Inhibiting and Supporting Factors of Land Administration Interoperability from a Governance Networks Perspective

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Digitizing land services through electronic land certificates is part of the digital public administration agenda in Indonesia. However, its implementation still faces serious challenges related to system interoperability between agencies. This study aims to analyze strategies for developing electronic land certificate interoperability in land administration in Indonesia. The study used a qualitative approach with an exploratory design through semi-structured interviews, policy document studies, and thematic analysis. The results indicate that interoperability is suboptimal due to system fragmentation, regulatory disharmony, and limited cross-agency coordination. This study emphasizes that interoperability is not merely a technical issue but also an issue of digital public administration governance. This research contributes to the development of a strategic framework for land administration interoperability that focuses on legal certainty and effective public services.

Keywords: Interoperability, Electronic Land Certificates, Land Administration, Digital Public Administration

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1. Introduction

The transformation of public administration toward digital government has fundamentally changed how the state manages information, coordinates institutions, and delivers public services. The digitalization of public services is no longer understood merely as a process of technology adoption, but rather as a governance reform process that requires institutional integration, regulatory alignment, and cross-sectoral coordination capacity[1]. One of the government's policy initiatives in the transformation of land administration is the implementation of electronic land certificates as part of the modernization of land administration services[2].

Although electronic land certificates have been implemented as a public service innovation, practical implementation indicates that digitalization continues to face structural challenges in the form of system fragmentation and weak inter-agency interoperability[3]. Land administration involves multiple governmental actors with different mandates, information systems, and data standards at both central and local levels. This lack of integration not only creates technical barriers to data exchange, but also limits the capacity of digital public administration governance to manage cross-sectoral services in an integrated manner[4].

Most existing studies on the interoperability of land administration services and electronic land certificates remain dominated by technical and information systems perspectives, which frame interoperability primarily as an issue of application integration, infrastructure compatibility, or data security. This approach tends to assume that improvements in technological capacity will automatically generate interoperability[5][6]. However, from a public administration perspective, this assumption is problematic

because it overlooks institutional, regulatory, and organizational dimensions that fundamentally determine the state's ability to produce sustainable interoperability.

This study is grounded in the conceptual novelty that interoperability in electronic land certification should not be approached merely as a technological issue, but rather as a capacity of digital public administration governance. Interoperability is conceptualized as the institutional capability of government to align mandates, integrate business processes, and coordinate cross-agency actors within a coherent policy and regulatory framework[7]. Consequently, interoperability failure cannot be reduced to technological system failure alone, but should be understood as an indication of weaknesses in the design and practice of digital public governance.

From a public administration perspective, system fragmentation in electronic land certification reflects more fundamental governance problems, including suboptimal cross-agency coordination mechanisms, regulatory misalignment, and limited institutional leadership in managing digital public services. This condition suggests that the digitalization of land administration risks reproducing bureaucratic silos in digital form if it is not accompanied by an interoperability strategy oriented toward governance reform.

Based on this conceptual framework, this study seeks to address two main research questions: first, how the current condition of interoperability in electronic land certification within land administration in Indonesia can be characterized; and second, what factors hinder and facilitate the development of interoperability in electronic land certification within the framework of digital public administration. By positioning interoperability as a public administration issue rather than a purely technical problem, this study aims to fill a gap in the literature that has thus far been overly technocratic, while also contributing theoretically and practically to the strengthening of digital land governance in Indonesia.

2. Literature Review and Problem Statement

The concept of digital public administration emphasizes that digital transformation in government extends beyond the mere adoption of information and communication technologies and involves fundamental changes in how the state manages information, coordinates institutions, and delivers public services[8]. Within this framework, interoperability emerges as a key determinant of successful cross-sectoral and multi-level digital service integration. Without adequate interoperability, digitalization risks reinforcing bureaucratic fragmentation in digital form rather than fostering an integrated and efficient public administration system.

Digital Public Administration and Interoperability

The digital government paradigm highlights a shift from isolated internal digitalization toward user-oriented, integrated public services and cross-agency collaboration (Klijn & Koppenjan, 2016; Koliba et al., 2018). In this context, public service delivery increasingly takes place within governance networks, where multiple governmental actors are interdependent and engaged in complex institutional, strategic, and substantive relationships. Governance network theory emphasizes the importance of network management in facilitating inter-organizational collaboration and enhancing democratic legitimacy in public service provision[9][10]. Empirical studies further demonstrate that effective digital government requires alignment between technological infrastructure, organizational arrangements, and public policy frameworks[11].

In Indonesia, the Electronic-Based Government System policy serves as the primary institutional framework for promoting inter-agency integration and data exchange across government entities[12]. The policy aims to reduce application fragmentation and improve administrative efficiency through a unified system architecture. However, existing studies indicate that the success of this policy is highly contingent upon institutional interoperability capacity rather than technological readiness alone. This suggests that

governance arrangements, coordination mechanisms, and regulatory coherence are critical determinants of effective digital integration[13][14].

The interoperability literature identifies several key dimensions, including technical, semantic, organizational, and legal interoperability[15]. Technical interoperability refers to the ability of information systems to connect and exchange data, while semantic interoperability concerns the consistency of data meanings and definitions across systems. Organizational interoperability involves coordination mechanisms, role distribution, and inter-agency collaboration, whereas legal interoperability relates to regulatory compatibility and the legitimacy of data exchange practices. Prior studies indicate that interoperability failures often stem not from technical limitations but from weaknesses in organizational and legal arrangements that receive insufficient attention in digital government design[16].

Digital Land Administration and Electronic Land Certification

Digital land administration represents one of the most complex domains of digital public administration due to the multidimensional nature of land-related data, which encompasses spatial, legal, and administrative components that must remain consistent and accurate[4]. Land information also carries high legal and economic value, meaning that data inconsistencies or misalignment can undermine legal certainty and public trust. Consequently, digital transformation in land administration presents unique governance challenges that extend beyond technical system integration.

Previous studies demonstrate that digital land administration involves multiple governmental actors and heterogeneous information systems, including land agencies, local governments, population registries, taxation authorities, and judicial institutions. Each of these actors operates under distinct institutional mandates, data standards, and organizational interests, thereby increasing the risk of system fragmentation[3]. In the context of electronic land certification, reliance on cross-agency data exchange makes interoperability a fundamental prerequisite for effective service delivery.

Several studies caution that digitalizing land administration without robust interoperability frameworks may reproduce longstanding administrative problems in digital form, such as data duplication, overlapping authorities, and legal uncertainty. Rather than enhancing efficiency and transparency, poorly integrated digital systems can reinforce bureaucratic silos and degrade service quality. Accordingly, the literature emphasizes that electronic land certificates should be conceptualized not merely as technological products but as components of a broader digital public administration system that requires comprehensive and sustainable interoperability governance.

2.3. Problem Statement and Research Gap

Despite the growing recognition of interoperability as a central requirement for digital public administration, existing research on electronic land certification remains heavily skewed toward technical and information systems perspectives. This technocratic orientation tends to assume that improving system architecture, applications, or cybersecurity will automatically generate interoperability outcomes[6]. However, public administration scholarship suggests that institutional coordination, regulatory alignment, and organizational capacity are decisive factors in enabling sustainable interoperability across government systems[15][16].

This discrepancy reveals a significant research gap in the current literature. While technical interoperability has received substantial attention, the governance dimensions of interoperability in electronic land certification, particularly in the context of Indonesia's multi-level administrative structure, remain underexplored. There is limited empirical understanding of how organizational arrangements, inter-agency

coordination mechanisms, and regulatory frameworks shape interoperability outcomes in digital land administration.

Accordingly, this study positions interoperability in electronic land certification as a digital public administration governance capacity rather than a purely technical problem. By integrating perspectives from digital government theory and land administration studies, this research seeks to provide a more comprehensive analytical framework for evaluating existing interoperability conditions and identifying institutional, organizational, and regulatory factors that hinder or facilitate effective interoperability. This approach contributes to addressing the technocratic bias in the literature and offers theoretically grounded and practically relevant insights for strengthening the governance of digital land administration in Indonesia.

3. Method

This study adopts a qualitative approach with an exploratory research design to examine interoperability in digital land administration within the broader framework of digital public administration in Indonesia. This methodological orientation is selected because interoperability in land administration represents an emerging and evolving phenomenon in public sector digital transformation. A qualitative exploratory design enables an in depth understanding of how interoperability is implemented in practice, the factors that shape its development, and the governance strategies that influence the quality of digital land administration [17][18].

The research focuses on exploring the institutional, organizational, semantic, and technical dimensions of interoperability in the integration of land information systems, inter-agency data exchange, and coordination across government institutions. This approach allows the study to capture the perceptions, experiences, and interpretations of key actors involved in the management and utilization of digital land administration systems. The analysis is guided by theoretical frameworks on interoperability and digital public administration, enabling the identification of patterns and governance dynamics that shape interoperability practices in land administration.

Purposive sampling is employed to select participants who possess relevant knowledge and professional experience related to interoperability in land administration and inter-agency system integration. The participants include officials from the land administration authority, representatives of local governments, data supporting agencies such as civil registration and taxation authorities, as well as land deed officials who are directly engaged in land administration services. Selection criteria include direct involvement in digital land administration systems, experience in cross-agency coordination, and the ability to provide reflective insights into interoperability practices and their implications for digital public administration.

Data are collected through semi structured in depth interviews and non participant observations conducted at land administration service offices. Semi structured interviews are used to explore interoperability practices, data exchange mechanisms, and the technical, organizational, and regulatory challenges encountered in implementation. This interview format ensures consistency across participants while allowing flexibility to probe emerging issues during the research process. The interview guide is developed based on a review of the interoperability and digital government literature, ensuring conceptual alignment with established theoretical models.

Interviews are conducted through face to face interactions and video conferencing, depending on participant availability and contextual constraints. Open ended questions are employed to encourage participants to articulate their experiences regarding system integration, inter-agency coordination, and the perceived impacts of interoperability on service delivery. Observational data complement interview findings

by providing contextual insights into everyday practices and institutional routines within digital land administration settings.

Data analysis follows a thematic analysis procedure involving systematic coding, categorization, and theme development. This analytical strategy facilitates the interpretation of empirical findings in relation to the conceptual dimensions of interoperability and digital public administration governance. The iterative coding process enhances analytical rigor and supports the identification of cross-cutting patterns across institutional contexts [17].

To ensure research ethics and trustworthiness, participants are informed about the objectives of the study, the voluntary nature of participation, and their right to withdraw at any stage without adverse consequences. Informed consent is obtained prior to data collection, and confidentiality as well as anonymity of participants are strictly maintained. Methodological rigor is further strengthened through careful documentation of analytical procedures and reflexive engagement with the data to enhance the credibility and dependability of the research findings[19].

4. Results and Discussion

Interoperability of Electronic Land Certificates

The national achievement of the Electronic-Based Government System index, which has exceeded the annual target with a score of 3.12 on a scale of 5 in the Good category, indicates that, from a formal–administrative perspective, Indonesia is on the right track in strengthening digital government governance. This readiness is mainly reflected in the policy, institutional, and governance framework aspects of SPBE. This condition is in line with empirical findings at the Central Jakarta Land Office of the National Land Agency, which show very high and consistent public service performance over the last three years, as reflected in the Community Satisfaction Index and the Corruption Perception Index, both of which fall within the very good range. These high performance achievements indicate that digital transformation has been effectively utilized at the organizational unit level to improve service quality and bureaucratic integrity. However, these findings also emphasize that normative success and service performance at the institutional level do not automatically represent the effectiveness of cross-sectoral interoperability at the national level. In other words, the achievement of the SPBE index and user satisfaction more strongly reflects internal organizational performance rather than systemic integration among agencies. Therefore, the main challenge of electronic land certificate interoperability does not lie in technology adoption or the quality of individual services, but in cross-sectoral and interregional synchronization that remains uneven.

Overall, informants' perceptions reflect the view that interoperability in land administration services is a functional necessity, but it has not yet been fully internalized as a cross-sectoral institutional mandate. Interoperability is still practiced in a partial and contextual manner and depends on the initiatives and capacities of certain agencies, so it has not yet formed an integrated and nationally consistent electronic land administration service system. The details can be seen in Figure 1 below.

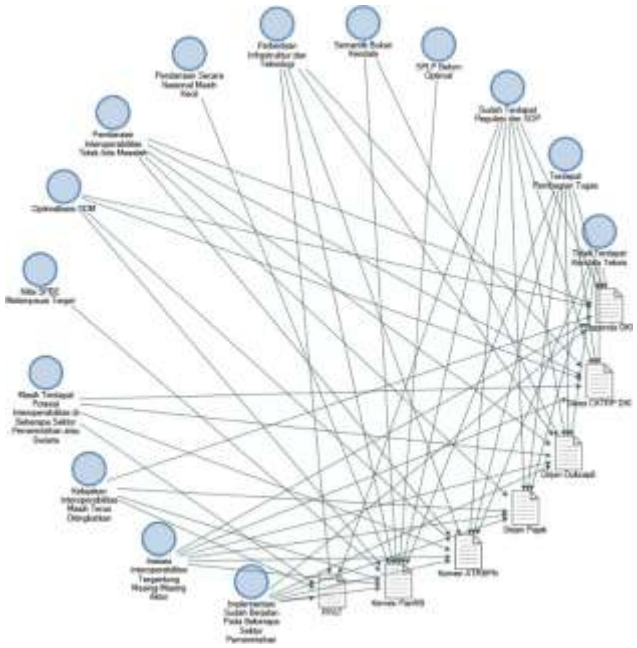

Figure 1 General Overview of Interoperability According to Informants' Perspectives

Interoperability of Electronic Land Certificates

The results indicate that interoperability in government services has begun to be implemented, particularly in sectors with high demand for cross-agency services. In the context of land administration, interoperability remains partial and sectoral, mainly limited to integration with population administration and central and local taxation systems. This pattern indicates that the initiation of interoperability is highly dependent on the commitment and interests of individual agencies, rather than on a systemic national drive. The governance networks perspective emphasizes that cross-agency collaboration will only function effectively when supported by shared rules and institutionalized network management, rather than merely by individual actors' initiatives[9]. Thus, interoperability in land administration to date is still more often understood as a policy option or an innovation project in government services, rather than as a structural obligation within digital government governance.

a. Legal Interoperability
   From a legal perspective, the regulatory framework for interoperability in public administration is essentially available through the Electronic-Based Government System policy and related regulations. However, these regulations remain general in nature and have not yet been fully operational in driving cross-agency service integration. The absence of thematic, service-based regulations has led to differences in interpretation among agencies, particularly regarding the formulation of cooperation agreements (MoU/PKS), the determination of types of data to be exchanged, and the classification of public and personal data. This lack of clarity encourages excessive caution in data exchange, which ultimately hampers interoperability
   In implementation, interoperability regulations are also not coercive in nature. Dependence on individual actors' initiatives indicates that regulations function more as an enabling framework than as a controlling instrument. Therefore, the main legal challenge lies in strengthening the binding force of regulations and harmonizing cross-agency policies so that interoperability of electronic land certificates is not only normatively permitted, but also operationally facilitated and mandated.
b. Organizational Interoperability
   At the national level, coordination structures for interoperability have been established through various institutional mechanisms, such as the National SPBE Coordination Team and the Government

Digital Transformation Acceleration Committee. These structures demonstrate a formal division of roles among agencies. However, organizational interoperability remains dominated by administrative coordination patterns and has not yet evolved into cross-sectoral collaboration based on thematic public services. In the context of land administration, the involvement of strategic actors such as the Directorate General of Taxes, Regional Revenue Agencies, the State Asset Management Agency (LMAN), the banking sector, and the Financial Services Authority (OJK) has not been systematically formalized, despite their substantive interest in land-related data. In terms of funding resources, budget availability at the agency level is not a major constraint, but nationally the allocation for interoperability remains limited relative to the complexity of cross-sectoral integration. Differences in fiscal capacity, institutional maturity, and infrastructure across regions further widen the gap in the level of interoperability maturity.

c. Semantic Interoperability
The semantic dimension does not emerge as a significant constraint in this study. Standardization of data meanings and structures is considered relatively well established, supported by the One Data Indonesia policy, the use of a single reference database, and clarity in the definition of administrative and legal-formal data in land services. A shared understanding among agencies is also reinforced by adequate civil servant capacity in comprehending cross-system terminology. This condition indicates that interoperability challenges in Indonesia have shifted from issues of data meaning toward problems of organizational governance and policy implementation, differing from the European Interoperability Framework context, which still positions semantic issues as a major challenge in cross-country interoperability.

d. Technical Interoperability
From a technical perspective, most informants indicate that there are no significant obstacles. Interoperability in principle utilizes existing data, with relatively minor technical adjustments. This finding confirms that the main barriers to interoperability do not lie in technology itself, but rather in legal, organizational, and governance aspects. Nevertheless, the suboptimal utilization of the Government Service Linkage System (SPLP) indicates a gap between the national SPBE architecture design and implementation practices in the field, where host-to-host solutions are more frequently chosen because they are perceived as faster and more pragmatic. Overall, interoperability of electronic land certificates is currently in a transitional phase from partial interoperability toward systemic interoperability. The main challenges lie in strengthening thematic regulations, cross-actor coordination, consistent utilization of SPLP, and alignment of funding policies.

Factors Inhibiting Interoperability of Electronic Land Certificates

This study identifies various inhibiting factors, including the complexity of public administration, differences in levels of authority and organizational interests, sectoral ego, lengthy cooperation agreement procedures, excessive caution related to personal data protection, limitations in human resources, suboptimal utilization of the Government Service Linkage System, and disparities in technological readiness across agencies and regions. From the governance networks perspective, this configuration of factors reflects the presence of strategic complexity, institutional complexity, and substantive complexity, which interact and result in interoperability being implemented only partially.

Table 1. Inhibiting Factors of Interoperability

Interoperability Dimension	Inhibiting Factor	Characteristics of the Barrier	Critical Analysis	Implications for Interoperability
Regulation	Personal Data Protection	High level of caution in data exchange without clear operational mechanisms	Data protection regulations have not fully provided technical guidance and governance arrangements that balance data security and integration needs	Data exchange becomes defensive and slows down interoperability
Regulation	Partial Cooperation Agreements	Cross-agency cooperation is partial and not systemically binding	Cooperation agreements are positioned as administrative prerequisites rather than strategic instruments of interoperability	Service integration remains limited and unsustainable
Regulation	Lengthy Agreement Procedures	Multi-layered and time-consuming approval processes	Rigid legal-formal approaches are not aligned with the need for rapid digital service integration	Acceleration of interoperability is hindered
Organization	Multiple Types of Public Administration	High complexity of cross-sectoral services and processes	Bureaucratic fragmentation increases coordination needs and complicates system integration	Interoperability requires high coordination efforts and often remains partial
Organization	Differences in Authority Levels, Organizational Interests, and Sectoral Ego	Lack of shared perception of interoperability as a collective interest	Organizations act autonomously and strategically, making integration dependent on individual priorities	Interoperability becomes inconsistent and not institutionalized
Organization	Budget Efficiency and Clearance	Multi-layered budgeting processes and limited funding allocation	Budgeting remains sectoral rather than service-oriented	Interoperability implementation is slow and uneven
Organization	Insufficient Human Resources	Shortages in the number and technical competence of personnel	Digital transformation is not accompanied by organizational capacity building	Sustainability and quality of interoperable systems are low
Semantic	–	No significant barriers identified	Uniform terminology and data structures across agencies have been established	Semantic interoperability is relatively mature and not a constraining factor
Technical	Suboptimal Utilization of GSLS	Uneven and inconsistent use of the Government Service Linkage System	Weak technical orchestration between national architecture design and field practices	System integration risks fragmentation

Interoperability Dimension	Inhibiting Factor	Characteristics of the Barrier	Critical Analysis	Implications for Interoperability
Technical	Rapid Technological Change and Technological Readiness	Differences in infrastructure readiness and technological adaptation across agencies and regions	Technical adaptation is not always accompanied by organizational and policy readiness	Interoperability is difficult to sustain

Source: Processed research data, 2026

Supporting Factors for Interoperability of Electronic Land Certificates

Regarding supporting factors, the study shows that interoperability strengthening is also supported by a combination of external and internal organizational factors that shape a relatively conducive digital governance ecosystem. Public pressure for fast, transparent, and integrated services, as well as agency participation in national performance indices and evaluations, creates institutional incentives that encourage interoperability improvement. These external factors are reinforced by internal determinants, such as visionary organizational leadership, the alignment of interoperability within institutional visions and missions, shared interests among agencies, understanding of interoperability benefits, availability of human resources, technological advancement, and attention to data security, which collectively strengthen trust and commitment among actors in sharing data and systems.

Table 2. Supporting Factors of Interoperability

Interoperability Dimension	Factor	Factor Characteristics	Critical Analysis	Implications for Interoperability
Regulation	Data Security	Emphasis on data protection and security	Data security is a prerequisite for the legitimacy of cross-agency data exchange; effectiveness depends on the clarity of derivative regulations and operational mechanisms	Increases inter-agency trust and opens wider opportunities for interoperability
Regulation	Ongoing Regulatory Development	Regulatory updating and adaptation	Regulatory development reflects policy responsiveness to interoperability needs, although it may create implementation gaps	Provides medium-term legal certainty for system integration
Organization	Participation in Indices, Assessments, and Events	Reputational and evaluative incentives	National indices and assessments create performance incentives for agencies to prioritize interoperability	Interoperability is positioned as part of institutional performance
Organization	Organizational Leadership	Leadership commitment and direction	Leadership plays a key role in aligning interests and overcoming sectoral ego	Strengthens cross-unit coordination and

Interoperability Dimension	Factor	Factor Characteristics	Critical Analysis	Implications for Interoperability
				integration sustainability
Organization	Shared Organizational Interests	Alignment of service objectives	Shared interests reduce coordination costs and increase willingness to share data	Interoperability becomes more stable and less dependent on individuals
Organization	Inclusion in Strategic Plans, Vision, and Mission	Strategic institutionalization of interoperability	Institutionalization in strategic documents indicates a shift from technical projects to organizational agendas	Ensures sustainability and consistency of implementation
Organization	Adequate Human Resources	Availability and competence of personnel	Adequate human resources enable organizations to manage interoperability independently and sustainably	Reduces external dependence and improves integration quality
Technical	Supporting Technology	Available infrastructure and platforms	Technological availability indicates that interoperability is no longer a basic technical issue but one of orchestration and governance	Enables faster and more efficient system integration
External	Public Pressure	Demand for fast and transparent services	External pressure acts as a catalyst for organizational change, encouraging agencies to open up to service integration	Accelerates the adoption of interoperability as a public service necessity
External	Perceived Benefits of Interoperability	Shared understanding of the value of data	Awareness of benefits strengthens shared meaning regarding cross-agency data and services	Strengthens alignment in understanding and data utilization

Within the governance networks framework, these findings are consistent with the concepts of strategic network management, institutional support, and substantive network capacity as prerequisites for the success of cross-actor collaboration. The theoretical contribution (novelty) of this study lies in emphasizing that external legitimacy pressures through evaluative mechanisms such as indices, performance assessments, and public demands function as significant leverage (external leverage) in accelerating digital government interoperability. These findings complement the governance networks theoretical framework, which has so far emphasized internal network factors, by demonstrating that external legitimacy dynamics

also play an important role in shaping the behavior and commitment of actors within digital governance networks.

5. Conclusion

This study concludes that the interoperability of electronic land certificates in Indonesia has demonstrated significant progress at the normative and institutional levels, as reflected in the achievement of the national Electronic-Based Government System index that exceeded the target and the very high service performance of the Central Jakarta Land Office of the National Land Agency based on the Community Satisfaction Index and the Corruption Perception Index. These findings indicate that digital transformation has been effectively utilized at the organizational level to enhance service quality and bureaucratic integrity. However, such achievements do not automatically translate into effective, systemic, and evenly distributed cross-sector interoperability at the national level. The results show that interoperability in land administration remains partial and sectoral, primarily limited to integration with population administration and taxation. This condition reflects the interaction of strategic complexity, institutional complexity, and substantive complexity within governance networks, which constrains effective cross-agency collaboration. The main obstacles are legal and organizational, including weak thematic operational regulations, lengthy cooperation procedures, and unstructured coordination, while semantic aspects are relatively mature and technical infrastructure is largely available but inconsistently utilized. This study also highlights the role of external legitimacy pressures, leadership, organizational alignment, and shared interests as key enablers of interoperability. Overall, electronic land certificate interoperability is in transition toward a more systemic model, with future challenges centered on governance reform rather than technology alone.

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