., 2022). Blockchain-based land registries may improve transaction traceability and reduce risks of data manipulation. Nevertheless, the literature tends to overemphasize technological potential while underexploring practical implementation issues such as legal validity, governance accountability and organizational readiness. Consequently, the long-term sustainability of these technologies within public sector land governance remains uncertain. By examining these emerging tools, the review provides a technical baseline for technological innovation (RQ1), focusing on how decentralized ledger technologies act as disruptive innovations in securing land transactions.

Another limitation within existing studies is the insufficient discussion regarding how digital transformation strategies align with broader public sector governance objectives. Most studies evaluate technological efficiency improvements but provide limited critical analysis regarding public trust, digital inclusion and institutional capability. Without addressing these dimensions, digital transformation initiatives may improve technical performance without necessarily strengthening governance effectiveness.

Therefore, digital transformation in land administration should be understood as a multidimensional governance process involving technology integration, organizational adaptation and institutional coordination. This broader perspective remains underdeveloped in current literature and highlights the need for more comprehensive research on how information system integration contributes to sustainable land governance outcomes.

2.3 Innovation Adoption and Implementation Challenges of eLAS

The implementation of Electronic Land Administration Systems (eLAS) represents a major innovation initiative within public sector governance. From an innovation management perspective, the adoption of digital technologies in public institutions is influenced by technological capability, organizational readiness and external governance environments. The Technology–Organization–Environment (TOE) framework and Diffusion of Innovation theory explain that successful technology adoption depends on the interaction between technological infrastructure, institutional capability and regulatory support (Rogers, 2003; Tornatzky & Fleischer, 1990). The application of the TOE Framework here is instrumental in answering what factors influence the adoption and integration of electronic land administration systems in land governance? (RQ2). As it categorizes the multifaceted 'Factors'—technological, organizational and environmental—that either facilitate or impede the successful adoption of eLAS.

Although many governments recognize the potential benefits of eLAS, implementation remains highly challenging. One of the most frequently reported issues is data interoperability. Land information is commonly stored in separate cadastral, registry and geospatial databases managed by different institutions using inconsistent standards (Hamamurad et al., 2022; Nyangweso & Gede, 2022). This fragmentation weakens information sharing and reduces the effectiveness of integrated digital systems.

However, many existing studies discuss interoperability mainly as a technical issue. This interpretation is limited because interoperability problems are often rooted in governance fragmentation, institutional silos and weak inter-agency coordination. Consequently, technological integration alone may not resolve implementation barriers unless governance structures are also strengthened. Identifying these legal and regulatory bottlenecks is crucial for knowing the factors influence the adoption of eLAS (RQ2), as it highlights the external 'Environment' factors in the TOE framework that dictate the pace of institutional digital integration.

Legal and regulatory constraints also remain significant barriers to eLAS implementation. Many land administration laws were originally designed for paper-based administrative procedures and therefore may not adequately support electronic records, digital signatures or online transactions (Ganason, 2022; Permadi, 2023). Although several studies recommend legislative reform, the literature rarely explains how legal modernization should be coordinated with institutional transformation and technological integration. This creates a gap between policy recommendations and operational implementation realities.

Institutional capability further influences the success of digital transformation initiatives. Implementing eLAS requires skilled personnel, strong leadership and long-term strategic commitment from public institutions (Azadi et al., 2023; Nwafor et al., 2022). Nevertheless, many developing countries continue to face resource limitations, bureaucratic resistance and inadequate technical expertise. These organizational challenges are often acknowledged in the literature but insufficiently analyzed from a technology management perspective.

Another important issue concerns the socio-economic implications of digital land governance. Existing studies frequently emphasize efficiency, transparency and security improvements while paying limited attention to digital inequality, public trust and cybersecurity risks. This imbalance creates a narrow understanding of eLAS implementation because sustainable digital transformation should also consider inclusivity and governance legitimacy.

Overall, the literature demonstrates that implementing eLAS is not solely a technological process but a multidimensional governance transformation. Current studies remain fragmented across technological, legal and organizational perspectives, resulting in limited understanding of how these dimensions interact during implementation. Therefore, a more integrated analytical framework is required to explain how innovation adoption, institutional governance and digital transformation collectively influence the implementation of eLAS towards sustainable land administration. Thus, the review of implementation challenges provides a structured diagnostic tool for answering what factors influence the adoption of eLAS (RQ2), ensuring that the factors identified in this study are grounded in established innovation adoption theories.

3. Methodology

This study adopts a systematic literature review approach to synthesize existing research on electronic land administration systems. Systematic reviews provide a structured and transparent method for identifying and evaluating scholarly literature on a specific research topic (Moher et al., 2009). The review process in this study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which provide standardized procedures for identifying, screening and analyzing relevant academic publications (Moher et al., 2009). By applying this methodological framework, the study systematically evaluates existing research related to eLAS implementation, identifies key implementation challenges and synthesizes findings to support the development of an integrated conceptual framework for sustainable land administration.

3.1 Systematic Literature Review Framework

The systematic review was conducted through four sequential stages adapted from the PRISMA methodological framework: review planning, study specification, data selection and data synthesis. These stages provide a structured procedure for identifying relevant literature, filtering studies according to predefined criteria and synthesizing research findings in a transparent manner. The structured approach ensures that the literature selection process is systematic, reproducible and aligned with established standards for conducting systematic literature reviews (Moher et al., 2009).

3.1.1 Review Planning

The review planning stage establishes the conceptual scope and research direction for the systematic literature review. In line with the objectives of this study, the review was designed to examine the implementation of Electronic Land Administration Systems (eLAS) within the broader context of digital transformation governance and technology management in land administration. Systematic literature reviews require clearly defined research questions to ensure that the review process is transparent, replicable and focused on synthesizing relevant scholarly evidence (Kitchenham & Charters, 2007; Moher et al., 2009).

Drawing upon the theoretical foundations discussed in the literature review—including digital transformation theory, information system integration and innovation adoption frameworks—the present study aims to investigate how digital technologies are transforming land administration systems and what factors influence the successful implementation of electronic land administration infrastructures. From a technology and innovation management perspective, the review emphasizes how technological readiness, institutional capability and governance environments influence the adoption and integration of digital land administration systems.

Accordingly, the systematic review was guided by the following research questions:

- RQ1: What are the key technological innovations and digital transformation strategies used in the implementation of Electronic Land Administration Systems (eLAS)?
- RQ2: What technological, organizational and institutional factors influence the adoption and integration of electronic land administration systems in land governance?
- RQ3: How do electronic land administration systems contribute to improving land information management and advancing sustainable land governance?

These research questions informed the development of search strategies, keyword selection and study inclusion criteria used in the literature identification process.

To obtain comprehensive coverage of relevant academic studies, the literature search was conducted across several major scholarly databases including Scopus, Web of Science (WoS), SpringerLink and IEEE Xplore. These databases were selected because they contain high-quality peer-reviewed publications related to land administration, geospatial information systems and digital governance. In addition, Google Scholar was used as a supplementary source to identify additional publications through citation tracking and snowballing techniques.

The initial search used the keyword “Electronic Land Administration System”, and additional keywords were later incorporated to broaden the search scope. These keywords included:

- “Land Administration System”
- “Digital Land Administration”
- “Land Information System”
- “Sustainable Land Administration”

Boolean operators such as “AND” and “OR” were applied to combine these terms and refine the search queries to ensure that relevant literature related to digital land administration and eLAS implementation could be identified.

3.1.2 Study Specification

To ensure the relevance and quality of the reviewed literature, predefined inclusion and exclusion criteria were established prior to the screening process. These criteria were applied to filter publications that are directly relevant to the implementation of eLAS. Only studies published between 2022 and 2024 were included in the review in order to capture recent scholarly developments related to digital land administration. Furthermore, only peer-reviewed journal articles and conference papers written in English were considered. Publications such as books, theses, editorial articles, short surveys and non-academic reports were excluded to maintain the academic rigor of the review.

In addition, the selected studies were required to contain empirical or conceptual discussions related to eLAS implementation, implementation frameworks, technological approaches or governance challenges associated with digital land administration. Articles that addressed only general land administration theories without

reference to electronic systems or digital transformation were excluded from the review. Inclusion and exclusion criteria in Table 1, are essential for an SLR.

Table 1 *Inclusion and exclusion criteria*

Criterion	Inclusion Criteria	Exclusion Criteria
Publication Period	Articles published between 2022 and 2024 to ensure contemporary relevance.	Articles published before 2022.
Language	Peer-reviewed publications written in English.	Publications in any language other than English.
Document Type	Original research articles and conference papers from reputable databases.	Books, theses, chapters, editorial notes, letters, short surveys, and non-academic reports.
Quality Appraisal	Journals indexed in Scopus with a ranking of Quartile 1 (Q1) to Quartile 4 (Q4).	Articles from non-indexed journals by Scopus Quartile.
Subject Focus	Explicit focus on eLAS implementation, including technological frameworks, governance, and institutional readiness.	Studies focusing only on general land theories or purely technical/engineering aspects without management context.
Data Integrity	Articles containing empirical evidence, conceptual models, or validated case studies.	General literature reviews, opinion pieces, or articles lacking empirical/substantive data.

To ensure a high-quality and comprehensive synthesis of the literature, a rigorous search strategy was implemented. The identification process utilized specific Boolean operators to bridge land administration concepts with digital transformation theories. The final search string was: *("Electronic Land Administration System" OR "eLAS" OR "Digital Land Administration") AND ("Sustainable Land Governance" OR "Technology Adoption")*.

Beyond the initial inclusion/exclusion criteria (Table 1), this study introduced a Quality Appraisal stage based on Scopus Quartile rankings. Only studies published in journals indexed in Scopus were retained for the final analysis. This stringent filtering ensures that the findings are synthesized from literature with high scientific impact, robust methodologies and rigorous peer-review processes, thereby strengthening the reliability of the eLAS implementation framework (Moher et al., 2009).

3.1.3 Data Selection

The literature identification process began with database searches using the defined keyword combinations. The initial search retrieved 72 articles from the Scopus database, 1,000 articles from SpringerLink, 410 articles from Web of Science (WoS) and 86 articles from IEEE Xplore. Additional publications were identified through Google Scholar searches and citation tracking, resulting in an additional 1,751 records.

Following the initial identification stage, the inclusion and exclusion criteria were applied to refine the dataset. After preliminary filtering, 514 articles remained for further screening, including the removal of duplicate records and non-relevant publications. A total of 59 records were removed due to duplication and non-article sources, primarily originating from the Google Scholar database.

Subsequently, titles and abstracts were reviewed to determine their relevance to the research scope, leading to the exclusion of 169 articles that did not address electronic land administration systems. Full-text assessments were then conducted on the remaining studies, resulting in 286 articles that were initially considered relevant. However, many of these publications primarily focused on theoretical discussions, engineering architectures or comparative analyses of existing platforms rather than the broader implementation of eLAS. After the final screening stage, 24 studies met all eligibility criteria and were selected for detailed analysis. The overall selection process follows the PRISMA protocol and is illustrated in Figure 2 below.

The selection process followed the PRISMA protocol to minimize bias and ensure procedural transparency. The reduction from 286 full-text articles to the final 24 selected studies (as illustrated in Figure 2) was driven by two critical justifications:

- **Substantive Relevance:** A significant number of articles were excluded because they focused exclusively on technical software engineering architectures without addressing the management of technology or organizational governance aspects.
- **Scopus Quartile Filtering (Quality Appraisal):** Articles from journals not indexed in Scopus Quartile were removed. This step is vital because land administration involves complex legal, social and economic implications; therefore, the synthesis must rely on high-integrity data. Failure to meet these Scopus

Quartile standards was viewed as a potential risk to the credibility of the systematic review outcomes (Adesola, 2024).

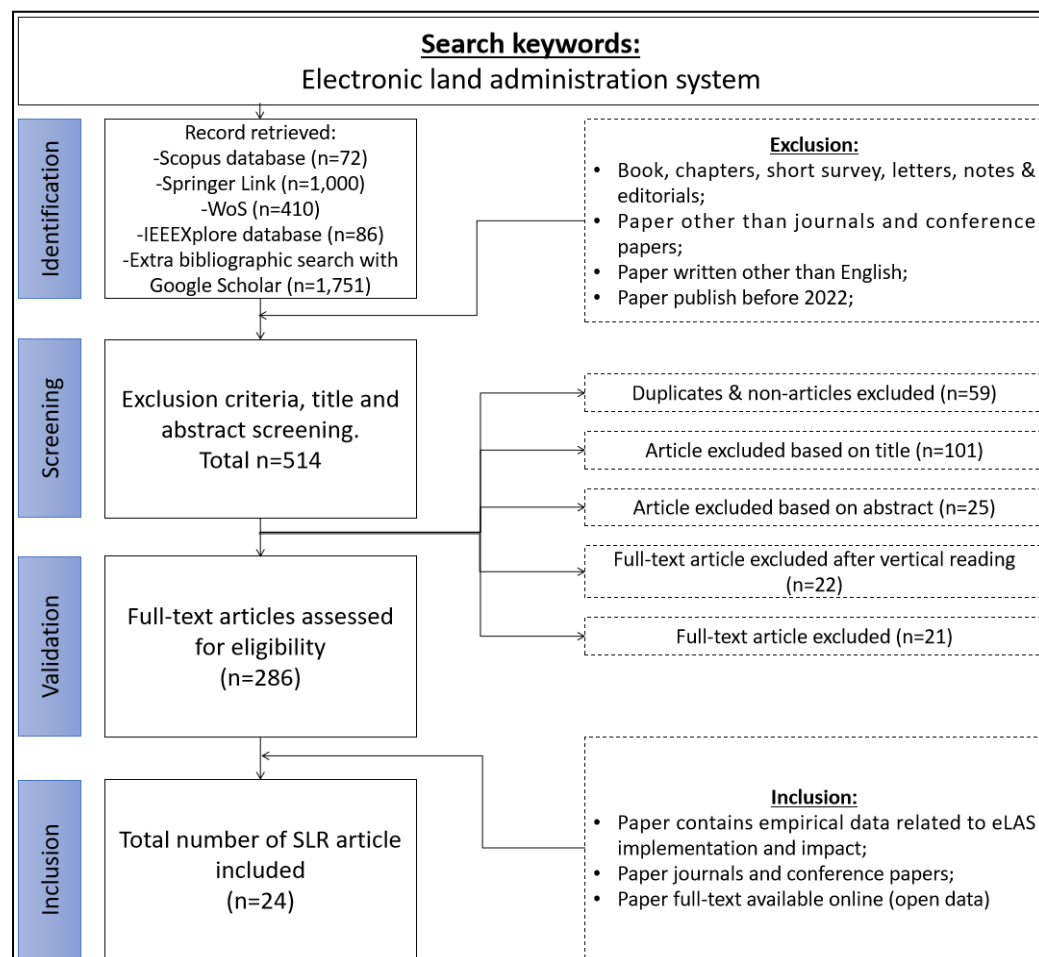


Fig. 2 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol model used

3.1.4 Profile of the Selected Articles

The yearly publication analysis presented in Figure 3 below reveals the growing academia's recent interest from 2022 and the attention substantially decrease in 2023-2024. It is not a final explanation because 2024 is still 6 months away when this SLR conducted.

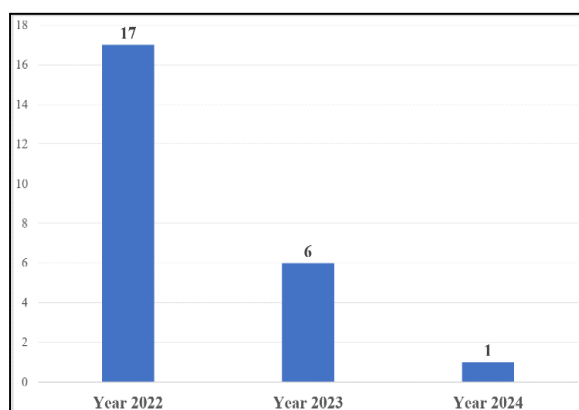


Fig. 3 Articles review by year

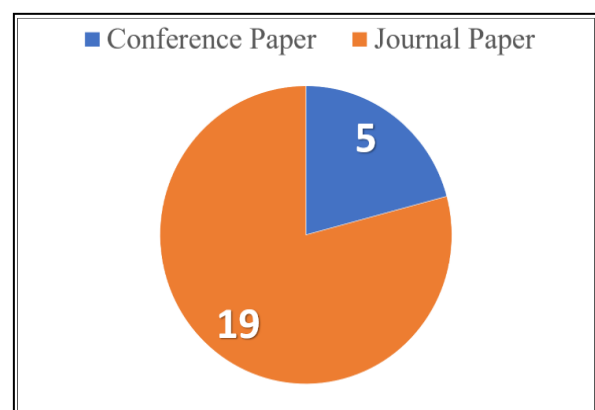


Fig. 4 Articles reviewed paper type

Majority of the references (Figure 4) 79.17% a from journals and balance 20.83% is from conference papers. The methods of data collection in selected articles are interviews, case studies, observations, questionnaires and surveys.

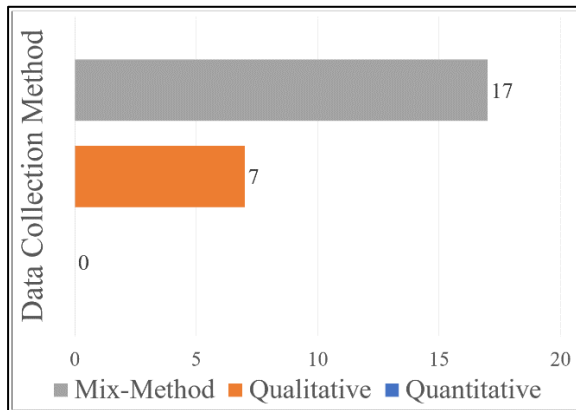


Fig. 5 Data collection method

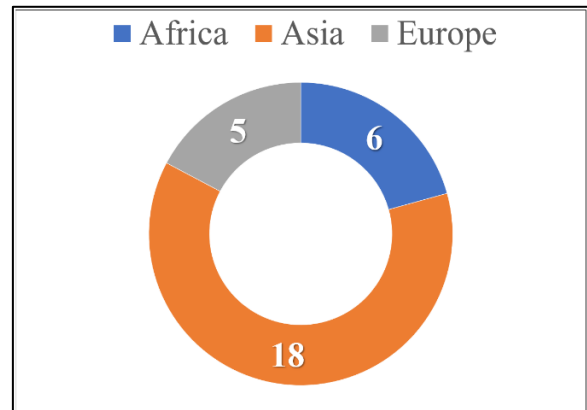


Fig. 6 eLAS case study by continents

Majority are using Mix-Method data collection in 17 of article reviewed and balance 7, are using Qualitative Method in collecting data as Figure 5. Highlighted also that Asia is the most continent research focus in eLAS (Figure 6) to illustrate the momentum of research are globally expend world-wide and direction of research on implementing eLAS toward sustainable land administration to support SDGs can be adopted generally. Nevertheless, eLAS potential is still being scrutinized, and other research has confirmed the eLAS applicability in various land administration functions specially in land tenure, registration and land use planning and also can respond to SDGs demand.

3.2 Data Extraction and Analysis

The selected articles were analyzed using thematic analysis, a qualitative analytical method widely used in systematic literature reviews to identify recurring patterns, themes and relationships within a body of literature. Thematic analysis allows researchers to systematically organize and interpret qualitative data by coding and categorizing information into meaningful themes that address the research objectives. This approach is particularly suitable for synthesizing findings from multiple studies because it facilitates the identification of common issues, conceptual patterns and research gaps across different contexts (Braun & Clarke, 2006; Nowell et al., 2017).

Table 2 Phases of thematic analysis (Braun & Clarke, 2006)

Phase	Description of The Process
1. Familiarizing yourself with your data:	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas.
2. Generating initial codes:	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
3. Searching for themes:	Collating codes into potential themes, gathering all data relevant to each potential theme.
4. Reviewing themes:	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic 'map' of the analysis.
5. Defining and naming themes:	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
6. Producing the report:	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis.

In this study, refer to Table 2, the thematic analysis process involved several stages, including familiarization with the selected articles, generation of initial codes, identification of recurring themes and interpretation of relationships between the identified themes.

The 24 selected articles were analyzed using Thematic Analysis (TA) following the six-phase approach proposed by Braun and Clarke (2006). The development of themes was conducted through both inductive and deductive reasoning:

- **Initial Coding Phase:** Raw data from the "Key Findings" and "Research Focus" sections of each paper were extracted and assigned initial codes (e.g., 'blockchain-based land records', 'data interoperability', 'regulatory reform').
- **Theme Development:** Codes with semantic similarities were clustered into sub-themes. For instance, codes relating to 'data interoperability' and 'regulatory reform' were grouped under the overarching theme of Institutional Capability. Codes relating to 'blockchain-based land records' and 'digital land records' were grouped under the overarching theme of Technological Innovation.
- **Reviewing and Refining:** Themes were cross-referenced against the three Research Questions (RQs) to ensure the analysis remained aligned with the study's objectives. This systematic transition from raw data to academic narrative ensures the process is transparent, replicable and grounded in the evidence base.

This process enabled the systematic classification of findings related to eLAS implementation. Specifically, the analysis focused on identifying: (1) The key technological innovations and digital transformation strategies used in the implementation of eLAS, (2) technological, organizational and institutional factors influence the adoption and integration of electronic land administration systems in land governance, and (3) eLAS contribution on improving land information management and advancing sustainable land governance. The identified themes were then synthesized to support the development of a conceptual framework for implementing eLAS towards sustainable land administration. Applying thematic analysis in this study ensures that the literature synthesis is systematic, transparent and aligned with established qualitative research practices.

4. Results

The systematic literature review analyzed 24 selected studies focusing on the implementation of Electronic Land Administration Systems (eLAS) and digital land governance initiatives. The findings were synthesized using thematic analysis to identify recurring technological, organizational and governance-related patterns across the selected studies. The analysis was structured according to the three research questions defined in the review planning stage, namely: (RQ1) technological innovations and digital transformation strategies in eLAS implementation, (RQ2) technological, organizational and institutional factors influencing eLAS adoption, and (RQ3) the contribution of eLAS to sustainable land governance. The synthesis reveals that successful implementation of digital land administration systems is strongly influenced by the interaction between technological innovation, institutional capability and governance frameworks. These findings are consistent with technology management and innovation adoption theories that emphasize the importance of technological readiness, organizational capacity and supportive policy environments in facilitating digital transformation (Vial, 2019; Tornatzky & Fleischer, 1990).

Table 3 below show the characteristics of selected studies included in the systematic literature review of Electronic Land Administration System implementation.

Table 3 Characteristics of selected studies in the systematic literature review

No.	Author(s)	Country/ Context	Technology/ System Focus	Research Focus	Key Findings
1.	Abraham (2023)	Global	Digital land governance systems	Legal framework for digital land administration	Regulatory reforms are necessary to support digital land records and transactions
2.	Adesola (2024)	Developing countries	Electronic land administration systems	Institutional readiness and governance	Institutional capacity is essential for successful digital land administration
3.	Akumuntu (2022)	Rwanda	Electronic land titling	Digital land registration	e-titling improves efficiency and transparency
4.	Alam et al. (2022)	Bangladesh	Blockchain land registry	Blockchain-based land records	Blockchain enhances security and transparency in land transactions

No.	Author(s)	Country/ Context	Technology/ System Focus	Research Focus	Key Findings
5.	Azadi et al (2023).	Global	Smart land governance systems	Digital governance frameworks	Digital governance strategies support sustainable land administration
6.	Bieliatynskiy et al. (2022)	Ukraine	Intelligent territorial land administration	Smart digital land infrastructure	Intelligent systems improve land data management
7.	Bobikova et al. (2022)	Europe	Land information systems	Digitalization of land records	Integrated digital land systems improve data accessibility
8.	Christine et al. (2022)	Indonesia	Blockchain land tracking	Digital land ownership tracking	Blockchain improves traceability of land ownership records
9.	Ganason (2022)	Malaysia	eLAS readiness	Technology adoption readiness	Institutional readiness affects eLAS implementation
10.	Halid & Nawawi (2023)	Malaysia	Digital land administration	Policy and governance	Digital governance frameworks support land administration modernization
11.	Hamamurad et al. (2022)	Malaysia	Spatial data sharing platforms	Data interoperability	Lack of spatial data sharing mechanisms limits system integration
12.	Heriz & Boubakeur (2022)	Malaysia	Land information management	Transition from paper to digital land administration	Digital systems improve transparency and administrative efficiency
13.	Khalid et al. (2022)	Malaysia	Land information system integration	Digital system integration	Integrated systems improve efficiency in land governance
14.	Langaliya & Gohil (2023)	India	Land information systems	Digital service delivery	Digital platforms improve citizen access to land services
15.	Nwafor et al. (2022)	Nigeria	Land information management systems	Institutional governance	Strong governance frameworks are required for digital transformation
16.	Nyangweso & Gede (2022)	Kenya	Land administration performance	Digital land records	Digital systems enhance transparency in land transactions
17.	Permadi (2023)	Indonesia	Electronic land certificates	Legal recognition of digital records	Digital certificates strengthen legal certainty in land ownership
18.	Pilare et al. (2022)	Developing countries	GIS-based land administration	Spatial land data integration	GIS technologies support better land information management
19.	Rana et al. (2022)	India	Blockchain land registry	Secure digital land transactions	Blockchain systems increase trust in land administration
20.	Racetin et al. (2022)	Croatia	Blockchain land management	Digital land registry	Blockchain improves transparency and reduces fraud

No.	Author(s)	Country/ Context	Technology/ System Focus	Research Focus	Key Findings
21.	Sahni et al. (2022)	India	Blockchain framework	Land ownership verification	Blockchain-based systems strengthen data integrity
22.	Singh et al. (2023)	India	Blockchain land administration	Digital governance	Blockchain supports secure land administration platforms
23.	Tomic et al. (2022)	Europe	Digital cadastral infrastructure	Digital land registry	Integrated digital cadastral systems improve governance
24.	Yadav et al. (2022)	India	Blockchain land registry	Secure land transaction system	Blockchain increases reliability of land records

4.1 Technological Innovations and Digital Transformation Strategies in eLAS Implementation (RQ1)

The first research question examines the technological innovations and digital transformation strategies used in the implementation of electronic land administration systems. The reviewed literature demonstrates that governments increasingly adopt integrated digital technologies to modernize land administration infrastructures and improve land information management. Key technological components identified in the literature include Geographic Information Systems (GIS), integrated land information systems (LIS), spatial data infrastructures (SDI), blockchain-based land registries and cloud-based digital platforms (Bennett et al., 2024; Rajabifard et al., 2019).

Geospatial technologies, particularly GIS-based cadastral systems, are among the most widely implemented technologies in digital land administration initiatives. These technologies enable the integration of spatial data with legal land ownership records, thereby improving the accuracy and accessibility of land information (Chehrehbargh et al., 2024; Williamson et al., 2010). Integrated land information systems further enhance data interoperability by connecting cadastral databases, land registry records and administrative information systems into unified digital platforms that support land governance processes.

Recent studies have also explored the use of emerging digital technologies such as blockchain to strengthen transparency and security in land transactions. Blockchain-based land registry systems provide decentralized data management mechanisms that reduce the risk of data manipulation and improve trust in land administration processes (Alam et al., 2022; Racetin et al., 2022). From a technology management perspective, these innovations illustrate how digital transformation strategies can improve operational efficiency and data governance within land administration institutions (Vial, 2019).

4.2 Technological, Organizational and Institutional Factors Influencing eLAS Adoption (RQ2)

The second research question focuses on the technological, organizational and institutional factors that influence the adoption and implementation of electronic land administration systems. The reviewed literature indicates that successful technology adoption in land administration is shaped by multiple factors including technological readiness, institutional capability, governance frameworks and regulatory environments (Azadi et al., 2023; Hamamurad et al., 2022).

One of the most frequently reported challenges relates to land data integration and interoperability. Many countries maintain separate databases for cadastral information, land registries and geospatial datasets managed by different agencies. The lack of standardized data models and interoperability mechanisms can significantly hinder the integration of digital land administration systems (Nwafor et al., 2022; Rajabifard et al., 2019).

Legal and regulatory frameworks also play an important role in technology adoption. Several studies highlight that existing land administration laws were originally designed for paper-based administrative processes and may not adequately support digital land records or electronic land transactions (Ganason, 2022; Permadi, 2023). Consequently, legislative reforms are often required to establish the legal validity of electronic land records and digital transaction platforms.

Institutional capability is another factor influencing the success of digital land administration initiatives. Implementing eLAS requires strong institutional leadership, technical expertise and effective coordination among government agencies responsible for land governance (Bennett et al., 2024; Chehrehbargh et al., 2024). From the perspective of innovation adoption theory, these findings align with the Technology–Organization–Environment

(TOE) framework, which emphasizes that technology adoption depends on technological readiness, organizational capability and the external policy environment (Tornatzky & Fleischer, 1990).

4.3 Contributions of eLAS to Sustainable Land Governance (RQ3)

The third research question examines how eLAS contribute to improving land information management and advancing sustainable land governance. The findings indicate that digital land administration systems can significantly enhance transparency, efficiency and accessibility in land governance processes (Bennett et al., 2024; Williamson et al., 2010).

Electronic land administration platforms enable governments to digitize land records and provide online access to land information services. These digital platforms reduce administrative delays, improve the accuracy of land records and facilitate more efficient land transactions (Akumuntu, 2022; Chehrehbargh et al., 2024). In addition, integrated land information systems support better decision-making in land management by enabling the integration of spatial and legal land data.

The literature also highlights the role of digital land administration in supporting sustainable development objectives. Reliable land information systems contribute to improved land tenure security, transparent land markets and more effective land governance (Chigbu & Antonio, 2020; United Nations, 2015). From a technology management perspective, these findings demonstrate that eLAS can act as digital governance infrastructures that support more efficient and transparent land administration processes. However, the effectiveness of these systems depends on the ability of institutions to manage digital transformation initiatives and ensure interoperability across information systems.

4.4 Results Summary

The results of the systematic literature review highlight key patterns in the implementation of eLAS based on the analysis of the selected studies. Table 4 below, elucidates the systematic synthesis of the 24 selected studies, mapping the extant literature against the three primary research questions (RQs).

Table 4 *Thematic mapping and characteristics of selected studies*

Research Question	Main Theme	Sub-Themes	Initial Coding (Patterns Identified)	Selected Articles
RQ1: Technological innovations in eLAS	Digital Infrastructure Integration	Geospatial & Cadastral Technologies	GIS-based systems; spatial data integration; 3D cadastral models; digital mapping.	Pilare et al. (2022); Tomic et al. (2022); Bieliatynskyi et al. (2022).
		Distributed Ledger Technology	Blockchain registries; smart contracts; Ethereum frameworks; decentralized verification.	Alam et al. (2022); Rana et al. (2022); Sahni et al. (2022); Racetin et al. (2022); Christine et al. (2022).
		Cloud & Integrated Platforms	eLAS platforms; LIS integration; cloud-based data storage; interoperable databases.	Bobikova et al. (2022); Khalid et al. (2022); Yadav et al. (2022); Singh et al. (2023).
RQ2: Factors influencing eLAS adoption	Socio-Technical Determinants	Institutional & Organizational Readiness	Leadership commitment; staff technical expertise; change management; resource allocation.	Adesola (2024); Ganason (2022); Nwafor et al. (2022); Nyangweso & Gede (2022).
		Regulatory & Legal Frameworks	Electronic record validity; digital signature laws; legislative reform; regulatory sandboxing.	Abraham (2023); Permadi (2023); Halid & Nawawi (2023).
		Technical Interoperability	Data standardization; inter-agency coordination; siloed database barriers.	Hamamurad et al. (2022).

Research Question	Main Theme	Sub-Themes	Initial Coding (Patterns Identified)	Selected Articles
RQ3: Contributions to sustainable land governance	Sustainable Administration	Operational Efficiency & Transparency	Reduced transaction time; fraud mitigation; improved record accuracy; service accessibility.	Akumuntu (2022); Heriz & Boubakeur (2022); Langaliya & Gohil (2023).
		Strategic Land Governance	Land tenure security; transparent land markets; SDG alignment; data-driven policy.	Azadi et al. (2023).

The alignment between the reviewed articles and the RQs is established via a multi-stage abstraction process, moving from initial coding to the derivation of overarching themes. . For RQ1, the mapping reveals a significant scholarly pivot towards decentralized and spatial technologies, where articles by Alam et al. (2022) and Tomic et al. (2022) provide the empirical basis for understanding how Blockchain and GIS-based cadasters function as the 'digital bedrock' of modern land administration. In addressing RQ2, the connection is articulated through the lens of socio-technical challenges; here, the literature—led by Adesola (2024) and Abraham (2023)—critically identifies institutional readiness and regulatory modernization as the non-negotiable determinants of system integration. Finally, the link to RQ3 is substantiated by articles that evaluate the transformative impact of eLAS on sustainable development. Studies such as Akumuntu (2022) and Azadi et al. (2023) provide longitudinal insights into how digital transparency directly correlates with improved land tenure security and SDG alignment.

As summarized in Table 4 above, this thematic convergence underscores that the implementation of eLAS is not a series of isolated technical events, but a coordinated socio-technical evolution where technological affordances (RQ1) are mediated by organizational capabilities (RQ2) to achieve sustainable governance objectives (RQ3)

5. Discussion

The findings of this systematic literature review provide important insights into how the implementation of eLAS contributes to the digital transformation of land governance. The results reveal that the modernization of land administration systems is driven by the convergence of technological innovation, institutional capability and governance frameworks. These findings are consistent with broader digital transformation literature which emphasizes that public sector digitalization requires coordinated technological and organizational change processes rather than isolated technological interventions (Vial, 2019; Bennett et al., 2024; Chehrehbargh et al., 2024).

The synthesis of results transcends a mere technical narrative, suggesting that eLAS implementation operates as a socio-technical evolution rather than a standard software deployment. From the lens of Technology Management Theory, this convergence underscores that 'Strategic Alignment'—the synchronization between digital infrastructure and organizational goals—is the primary determinant of long-term sustainability (Vial, 2019). Unlike traditional public sector IT projects, digital land governance requires an agile governance posture to navigate the complex interplay between rigid legal mandates and rapidly evolving technological affordances (Bennett et al., 2024).

From a technology management perspective, the technological innovations identified in this review—such as Geographic Information Systems (GIS), blockchain-based land registries, integrated land information systems and spatial data infrastructures—represent critical components of digital transformation strategies in land governance (Rajabifard et al., 2019; Alam et al., 2022; Racetin et al., 2022; Rana et al., 2022; Sahni et al., 2022; Singh et al., 2023). These technologies enable governments to digitize land records, integrate spatial and legal datasets and provide digital services for land transactions. The increasing adoption of such technologies reflects the broader shift toward digital governance infrastructures that improve information accessibility, operational efficiency and transparency in public administration (Bennett et al., 2024; Vial, 2019). Furthermore, the use of advanced technologies such as blockchain highlights how emerging digital innovations can enhance trust, security and traceability in land administration systems (Alam et al., 2022; Racetin et al., 2022; Rana et al., 2022).

However, the results also demonstrate that technological innovation alone is insufficient to ensure successful implementation of electronic land administration systems. The adoption of digital land administration technologies is strongly influenced by organizational and institutional factors such as regulatory frameworks, governance structures and institutional readiness. These findings align with innovation adoption theories, particularly the Technology–Organization–Environment (TOE) framework and Diffusion of Innovation theory, which emphasize that technology adoption depends on technological readiness, organizational capability and

external policy environments (Rogers, 2003; Tornatzky & Fleischer, 1990). In the context of land governance, these factors manifest through the need for regulatory reforms, inter-agency coordination and institutional capacity building to support digital transformation initiatives (Ganason, 2022; Permadi, 2023; Azadi et al., 2023).

The review also highlights that data interoperability and institutional coordination remain key challenges in implementing electronic land administration systems. Many land administration institutions maintain fragmented databases for cadastral information, land registry records and spatial datasets, which limits the ability to integrate information systems effectively (Hamamurad et al., 2022; Nwafor et al., 2022; Nyangweso & Gede, 2022). Similar challenges have been reported in other digital governance initiatives where institutional silos and incompatible data standards hinder information system integration (Rajabifard et al., 2019; Bennett et al., 2024). Addressing these issues requires not only technological solutions but also institutional governance mechanisms that promote data sharing, interoperability standards and coordinated digital transformation strategies. Also, to bridge this, the research advocates for Regulatory Sandboxing as part of Regulatory Framework in eLAS implementation framework to test digital innovations within a controlled legal environment before full-scale national implementation.

Another important insight emerging from this review relates to the role of eLAS in advancing sustainable land governance. The findings show that digital land administration platforms improve land information management, enhance transparency in land transactions and facilitate more efficient public service delivery (Akumuntu, 2022; Langaliya & Gohil, 2023; Pilare et al., 2022). These improvements contribute to broader development objectives by strengthening land tenure security, supporting transparent land markets and improving access to land-related services (Chigbu & Antonio, 2020; United Nations, 2015; Williamson et al., 2010). Consequently, eLAS can be understood as a digital governance infrastructure that enables governments to manage land resources more effectively while supporting sustainable development goals.

Ultimately, eLAS serves as the digital backbone for achieving the UN-SDGs. However, a critical reflection on the findings suggests that 'Digital Transparency' must be balanced with 'Data Sovereignty.' The transition to digital systems must not inadvertently exacerbate the digital divide among marginalized landholders. Therefore, this study concludes that sustainable land governance is only achievable when technology is deployed as an inclusive instrument of equity, rather than a tool for administrative exclusion (Chigbu & Antonio, 2020).

The findings of this study also contribute to the growing body of knowledge on digital transformation in the public sector. Previous research on land administration has primarily focused on technological innovations or legal frameworks in isolation. In contrast, the present study synthesizes evidence across technological, organizational and governance dimensions to provide a more comprehensive understanding of how digital land administration systems are implemented (Heriz & Boubakeur, 2022; Halid & Nawawi, 2023; Nwafor et al., 2022). By integrating insights from technology management theory and land governance research, this study highlights the importance of aligning digital technologies with institutional capability and governance readiness.

Furthermore, the findings reinforce the view that digital transformation in land administration should be managed as a strategic technology management initiative rather than a purely technical modernization project. Successful implementation requires strong leadership, institutional coordination and long-term policy commitment to support digital innovation and system integration (Bennett et al., 2024; Chehrehbargh et al., 2024). Governments seeking to modernize land administration systems should therefore adopt integrated technology management strategies that combine technological infrastructure development with organizational capacity building and regulatory modernization. Figure 7 below show a framework illustrates the interaction between digital transformation governance, information system integration, innovation adoption and institutional capability, which collectively enable the implementation of electronic land administration systems and contribute to sustainable land governance outcomes.

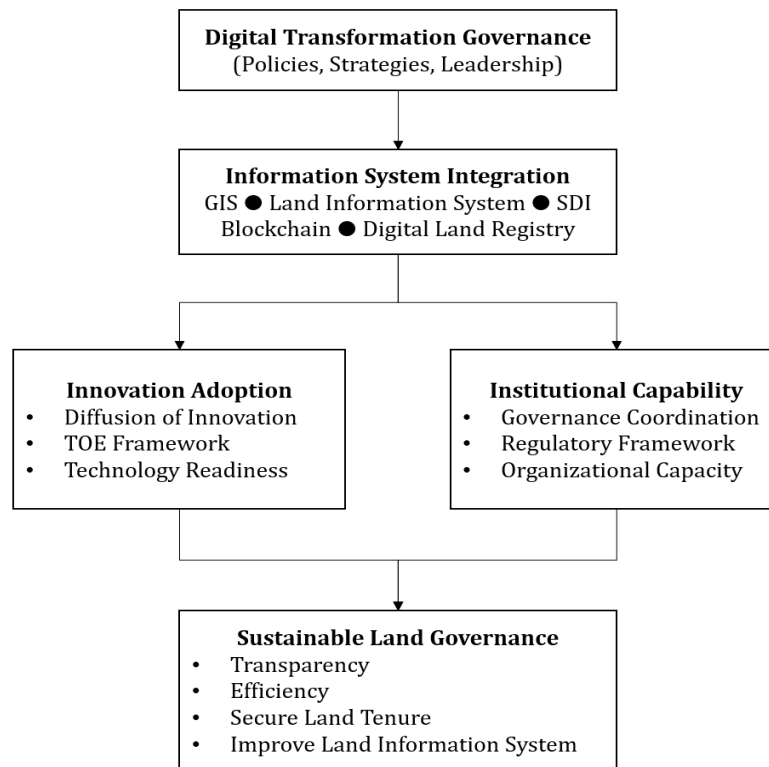


Fig. 7 Integrated technology management framework for eLAS implementation

Overall, the discussion highlights that the digital transformation of land governance through electronic land administration systems is a multidimensional process involving technological innovation, institutional capability and governance frameworks. The integration of these elements is essential for achieving effective and sustainable digital land administration systems.

6. Conclusion

This study concludes that the successful implementation of Electronic Land Administration Systems (eLAS) is a multidimensional socio-technical evolution rather than a mere technical upgrade. From a theoretical perspective, the research bridges the gap between Technology Management Theory and land governance by demonstrating that 'Strategic Alignment', the harmony between digital infrastructure and organizational capability is the core driver of transformation (Vial, 2019). By synthesizing evidence from 24 high-impact studies (2022-2024), this review provides a novel integrated framework that connects the TOE (Technology-Organization-Environment) framework directly to Sustainable Development Goals (SDGs), offering a robust conceptual foundation for future digital governance scholarship.

From a technology management perspective, the study highlights the importance of strategic digital transformation governance in guiding the adoption and integration of electronic land administration systems. The findings suggest that effective implementation requires coordinated technology management strategies that align technological infrastructure with institutional capacity, regulatory frameworks and inter-agency collaboration. These insights offer important policy implications for governments and land administration agencies seeking to modernize land governance systems and improve public service delivery. Policymakers should prioritize investments in digital infrastructure, interoperability standards and institutional capacity building to ensure the sustainability of digital land administration initiatives. Future research should further explore empirical case studies of eLAS implementation across different national contexts and examine emerging technologies such as artificial intelligence, blockchain interoperability and spatial data infrastructures in digital land governance. Such research will contribute to advancing knowledge on technology-enabled land administration and support the development of more resilient and sustainable digital land governance systems.

To translate these findings into real-world applications, practitioners and land administrators should adopt the following actionable strategies:

- **Prioritize Interoperability Standards:** Agencies must move beyond 'digital silos' by implementing unified data protocols that enable real-time sharing between cadastral, legal, and financial land records (Bennett et al., 2024).

- **Adopt Regulatory Sandboxing:** Policymakers should establish controlled legal environments to test digital certificates and blockchain transactions before full-scale national deployment, ensuring legal validity without stifling innovation (Permadi, 2023).
- **Continuous Institutional Upskilling:** Implementation must be accompanied by rigorous change management programs that focus on digital literacy for staff and leadership, addressing the 'human barrier' often found in bureaucratic institutions (Adesola, 2024)

In terms of policy context, governments must recognize eLAS as a 'critical digital infrastructure' that requires long-term fiscal commitment and legislative modernization. Digital land governance is only sustainable when it promotes digital equity; therefore, policies must ensure that modernization does not disenfranchise marginalized landholders. Future research should prioritize empirical case studies on the impact of Artificial Intelligence (AI) in land valuation and the role of blockchain interoperability in cross-border land transactions. Such advancements will be instrumental in fostering resilient, transparent, and inclusive land governance systems globally.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

*The authors confirm contribution to the paper as follows: **study conception and design:** Kamarul Akhtar Idris, Abdul Halim Hamzah; **data collection:** Kamarul Akhtar Idris; **analysis and interpretation of results:** Kamarul Akhtar Idris, Abdul Halim Hamzah; **draft manuscript preparation:** Kamarul Akhtar Idris. All authors reviewed the results and approved the final version of the manuscript.*

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