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Exogenous Predictors of Land Administration Digitisation in South-South Nigeria: A SEM Analysis

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ABSTRACT: The study examines the external determinants influencing the digitisation of Land Administration Systems (LAS) in South-South Nigeria. Particularly, it focused on exogenous opportunities and threats that influence institutional readiness, technological standardisation, information dissemination, and technological adoption. Anchored in the Technology–Organization–Environment (TOE) framework and Institutional Theory, the research adopts a cross-sectional survey methodology, engaging 303 participants, comprising land professionals, government actors, and key stakeholders across the six states in the region. Structural Equation Modelling (SEM) was employed in evaluating the predictive validity of exogenous factors. The results indicate that opportunity variables, such as the existence of clear land title protocols, improved accessibility of online platforms, and robust GIS infrastructure, were statistically significant enablers of LAS digitisation. Conversely, commonly cited constraints including digital exclusion, tenure-related disputes, inadequate infrastructure, and unreliable electricity supply demonstrate limited statistical influence. These outcomes stress the importance of opportunity-led drivers over threats. Conceptually, the study advances the TOE framework by illustrating the decisive role of technological opportunities within fragile institutional ecosystems, while simultaneously challenging the presupposed centrality of coercive institutional pressures posited by Institutional Theory. From a policy standpoint, the study advocates for an emphasis on scaling enabling technologies and harmonising regulatory environments as critical imperatives for advancing sustainable LAS digitisation in Nigeria and comparable developing contexts.

KEYWORDS: Exogenous predictors, land administration digitisation, South-South Nigeria, structural equation modelling, TOE framework.

INTRODUCTION

Land administration underpins economic development, environmental sustainability, and social stability by defining, recording, and disseminating land rights and spatial data (Mello et al., 2023; Roestamy et al., 2022). Globally, digitisation of land administration systems (LAS) is promoted as a mechanism for enhancing transparency, reducing corruption, and improving efficiency through electronic cadastral mapping, online registries, and e-governance platforms (Nissi, Diala & Ewurum, 2021; Gebrihet & Pillay, 2021). Yet, the transition from paper-based to digital systems in sub-Saharan Africa has remained constrained by a combination of endogenous and exogenous forces.

In Nigeria, where the land sector has long been associated with inefficiency, corruption, and tenure insecurity (Badiora, 2020; Chiweshe, 2021), digitisation initiatives are unevenly diffused across states. This challenge is particularly pronounced in the South-South region, comprising Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers States due to the region's socio-cultural complexity, characterised by overlapping customary and statutory tenure systems, fuels persistent disputes and weakens the enforceability of digital records (Sasa, Adebayo & Maurice, 2022). Likewise, its economic dependency on oil and gas extraction exacerbates land-related conflicts, displacements, and contestations over compensation and resettlement, complicating the adoption of transparent digital registries (Iheme, 2023). Additionally, environmental conditions, coastal erosion, flooding, and soil degradation, compound the vulnerability of land tenure systems and underscore the urgency of reliable geospatial technologies (Okpebenyo et al., 2023).

Globally, technological infrastructure has proven to be a critical exogenous determinant of LAS digitisation. Studies from Asia, Latin America, and Africa reveal that inadequate ICT infrastructure, unstable electricity supply, and limited broadband penetration constitute recurrent barriers to successful system rollouts (Gebrihet & Pillay, 2021; Nissi, Diala & Ewurum, 2021). At the same time, legal and political contexts remain decisive; in many developing countries, ambiguities in land-use statutes, overlapping customary and statutory rights, and outdated land laws have constrained the institutionalisation of digital titles (Ameyaw & de Vries, 2021;

Ugonabo, Egolum & Sado, 2023). These challenges, often external to land agencies themselves, create what comparative scholarship terms a maturity gap, where internal factors such as institutional readiness and human capacity cannot fully explain system performance.

Against this backdrop, Nigeria presents a mixed record. While some states, such as Lagos, have advanced LAS digitisation through electronic certificates of occupancy and online registries, others lag due to infrastructural constraints, policy inconsistencies, and political interference (Azie, Egolum & Ugonabo, 2022; Akor & Ihuah, 2024). However, beyond anecdotal evidence and government reports, there remains limited empirical inquiry into the actual exogenous predictors shaping digitisation outcomes in specific regions. The South-South, with its resource dependence, tenure pluralism, and environmental vulnerabilities, epitomises this gap. Hence, this study seeks to ascertain the exogenous dimensions that most significantly predict the digitisation of LAS in the South-South region of Nigeria. In doing so, it advances the discourse beyond generic institutional readiness, offering an understanding of how exogenous conditions enable or constrain the digitisation of land administration in resource-rich but institutionally fragile contexts.

Objectives of the Study

The specific objectives of this study are to:

i) To investigate external opportunities and threats that condition institutional preparedness for digitised LAS adoption in South-South Nigeria.

ii) To analyse the opportunities and risks posed by technological factors in the standardisation of LAS processes within the region.

iii) To explore the external opportunities and threats that determine the uptake of digitised land information dissemination systems in the study area.

iv) To evaluate the technological opportunities and constraints that influence the overall viability of LAS digitisation in South-South Nigeria.

Justification of the Study

Digitisation of land administration is globally recognised as a strategic lever for achieving efficiency, transparency, and accountability in land governance. However, existing scholarship has shown that beyond internal capacity factors, exogenous conditions, such as socio-cultural dynamics, political-legal frameworks, environmental stressors, economic constraints, and technological infrastructures, exert decisive influence on the success or failure of digital land reforms (Gebrihet & Pillay, 2021; Ameyaw & de Vries, 2021). In Nigeria, evidence remains fragmented and largely anecdotal, with most studies focusing on either institutional capacity or governance gaps without systematically quantifying external opportunities and threats (Azie, Egolum & Ugonabo, 2022).

The South-South geopolitical zone presents a particularly compelling case. Its oil-dependent economy, tenure pluralism, and environmental fragility position it at the intersection of digital promise and systemic vulnerability. Yet, empirical knowledge of the opportunities that can be harnessed (such as technological innovations, international partnerships, and growing policy interest in e-governance) and the threats that must be mitigated (such as infrastructural deficits, legal ambiguities, and socio-political instability) remains scarce. So, the study offers a balanced, evidence-based perspective that extends beyond government reports and normative assumptions.

This justification rests on both scholarly and practical grounds. Academically, it fills a critical gap in the digitisation literature by providing a structural-equation modelling (SEM) analysis of exogenous influences, thereby advancing comparative land administration research in developing contexts. Practically, the findings will guide policymakers, development partners, and land governance institutions in tailoring interventions that align with contextual realities, ensuring that digitisation initiatives in South-South Nigeria are not only technically viable but also socially inclusive, legally enforceable, and environmentally resilient.

Review

Conceptual Review

Land Administration and its Digitisation

Land administration (LAS) encompasses the processes of defining, recording, and disseminating land rights, uses, and values, thereby providing the foundation for economic growth, environmental sustainability, and social equity (Enemark, 2005; UNECE, 2023). In theory, LAS integrates tenure security, land valuation, land use planning, and land development as interdependent pillars of sustainable governance. However, while developed economies operate mature LAS underpinned by reliable cadastral infrastructure and advanced ICT systems, many developing contexts remain burdened with manual registries, inefficiencies, and tenure insecurity (Nissi et al., 2021).

Exogenous Predictors of Land Administration Digitisation in South-South Nigeria: A SEM Analysis

Digitisation emerged in the 1990s as a transformative pathway for LAS, facilitating e-cadastres, online registries, blockchain-based titling, and geospatial data integration (McLaren & Stanley, 2017; Biscaye et al., 2017). Globally, digital LAS has been credited with shortening transaction times, curbing corruption, and enhancing tenure security. Yet, digitisation is not merely a technological reform; it is embedded in broader institutional, socio-cultural, and political contexts. The Bathurst Declaration (UN-FIG, 1999) emphasises this integrative view, calling for institutional coordination, standardised processes, information dissemination, and enabling technologies as the cornerstones of sustainable LAS reform.

Exogenous Predictors of LAS Digitisation

While internal capacities such as trained personnel and institutional efficiency are vital, recent scholarship stresses that LAS digitisation is equally, if not more, conditioned by exogenous factors. These operate as opportunities that enable reforms or threats that constrain them.

i) Institutional and Governance Contexts

External partnerships with international organisations, donor agencies, and private sector actors provide opportunities for technological transfer, funding, and capacity building (Ameyaw & de Vries, 2021). However, political interference, fragmented governance frameworks, and ambiguities in land use laws remain systemic threats that undermine digital reforms (Ugonabo, Egolum & Sado, 2023).

ii) Technological Infrastructure

Globally, ICT diffusion, cloud computing, and mobile platforms present opportunities for digitisation in resource-constrained contexts, lowering entry costs and improving accessibility (Gebrihet & Pillay, 2021). Conversely, inadequate broadband penetration, unreliable electricity, and interoperability challenges often cripple large-scale adoption in Africa (Azie, Egolum & Ugonabo, 2022).

iii) Socio-Cultural Dynamics

Opportunities lie in the democratisation of access through digital dissemination systems, which can empower marginalized groups and enhance transparency (Nissi et al., 2021). Yet, pluralistic tenure systems, digital illiteracy, and resistance to change act as threats, particularly in regions where communal and statutory land rights overlap (Sasa, Adebayo & Maurice, 2022).

iv) Legal and Policy Frameworks

Well-structured property laws, harmonised land-use regulations, and the legal recognition of electronic titles offer enabling conditions for digitisation (Ameyaw, 2024). Still, outdated statutes, conflicting federal–state mandates, and weak enforcement institutions pose substantial barriers to institutionalising LAS reforms (Akor & Ihuah, 2024).

v) Environmental and Economic Conditions

In regions vulnerable to climate change, digitisation creates opportunities for accurate geospatial monitoring of land degradation, flooding, and coastal erosion, enabling adaptive planning (Okpebenyo et al., 2023). Yet, macroeconomic instability, high upfront costs of digital infrastructure, and competing fiscal priorities constrain government commitment to LAS digitisation (Verdecchia, Lago & de Vries, 2022).

The literature reveals a duality: while digitisation promises efficiency, transparency, and inclusivity, exogenous threats continue to challenge its sustainability in developing contexts. Global frameworks such as the Bathurst Declaration provide normative guidance, but they often assume institutional stability and technological maturity that are absent in regions like Nigeria's South-South. Existing studies in Nigeria generalise digitisation experiences nationally, offering little empirical clarity on which opportunities and threats are most decisive regionally. This creates a conceptual gap regarding the need for an evidence-based model that quantifies and prioritises exogenous predictors of LAS digitisation within context-specific realities. Accordingly, this study advances a conceptualisation of LAS digitisation as a function not only of institutional capacity but also of exogenous drivers spanning governance, technology, socio-cultural systems, legal frameworks, environmental conditions, and economic constraints.

Theoretical Framework

Institutional Theory

Institutional theory provides a powerful lens for analysing how external pressures, normative, coercive, and mimetic, shape organisational behaviour and reform trajectories (DiMaggio & Powell, 1983). Applied to LAS digitisation, the theory posits that adoption is not merely a function of internal agency decisions but is driven by exogenous forces such as legal mandates, donor conditionalities, and public expectations of transparency. In the Nigerian context, coercive pressures emerge from statutory frameworks such as the Land Use Act of 1978, normative pressures from professional bodies and international declarations like the Bathurst Declaration (UN-FIG, 1999), and mimetic pressures from states like Lagos that have piloted digital registries. These institutional logics highlight that digitisation pathways are embedded in broader political and socio-cultural environments, often overriding endogenous agency readiness.

Technology–Organization–Environment (TOE) Framework

The TOE framework, developed by Tornatzky and Fleischer (1990), offers a systematic approach for evaluating technology adoption. It emphasizes that technological innovation is influenced not only by organisational capacities but also by the wider technological infrastructure and environmental conditions. For LAS digitisation, the technological context includes opportunities in GIS, blockchain, and cloud-based platforms, alongside threats such as interoperability risks, cybersecurity, and infrastructural deficits. The environmental context incorporates exogenous drivers such as legal frameworks, socio-cultural norms, environmental stressors, and market dynamics that either enable or constrain adoption. Through the situation of LAS digitisation within this triadic frame, TOE underscores that successful implementation cannot be explained by institutional readiness alone, but by the interplay of technological opportunities and environmental threats.

Drawing on Institutional Theory and the TOE framework, this study conceptualises LAS digitisation in South-South Nigeria as a process mediated by exogenous predictors. Institutional theory accounts for how governance, legal mandates, and cultural norms exert external pressure, while the TOE framework structures the analysis of technological opportunities and environmental threats. Together, these theories justify the study's structural equation modelling (SEM) approach by providing a conceptual scaffold for testing the influence of external drivers on digitisation outcomes.

This integrative framework advances existing scholarship by moving beyond generic SWOT analyses to an empirically grounded model of exogenous predictors. It highlights that LAS digitisation in South-South Nigeria cannot be understood as a purely technical or institutional reform, but as a complex outcome of external pressures, opportunities, and threats operating within a resource-dependent and institutionally fragile context.

METHODOLOGY

The study employed a triangulated mixed-methods design, integrating quantitative and qualitative approaches to generate both statistical and contextual insights. The quantitative component enabled the testing of hypothesised relationships among exogenous predictors through SEM, while the qualitative component, semi-structured interviews, provided interpretive depth. This integration ensures methodological rigour and validity, consistent with best practices in land administration research (Ameyaw & de Vries, 2021; Nilashi et al., 2024).

The population comprised 1,246 stakeholders across the six land registries of the South-South geopolitical zone of Nigeria. These included registry staff, estate surveyors and valuers, land surveyors, ICT experts, urban planners, legal practitioners, property owners, and oversight agency representatives. The study drew its sample through stratified random sampling of 303 that was obtained using Krejcie & Morgan (1970) estimation model, which ensured representation across states and stakeholder categories, while a purposive sub-sample was selected for qualitative interviews. A total of 303 respondents completed valid questionnaires, forming the quantitative dataset. In addition, 30 key informants were purposively interviewed to provide expert perspectives on the opportunities and threats influencing LAS digitisation in the study area.

Data were collected through structured questionnaire designed on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), focusing on the external opportunities and threats to LAS digitisation. Semi-structured interview guide designed to elicit explanatory insights from registry heads, ICT specialists, and professional stakeholders was used to augment the data collection.

Instrument validity was assured through expert review, and a pilot test confirmed high internal reliability (Cronbach's alpha = 0.87). Quantitative data were analysed using Covariance-Based Structural Equation Modelling (CB-SEM) in AMOS. This method was selected for three key reasons. It allows simultaneous estimation of multiple causal paths among latent constructs, captures measurement error, thereby improving reliability, and is widely applied in technology adoption and institutional studies where complex exogenous factors interact (Byrne, 2016).

The measurement model links observed indicators to their latent constructs, expressed as follows:

$$X=\Lambda x\xi+\delta$$

Where X = vector of observed indicators, Λx = factor loadings, ξ = latent constructs (opportunities, threats), δ = error terms. The hypothesised causal relations were expressed as:

$$\eta=B\eta+\Gamma\xi+\zeta$$

Where η = endogenous latent variable (LAS digitisation outcomes), B = coefficient matrix of relationships among endogenous variables, Γ = effects of exogenous predictors, ξ = exogenous constructs (institutional, technological, socio-cultural, legal-political, environmental, and economic drivers), ζ = disturbance terms. Model adequacy was assessed using widely accepted indices, including Chi-square/df ≤ 3.0, Comparative Fit Index (CFI ≥ 0.90), Tucker–Lewis Index (TLI ≥ 0.90), Root Mean Square Error of Approximation (RMSEA ≤ 0.08), and Standardised Root Mean Square Residual (SRMR ≤ 0.05).

Qualitative data from interviews were thematically coded and clustered to enrich interpretation of SEM findings, particularly in explaining the opportunities and threats affecting LAS digitisation in the study area.

RESULTS

Model Fit

The structural equation modelling (SEM) produced a satisfactory overall fit: $\chi^2/df = 2.18$, CFI = 0.964, TLI = 0.951, RMSEA = 0.049, and SRMR = 0.041. These values fall within the recommended thresholds (Hu & Bentler, 1999; Byrne, 2016), confirming the robustness of the estimated paths.

Table 1. SEM Results for Exogenous Predictors of LAS Digitisation

Exogenous Predictor	Standardised Estimate (β)	SE	CR	p-value	Decision on Path	Direction
Partnerships with international organisations → Readiness	0.084	0.058	1.448	0.148	Not Significant	Positive
Lack of political will → Institutional readiness	-0.021	0.042	-0.497	0.619	Not Significant	Negative
Clear land title protocols → LAS standardisation	0.134	0.055	2.429	0.015*	Significant	Positive
Inconsistent data formats → LAS standardisation	-0.064	0.049	-1.306	0.192	Not Significant	Negative
Tenure conflicts → LAS standardisation	-0.051	0.046	-1.109	0.267	Not Significant	Negative
Online platform access → Information dissemination	0.147	0.057	2.573	0.010*	Significant	Positive
Digital exclusion → Information dissemination	-0.037	0.054	-0.685	0.493	Not Significant	Negative
Software implementation → Information dissemination	0.071	0.052	1.365	0.172	Not Significant	Positive
Cybersecurity risks → Information dissemination	-0.059	0.048	-1.229	0.219	Not Significant	Negative
Access to GIS infrastructure → Technological viability	0.158	0.053	2.975	0.003*	Significant	Positive
High infrastructure costs → Technological viability	-0.066	0.050	-1.320	0.187	Not Significant	Negative
Advances in digital surveying → Technological viability	0.079	0.056	1.411	0.158	Not Significant	Positive
Unreliable power supply → Technological viability	-0.042	0.049	-0.857	0.391	Not Significant	Negative

*Significant at $p < 0.05$

Insights from Table 1 are interpreted in line with the objectives of the study.

Objective 1: Institutional Preparedness

Exogenous institutional predictors showed no statistically significant effects. Neither international partnerships (β = 0.084, p = 0.148) nor lack of political will (β = -0.021, p = 0.619) significantly explained readiness. This suggests that institutional preparedness for digitisation in South-South Nigeria is not being externally driven by global or political incentives, but depends more on internal capacity, which was beyond this study's focus.

Objective 2: Technological Standardisation

Clear land title protocols emerged as a significant external opportunity (β = 0.134, p = 0.015). By contrast, threats such as inconsistent data formats (β = -0.064, p = 0.192) and tenure conflicts (β = -0.051, p = 0.267) were not significant. This indicates that regulatory and procedural clarity is a stronger exogenous driver of LAS standardisation than external risks arising from conflicting data and tenure systems.

Objective 3: Information Dissemination

Access to online platforms significantly enhanced information dissemination (β = 0.147, p = 0.010). However, external threats such as digital exclusion (β = -0.037, p = 0.493), software gaps (β = 0.071, p = 0.172), and cybersecurity risks (β = -0.059, p = 0.219) did

not exhibit significant predictive power. The implication is that opportunities in expanding digital access are more decisive than the perceived threats in shaping uptake of land information dissemination systems.

Objective 4: Technological Viability

Access to GIS infrastructure was the strongest significant exogenous opportunity (β = 0.158, p = 0.003). Other exogenous threats, including high infrastructure costs (β = -0.066, p = 0.187), unreliable power supply (β = -0.042, p = 0.391), and even advances in digital surveying (β = 0.079, p = 0.158), were statistically non-significant. This suggests that strategic access to GIS infrastructure is a priority external enabler of technological viability, outweighing cost and energy-related threats in the current phase of LAS digitisation.

The results highlight that exogenous opportunities, clear land title protocols, online platforms, and GIS infrastructure, were the significant predictors of LAS digitisation in South-South Nigeria. Conversely, the exogenous threats widely cited in the literature, political inertia, inconsistent data formats, tenure conflicts, digital exclusion, high costs, and unreliable power supply, did not show significant effects in the tested model. This points to an opportunity-driven digitisation trajectory in the region, where progress is propelled by enabling external drivers rather than constrained by external risks, at least in the present stage of implementation.

DISCUSSION OF RESULTS

The findings of this study provide insights into the role of exogenous predictors in shaping the digitisation of Land Administration Systems (LAS) in South-South Nigeria. Contrary to expectations from institutional theory, coercive and normative pressures such as international partnerships and political will did not significantly determine institutional readiness. This divergence buttresses a muted effect of institutional pressures in the region, suggesting that exogenous institutional drivers are insufficient to overcome entrenched internal constraints. This outcome partially contradicts Ameyaw and de Vries (2021), who emphasised donor partnerships as catalysts of LAS reform, and aligns with Ugonabo, Egolum, and Sado (2023), who highlighted the limited enforceability of political incentives in Nigeria's land governance.

Conversely, consistent with the TOE framework, technological opportunities emerged as decisive predictors. The significance of clear land title protocols for LAS standardisation and online platforms for information dissemination corroborates the importance of regulatory clarity and digital accessibility as highlighted by Gebrihet and Pillay (2021). These findings reinforce the Bathurst Declaration's emphasis on standardisation and information dissemination as pillars of sustainable LAS reform, demonstrating that clarity and accessibility are pivotal for digitisation. Importantly, GIS infrastructure was identified as the strongest external enabler of technological viability, reflecting global evidence that geospatial technologies provide adaptive solutions in environmentally vulnerable contexts (Okpebenyo et al., 2023).

CONCLUSION

This study concludes that exogenous opportunities, particularly clear land title protocols, access to online platforms, and GIS infrastructure, were the most significant exogenous predictors of LAS digitisation in South-South Nigeria. In contrast, commonly cited threats such as political inertia, tenure conflicts, digital exclusion, and infrastructural deficits exert limited statistical influence in the present phase of digitisation. Theoretically, this reinforces the TOE framework's proposition that technological and environmental opportunities serve as critical external enablers, while tempering institutional theory's assumption of strong coercive and normative effects in fragile governance contexts. Practically, the results suggest that LAS digitisation in South-South Nigeria is best advanced by scaling up enabling technologies and regulatory clarity, rather than overemphasising threats whose impacts may be latent or contextually muted.

IMPLICATIONS OF THE STUDY

The findings of this study carry several theoretical, methodological, and practical implications for the discourse on land administration digitisation in emerging economies, with specific reference to South-South Nigeria.

1. Theoretical Implications

The study advances the Technology–Organization–Environment (TOE) framework by empirically demonstrating that exogenous technological opportunities, rather than institutional pressures or perceived threats, are more decisive in shaping digitisation outcomes in fragile governance contexts. This insight tempers the assumptions of Institutional Theory, which often advances coercive and normative drivers such as political will and international partnerships. By highlighting the muted influence of institutional pressures in the Nigerian context, the study underlines the need for recalibrating theoretical models of LAS digitisation to account for regional variations where institutional voids prevail.

2. Methodological Implications

Through the application of Structural Equation Modelling (SEM), this research demonstrates the utility of quantitatively disentangling the relative effects of opportunities and threats as exogenous predictors. The approach provides a replicable pathway for future research, offering more robust statistical evidence compared to descriptive SWOT analyses that dominate LAS digitisation studies. This methodological contribution strengthens the analytical rigour of exogenous-focused research in land governance.

3. Practical and Policy Implications

At the policy level, the study suggests that interventions aimed at scaling up clear title protocols, online platform access, and GIS infrastructure will yield the most immediate gains in LAS digitisation. This directs government and donor investment away from overemphasising threat mitigation, such as unreliable power supply, towards harnessing enabling technologies that demonstrate stronger predictive power in this context. Furthermore, the muted role of political and legal uncertainties highlights the urgency of harmonising federal-state statutes and updating outdated land laws to ensure that digital platforms have legal enforceability.

4. Regional Development Implications

For the South-South region, the results point to a policy window in which LAS digitisation can be accelerated through opportunity-driven strategies rather than reactive responses to threats. This calls for a paradigm shift from deficit-oriented policy frameworks towards a proactive model that builds on enabling conditions. The lessons also carry transferability to other emerging economies where fragile institutional environments may limit the effect of traditional institutional drivers.

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