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Land Management Solutions in the Context of Digital Transformation

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Abstract: In the context of Vietnam's national digital transformation strategy, the digitalization of land management has become a critical priority to enhance transparency, efficiency, and accountability in public governance. This study examines the theoretical foundations, practical progress, and international experiences of digital land administration, with the aim of identifying feasible solutions for Vietnam. Using a mixed-method approach that combines policy analysis, comparative case studies, and expert consultation, the research evaluates the benefits, costs, and institutional challenges of land digitalization. The findings indicate that digital transformation has significantly improved administrative efficiency, shortened processing times, and reduced transaction costs and disputes. However, substantial gaps remain in data infrastructure, inter-agency coordination, and human resource capacity, particularly in mountainous and rural areas. The study proposes three core policy directions: (i) improving the legal and institutional framework for electronic land transactions, (ii) developing an integrated and secure spatial data infrastructure, and (iii) enhancing digital skills and governance capacity among local officials. These recommendations aim to promote a modern, transparent, and sustainable land management system aligned with Vietnam's vision of a digital government and data-driven economy.

Keywords: *Digital Transformation; Land Administration; Institutional Framework; Cadastral Data; E-Governance; Policy Innovation.*

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I. INTRODUCTION

Digital transformation has become a defining trend in global public governance, reshaping how governments manage information, deliver public services, and engage with citizens. According to Kitchin (2014), digital technologies—particularly data infrastructures and analytics—have transformed governance from rule-based administration into data-driven management. In this context, the land administration sector has emerged as one of the most data-intensive domains, where the integration of digital systems can significantly enhance transparency, efficiency, and accountability (World Bank, 2021).

In Vietnam, the Government has recognized digital transformation as a national priority. Decision No. 749/QĐ-TTg, dated June 3, 2020, approved the "National Digital Transformation Program to 2025, with a Vision to 2030," which emphasizes the development of digital government, digital economy, and digital society. Within this framework, land administration—being a foundation of sustainable development and public revenue—plays a central role in modernizing administrative services (Government of Vietnam, 2020).

International experience demonstrates that the adoption of technologies such as Geographic Information Systems (GIS), Big Data, blockchain, and artificial intelligence (AI) has revolutionized land management processes. Countries like Estonia, South Korea, and Singapore have built integrated electronic land administration systems that allow most transactions to be processed online, reducing registration time from several weeks to a few days (Li, Zhang, & Chen, 2020; FIG & UNECE, 2022). These systems not

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only improve efficiency but also strengthen legal security, minimize disputes, and support digital economies (FAO & FIG, 2022).

In Vietnam, the Ministry of Natural Resources and Environment (MONRE) has made notable progress in building a national cadastral database and promoting online public services. However, challenges persist—especially in data standardization, system interoperability, and human resource capacity across provinces (MONRE, 2023). Most domestic studies to date have focused on the technical or administrative aspects of land digitalization but have not sufficiently analyzed the institutional and governance dimensions that determine implementation effectiveness (Nguyen & Pham, 2022).

Therefore, this study aims to fill that research gap by analyzing the theoretical foundations and current progress of Vietnam's digital land management, comparing international experiences, and proposing practical policy solutions. The overarching objective is to identify how institutional reforms, data infrastructure, and human capacity can interact to create an efficient, transparent, and citizen-centered digital land administration system.

II. THEORETICAL FRAMEWORK AND METHODOLOGY

➢ *Theoretical Framework*

Land administration is a core component of public governance and sustainable development, as it determines how land resources are allocated, used, and protected. According to Li, Zhang, and Chen (2020), modern land management extends beyond cadastral measurement and registration to encompass the collection, integration, and utilization of spatial and socioeconomic data that inform policy decisions. Digital transformation, in this context, refers to the systematic application of advanced information and communication technologies—such as Geographic Information Systems (GIS), Big Data, blockchain, and artificial intelligence (AI)—to improve the efficiency, transparency, and accountability of land governance (Kitchin, 2014; Batty et al., 2012).

The conceptual foundation of this study is based on three interrelated pillars that determine the success of digital land administration:

- *Institutional and Legal Framework:*

Effective governance requires clear regulations defining property rights, digital signatures, data sharing, and cybersecurity (FAO & FIG, 2022; Government of Vietnam, 2024).

- *Technological and Data Infrastructure:*

The deployment of interoperable and secure databases, spatial data infrastructures (SDI), and open data platforms enables information exchange among government agencies, businesses, and citizens (FIG & UNECE, 2022).

- *Human and Governance Capacity:*

Skilled personnel and adaptive organizational culture are essential for maintaining the long-term sustainability of digital transformation (Tran, Do, & Tran, 2024).

These three components form the theoretical model adopted in this study, in which institutional arrangements provide direction, technology serves as the operational instrument, and human capacity acts as the driving force ensuring the system's effectiveness. This integrated framework aligns with FAO's digital governance model, which views land information systems as socio-technical ecosystems rather than merely technological infrastructures (FAO, 2022).

➢ *Research Methodology*

To ensure comprehensive and reliable results, this study employed a mixed-method approach, combining qualitative and quantitative analyses. The methodology consisted of four stages:

- *Policy and Legal Analysis:*

The research reviewed and compared key legislative documents, including the Land Law (2013), Revised Land Law (2024), and Decree No. 13/2023/NĐ-CP on personal data protection. This analysis identified legal gaps and inconsistencies that affect the digitalization process (Government of Vietnam, 2023; 2024).

- *Comparative International Study:*

A cross-country comparison was conducted using case studies from South Korea, Estonia, and Singapore—countries that have successfully implemented integrated digital land systems (Li et al., 2020; FIG & UNECE, 2022). The comparison focused on governance structure, data management, and citizen access to digital land services, enabling Vietnam-specific policy lessons to be drawn.

- *Expert Consultation and Qualitative Synthesis:*

Semi-structured interviews and expert workshops were conducted with specialists in land administration, information technology, and public management. Their insights were synthesized to evaluate the benefits, costs, and potential risks of land digitalization in Vietnam (Nguyen & Pham, 2022).

- *Quantitative Data Analysis:*

Secondary data were collected from official reports by the General Department of Land Administration, including indicators such as the percentage of completed cadastral databases, online service levels, and administrative transaction volumes (MONRE, 2025). Descriptive statistics and trend analysis were applied to identify patterns and measure progress over time.

- *Research Scope and Limitations:*

The study focuses on the national and provincial levels, with selected pilot provinces, including Da Nang, Binh Duong, and Dak Lak, representing varying stages of digital transformation. Due to data constraints, the analysis does not

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cover micro-level factors such as household land transactions. Nevertheless, the findings provide robust evidence for macro-policy formulation and institutional improvement.

III. RESULTS AND DISCUSSION

➢ *Progress and Current Status of Digital Land Administration in Vietnam*

Vietnam has made substantial progress in digitalizing its land management system during the 2020–2025 period. According to the General Department of Land Administration under the Ministry of Natural Resources and Environment (MONRE, 2025), 71% of district-level administrative units have completed cadastral databases, while 100% have finalized statistical and inventory databases. However, progress remains uneven in the creation of land-use planning and land price databases.

Table 1 Progress of National Land Data System by Mid-2025

No.	Type of Database	Number of Districts Completed	Completion Rate (%)
1	Cadastral (Land Parcels)	495 / 696	71
2	Land Statistics and Inventory	696 / 696	100
3	Land-Use Planning and Zoning	325 / 696	47
4	Land Price Database	300 / 696	43
5	Digitized Land Parcels (million)	46 / 100	46

Source: General Department of Land Administration – MONRE (2025).

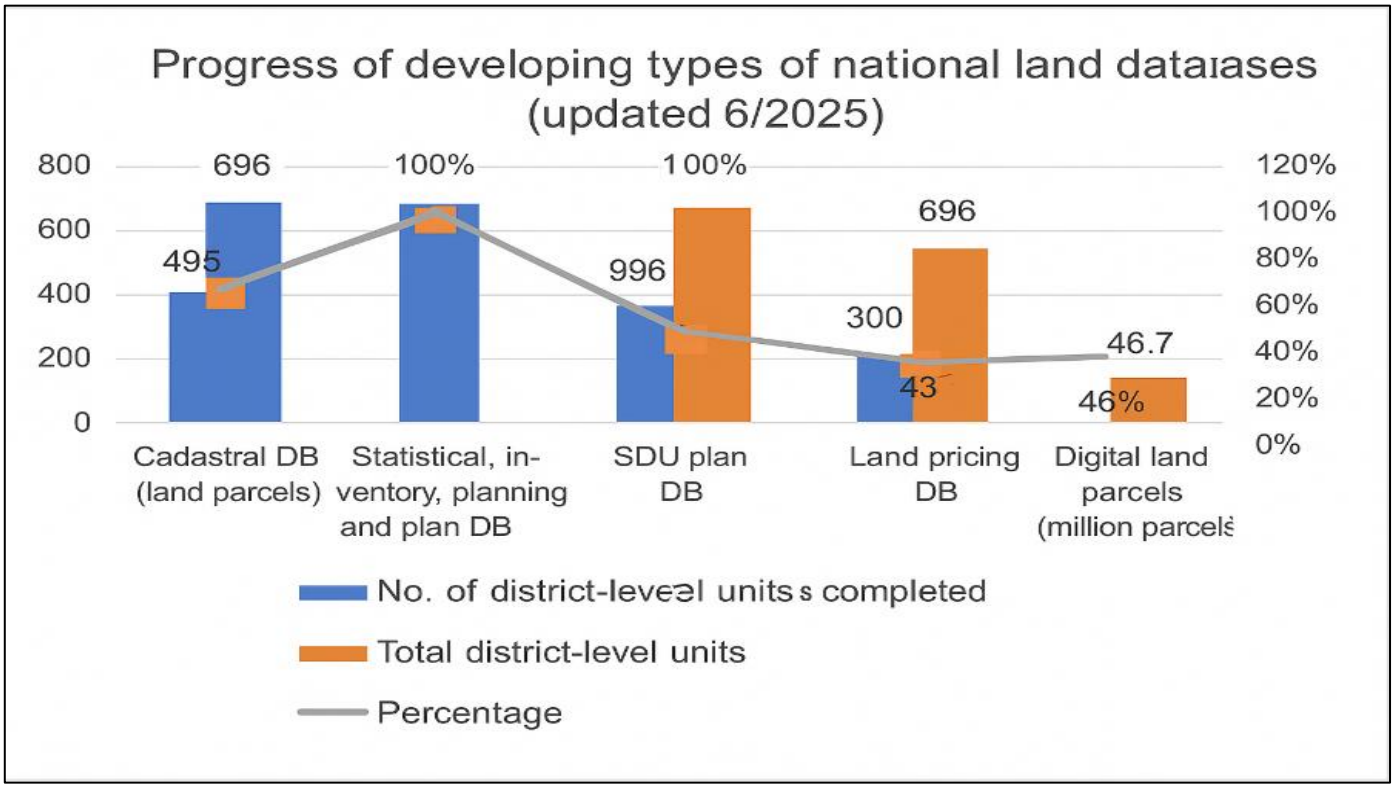

Fig 1 Progress of Building Land Databases Nationwide (June 2025)
(Source: Department of Land Management, 70-TTr/DU dated October 7, 2025)

As shown in Table 1, although the cadastral and inventory databases have achieved significant coverage, land-use planning and valuation data remain incomplete. The digitization rate of land parcels, reaching 46%, marks a strong improvement from less than 25% in 2020, yet demonstrates that full national coverage has not been achieved.

This uneven progress is largely due to differences in infrastructure and technical capacity among regions. Lowland and urban provinces such as Hanoi, Binh Duong, and Da Nang have achieved nearly complete digital databases, whereas mountainous and remote provinces (e.g., Ha Giang, Dak Nong, Kon Tum) continue to face major challenges in network connectivity, hardware systems, and human resources (Nguyen & Pham, 2022).

➢ *Level of Online Land Administrative Services*

To assess how digital transformation has affected service delivery, Table 2 presents data on the availability of online land-related administrative services in Dak Lak Province.

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Table 2 Levels of Online Public Services in Land Administration in Dak Lak Province (2022)

Authority	Level 2	Level 3	Level 4
Provincial People's Committee	3	3	1
Department of Natural Resources and Environment	19	4	0
District and Commune Levels	21	1	2

Only 5.6% of total land administration procedures in Dak Lak reached Level 4, where the process is fully conducted online. Most services remain at Levels 2–3, indicating that while online submission is possible, in-person confirmation or payment is still required. This finding shows that Vietnam's digital land management is still in its initial automation stage, lacking a fully interconnected ecosystem of digital services.

➢ *Economic and Environmental Benefits of Digital Transformation*

The shift to digital platforms has generated measurable economic savings. Based on 4.5 million land-related transactions processed annually, reducing the average waiting time by four hours per transaction saves an estimated 2.25 million working days per year—equivalent to approximately VND 511 billion (USD 20 million), calculated at Vietnam's average 2024 per capita income (World Bank, 2024).

Furthermore, the full digitization of 48 administrative procedures, as announced in Decision No. 2304/QĐ-BNNMT (MONRE, 2025), results in an annual reduction of more than 200 tons in paper consumption. At a printing cost of VND 500 per sheet, this reduction corresponds to approximately VND 22.7 billion in cost savings and a significant reduction in carbon footprint.

➢ *Global Spending and Technological Trends*

Digital transformation is not isolated to Vietnam. Figure 2 shows the global trend of investment in digital transformation technologies from 2017 to 2027, highlighting continuous growth across both developed and developing economies.

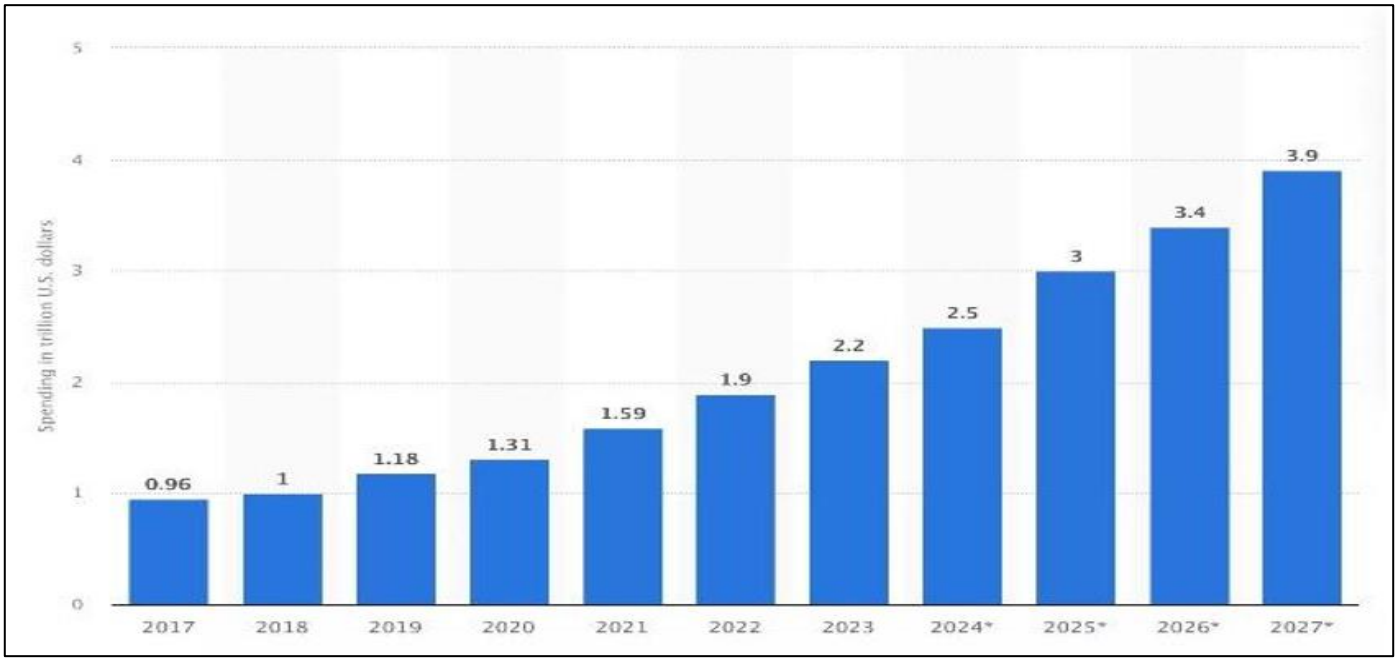

Fig 2 Global Expenditure on Digital Transformation Technologies, 2017–2027 (Trillion USD)
(Source: Adapted from EPAM SolutionsHub, 2023)

Global digital transformation spending is projected to rise from USD 1.3 trillion in 2017 to nearly USD 3.9 trillion by 2027 (EPAM SolutionsHub, 2023). This surge reflects growing public investment in data infrastructure, AI, and blockchain, emphasizing that Vietnam's commitment aligns with a broader international trend.

➢ *Comparative International Experiences*

Comparative data reveal that countries such as Estonia, South Korea, and Singapore have achieved significant efficiency gains through integrated digital land systems.

Table 3 Comparison of Land Digitalization in Selected Countries

Country	Main System	Integration Features	Time to Register Land	Key Outcomes
Estonia	X-Road	Full data interconnection among ministries	1–2 days	99% services online

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South Korea	K-LIS	Integrated cadastral, tax, valuation data	3–5 days	Saves USD 300 million annually
Singapore	INLIS	Real-time data access, e-contracts	1–2 days	Transparent property market
Vietnam	MONRE Land DB (partial)	Fragmented data integration	5–17 days	Limited transparency; local variation

Sources: Li et al. (2020); FIG & UNECE (2022); MONRE (2025).

The comparison shows that Vietnam lags behind regional leaders in terms of interoperability and speed of service delivery. The main constraints include insufficient legal frameworks, limited cross-sectoral data integration, and uneven local implementation. However, pilot provinces like Da Nang and Binh Duong demonstrate that rapid digital transformation is achievable with strong institutional commitment and budget prioritization.

➢ *Discussion and Policy Implications*

The results highlight that digital transformation in land administration is not merely a technical upgrade but a systemic reform of governance. Three critical insights emerge:

- *Institutional Coherence:*

The legal framework must recognize digital cadastral data, e-signatures, and electronic transactions as legally binding. Currently, overlapping jurisdiction and fragmented authority hinder consistent implementation (Government of Vietnam, 2024).

- *Interoperable Infrastructure:*

Integration between land, taxation, planning, and financial data systems remains limited. Establishing a National Spatial Data Infrastructure (NSDI) with standardized metadata and shared protocols will promote transparency and efficiency (FIG & UNECE, 2022).

- *Human Capacity and Digital Culture:*

Local-level officials often lack adequate digital skills and awareness of cybersecurity and data ethics. Continuous capacity building and incentive-based digital literacy programs are essential for long-term success (Tran, Do, & Tran, 2024).

These findings confirm that technology alone is insufficient; the success of digital transformation depends on coherent institutional design, data governance, and human resource development.

IV. CONCLUSION AND POLICY RECOMMENDATIONS

➢ *Conclusion*

Digital transformation in land administration represents both a strategic opportunity and a governance challenge for Vietnam. The findings of this study confirm that substantial progress has been achieved, particularly in building the national cadastral database and enhancing administrative efficiency. By mid-2025, approximately 71% of district-level administrative units had completed digital cadastral databases, and over 46 million land parcels—equivalent to 46% of the national total—were digitized (MONRE, 2025).

Digitalization has yielded measurable benefits in terms of cost reduction, time savings, and service accessibility. It has shortened processing times for land registration and transactions, reduced the volume of paper-based administrative work, and improved transparency in data disclosure. Moreover, online access to land information has enhanced equity by allowing citizens—especially women and residents in remote areas—to access services more conveniently (FAO & FIG, 2022; World Bank, 2024).

Nevertheless, several challenges persist. Data integration across sectors remains fragmented; legal recognition of digital records and e-signatures is incomplete; and human capacity at the local level is limited. These weaknesses hinder Vietnam's ability to establish a truly interoperable, transparent, and citizen-centered land governance ecosystem. Therefore, strategic policy interventions are required to sustain and accelerate the digital transformation of land administration.

➢ *Policy Recommendations*

Based on the empirical findings and international experience, three groups of policy solutions are proposed to strengthen Vietnam's digital land governance framework.

Table 4 Key Policy Recommendations for Digital Land Administration

Policy Dimension	Proposed Actions	Expected Outcomes
1. Legal and Institutional Reform	- Revise regulations to recognize the legal validity of electronic land records, e-signatures, and online contracts.- Establish a unified inter-ministerial coordination body for land data governance.- Align land-related digitalization with national strategies for open data and cybersecurity.	Enhanced legal certainty; stronger institutional coherence; reduction of administrative overlap.
2. Data Infrastructure and Interoperability	- Develop a National Spatial Data Infrastructure (NSDI) linking cadastral, tax, planning, and financial databases.- Apply open data standards and interoperable APIs across ministries.- Upgrade cadastral maps from 2D to 3D for smart urban planning.	Integrated data systems; improved transparency and cross-sectoral efficiency.

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3. Human Resource Development and Digital Culture	- Implement continuous training programs for local land officers on digital literacy, cybersecurity, and data ethics.- Incentivize innovation and digital performance through reward mechanisms.- Foster collaboration with universities and technology enterprises.	Improved human capacity; sustainable digital transformation; stronger data governance culture.

Source: Author's Synthesis Based on MONRE (2025); FIG & UNECE (2022); Tran, Do, & Tran (2024).

➢ *Future Research Directions*

Future studies should aim to quantify the economic impact of digital land administration reforms at the provincial level using econometric modeling or cost–benefit analysis. Additionally, there is a need to examine the potential of emerging technologies—such as blockchain, AI-based geospatial analytics, and cloud computing—in strengthening data integrity and citizen trust. Comparative longitudinal studies could also help evaluate the contribution of digital transformation to sustainable land governance and environmental planning.

In conclusion, Vietnam's ongoing digital transformation in land administration demonstrates clear momentum but requires coherent institutional frameworks and sustained investment in infrastructure and human resources. By combining technological innovation with governance reform, Vietnam can establish a modern, transparent, and inclusive land management system that aligns with the goals of its National Digital Transformation Program for 2030.

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➢ *Declaration of Conflict of Interest*

The authors affirm that there are no conflicts of interest regarding the research, authorship, or publication of this article.

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