

# Fixed Asset Planning and Safeguarding in Regional Asset Management: The Moderating Role of Information Technology Utilization

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The author(s) declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## ABSTRACT

**Purpose:** This study examines the effects of fixed asset planning and safeguarding on the effectiveness of regional asset management while evaluating the moderating role of information technology utilization.

**Research Method:** Using a quantitative explanatory design, empirical data were gathered via purposive sampling from 95 public officials in Tana Toraja Regency and analyzed using multiple linear regression, specifically Moderated Regression Analysis (MRA).

**Results and Discussion:** The findings revealed that both asset planning and safeguarding significantly enhanced management effectiveness. Information technology utilization strengthened the relationship between planning and effectiveness but showed no significant interaction in the safeguarding pathway.

**Implications:** These insights suggest that local governments should prioritize digital integration during planning phases while independently reinforcing physical security protocols.

**Originality:** This research provides unique empirical evidence regarding the asymmetric capability of digital governance tools across different operational stages of public asset administration

**Keywords:** fixed asset planning; fixed asset safeguarding; information technology utilization; regional asset management.

## 1. Introduction

The efficient management of public assets is a critical pillar of sound governance, particularly within decentralized administrative structures with fiscal and operational autonomy. Among various classes of public property, fixed assets such as land hold substantial economic significance, playing a vital role in regional development, strategic spatial planning, and the delivery of public services (Pinargote *et al.*, 2025). Conversely, suboptimal land governance often leads to severe institutional vulnerabilities, including protracted legal disputes, physical asset degradation, and the loss of potential public utility (Pethe *et al.*, 2012). Consequently, local governments must systematically plan and safeguard public land to ensure strict regulatory compliance and maximize economic and social returns (Alquraiddi & Awad, 2024).

In the global arena, public asset modernization has emerged as a cornerstone of public sector reform, where international best practices increasingly leverage digital mapping, smart governance initiatives, and Geographic Information System (GIS) tools aligned with the Sustainable Development



Goals (Kumar *et al.*, 2019). Advanced economies, such as Australia, Canada, and South Korea, have pioneered integrated digital asset frameworks to optimize fiscal efficiency and service performance (Nielsen & Jordanoski, 2020). To replicate these institutional efficiencies within an emerging economy, the Government of Indonesia established a comprehensive regulatory framework for regional government-owned assets (Barang Milik Daerah), primarily governed by Government Regulation No. 27 of 2014 and Ministry of Home Affairs Regulation No. 47 of 2021 (Republik Indonesia, 2014; Kementerian Dalam Negeri RI, 2021).

At the subnational level, the Government of Tana Toraja Regency aligned its local policies with these national mandates by enacting Regional Regulation No. 4 of 2015 to govern the strategic planning, procurement, and protection of localized land assets (Pemerintah Kabupaten Tana Toraja, 2015). However, official audit reports compiled by the Audit Board of the Republic of Indonesia (Badan Pemeriksa Keuangan Republik Indonesia) continue to reveal persistent structural deficiencies in local land administration, including incomplete physical data, inaccurate record-keeping, and the absence of formal valuations for numerous public plots (Monalika, 2024).

These audit findings expose systemic inefficiencies across the asset life cycle, particularly during the planning and oversight phases (White, 2011; Alquraiddi & Awad, 2024). Public land parcels lacking legal certification or precise coordinates remain highly vulnerable to unlawful third-party encroachment, title conflicts, and prolonged underutilization (Katina *et al.*, 2021). Furthermore, significant discrepancies in location and land area parameters introduce reporting errors into regional financial statements, ultimately undermining municipal accountability and eroding public trust.

To address these systemic vulnerabilities, the Indonesian central government has actively accelerated the integration of Information and Communication Technology (ICT) through Presidential Instruction No. 3 of 2003 regarding national e-government strategies (Pemerintah Republik Indonesia, 2003). Within public administration, ICT is an essential driver of operational efficiency, facilitating automated documentation, rigorous reporting, and transparent legal safeguards (Surya *et al.*, 2022; Kurniawan & Aditya, 2021; Yuniarti *et al.*, 2020). Various Indonesian municipalities have adopted specialized digital applications, such as the Regional Asset Management Information System (SIMDA BMD), alongside multi-layered GIS platforms to enable real-time asset tracking and transparent mapping (Setiawan *et al.*, 2021; Yusuf & Amaliah, 2022; Andriani & Hidayat, 2023). In accordance with this technological trajectory, the local administration of Tana Toraja Regency has increasingly explored digital and geospatial tools to support data accuracy during land asset planning and safeguarding cycles; however, adoption within Tana Toraja Regency itself remains at an early and uneven stage, an empirical gap this study investigates.

Although digital and geospatial tools are intended to centralize spatial parameters and improve registry precision, their actual capacity to elevate governance quality in this setting requires empirical validation. Prior literature heavily focuses on the direct effects of technology on administrative performance, leaving a notable scholarly gap regarding the role of ICT as a moderating factor that dynamically interacts with core asset management functions. Theoretical frameworks on asset life cycle management indicate that planning and safeguarding are key determinants of governance efficacy (Neonbasu *et al.*, 2024; Waskita & Cahyo, 2024). Concurrently, digital governance models suggest that technology should not be evaluated merely as an isolated tool, but as an institutional enabler that structurally alters governance capability (Misuraca *et al.*, 2010). Therefore, examining how the interaction

between asset planning, asset protection, and digital infrastructure determines management outcomes is critical to establishing adaptive and accountable public systems.

This study deliberately narrows its scope to the planning and safeguarding stages of the asset life cycle rather than examining utilization, maintenance, and disposal in parallel. Planning and safeguarding were prioritized because they are the stages most directly implicated in the documentation and encroachment deficiencies identified in prior audit findings for Tana Toraja Regency (Monalika, 2024), and because they represent the upstream control points on which the accuracy of subsequent utilization, maintenance, and disposal records depends. Utilization, maintenance, and disposal are procedurally downstream of, and conditional upon, secure planning and title records, and are therefore treated as boundary conditions for future research rather than as parallel constructs within the present model.

To address these empirical and theoretical limitations, this study investigates how land asset planning and safeguarding affect the effectiveness of public asset management in Tana Toraja Regency. Crucially, this research evaluates how the use of information technology moderates these relationships. By assessing the interface between traditional asset controls and digital governance tools, this paper contributes to the broader scholarly discourse on public sector modernization in developing countries. It offers actionable insights for municipal policymakers seeking to implement sustainable, data-driven land asset governance.

The remainder of this paper is organized as follows. Section 2 provides a literature review and hypothesis development. Section 3 presents the research method and design. Section 4 provides the results and discussion. Section 5 presents Concluding Remarks and Recommendations.

## 2. Literature Review and Hypothesis Development

### 2.1 Asset Life Cycle Theory and Asset Planning

Asset life cycle theory provides a comprehensive framework that spans the progressive stages of public property management, specifically encompassing planning, acquisition, utilization, maintenance, and ultimate disposal (Neonbasu *et al.*, 2024; Waskita & Cahyo, 2024). Within this conceptual continuum, the strategic planning phase serves as the foundational mechanism that determines the long-term efficiency and fiscal sustainability of property governance (Kaganova & Telgarsky, 2018). Comprehensive asset planning requires local government institutions to conduct rigorous procurement assessments, evaluate the physical and legal conditions of existing plots, and systematically align future land acquisitions with actual public service requirements.

By establishing structured planning protocols, decentralized administrations can optimize regional budget allocations, minimize spatial discrepancies, and mitigate the risk of acquiring underutilized property. In the context of regional development, proactive inventory management and legal validation during the planning stage enhance the institutional capability to deliver public infrastructure effectively (Pinargote *et al.*, 2025). Consequently, systematic planning practices directly address the structural inefficiencies highlighted in municipal audits, thereby elevating overall management quality. Based on these theoretical insights, the following hypothesis is proposed:

**H1:** *Fixed asset planning has a positive and significant effect on the effectiveness of regional asset management.*

## 2.2 Public Asset Safeguarding and Governance Outcomes

The preservation of government-owned property depends heavily on the implementation of robust asset-safeguarding protocols, which traditionally comprise physical, administrative, and legal protection mechanisms (Khoir & Priyono, 2023). Physical safeguarding involves securing tangible boundaries and establishing localized monitoring systems to prevent unauthorized use or illegal encroachment by third parties. Administrative safeguarding focuses on the precision of public records, ensuring that asset registries accurately reflect dimensions, values, and geographic parameters. Legal safeguarding requires obtaining formal land certificates and clear legal titles to secure institutional tenure and insulate public property from ownership disputes (Katina *et al.*, 2021). When executed systematically, these multi-layered safeguarding practices protect the municipal land portfolio from legal vulnerabilities and administrative neglect (Alquraiddi & Awad, 2024). Securing clear land titles enables local governments to deploy public assets safely for community utility, thereby preventing asset degradation and substantial financial losses (Pethe *et al.*, 2012; Abdillah *et al.*, 2022). Therefore, effective asset protection forms a core determinant of public governance outcomes. Based on these arguments, the following hypothesis is advanced:

**H2:** *Fixed asset safeguarding has a positive and significant effect on the effectiveness of regional asset management.*

## 2.3 Information Technology as an Institutional Enabler

Digital governance models suggest that Information and Communication Technology (ICT) does not function merely as an isolated operational tool, but acts as an institutional enabler that transforms organizational capacity (Misuraca *et al.*, 2010). In modern public administration, the integration of specialized databases, digital registries, and Geographic Information System (GIS) platforms reduces information asymmetry, minimizes human error, and fosters inter-agency coordination (Nielsen & Jordanoski, 2020; Setiawan *et al.*, 2021). By centralizing spatial and administrative parameters, technological tools allow local authorities to maintain a single, verifiable source of truth regarding public land holdings (Park *et al.*, 2023). This digital infrastructure accelerates administrative workflows, enhances reporting transparency, and reinforces the enforcement of municipal regulations (Krah & Mertens, 2020; Latupeirissa *et al.*, 2024). Consequently, the use of ICT is a critical catalyst for administrative modernization and fiscal accountability in decentralized jurisdictions (Surya *et al.*, 2022; Kurniawan & Aditya, 2021; Yuniarti *et al.*, 2020).

## 2.4 The Moderating Influence of Technology Utilization

Beyond its direct administrative benefits, digital infrastructure functions as an environmental moderator that can amplify or alter the efficacy of traditional governance controls. According to digital governance frameworks, the integration of strategic administrative activities with advanced ICT systems yields superior organizational outcomes compared to manual processes (Nübel *et al.*, 2021). During the planning phase, the availability of real-time geospatial data and automated systems enhances the precision of need assessments and coordination among local departments (Yusuf & Amaliah, 2022; Andriani & Hidayat, 2023). This integration bridges the gap between strategic design and operational execution, thereby maximizing the positive impact of planning on asset management effectiveness (Aguiar *et al.*, 2024). Similarly, the use of technology can strengthen the relationship between safeguarding practices and management performance. Automated digital mapping, real-time tracking,

and secure cloud registries protect public records from physical degradation or unauthorized manipulation (Kumar *et al.*, 2019). By providing precise coordinates and instant legal tracking, digital systems can enhance field-level monitoring and expedite the resolution of boundary disputes (Asif *et al.*, 2023). Therefore, the presence of high-quality technological infrastructure is expected to reinforce the governance value of both asset planning and safeguarding. Based on these interaction dynamics, the following hypotheses are formulated:

**H3a:** *Information technology utilization significantly strengthens the positive effect of fixed asset planning on the effectiveness of regional asset management.*

**H3b:** *Information technology utilization significantly strengthens the positive effect of fixed asset safeguarding on the effectiveness of regional asset management.*

### 3. Research Method

This study employed a quantitative explanatory research design to examine the causal relationships and interaction effects among variables influencing the effectiveness of public land asset management. The empirical investigation was conducted within the administrative framework of the Tana Toraja Regency Local Government, Indonesia. This specific setting was selected for its institutional relevance to regional asset decentralization challenges and the availability of specialized operational data from municipal authorities. The target population for this research comprised civil servants working across 59 Local Government Work Units (Organisasi Perangkat Daerah), which included sectoral agencies, departments, regional secretariats, subdistrict offices, and community health centers (UPTD Puskesmas). To select an appropriate sample from this heterogeneous population, the study utilized a purposive sampling strategy based on professional inclusion criteria adapted from Nuwafal Khoir (2023). The selection process specifically targeted municipal employees who were directly responsible for land asset planning, registration, and safeguarding, and who had at least 1 year of operational experience within their respective units. A total of 95 respondents met these rigorous inclusion criteria, comprising 65 male and 30 female participants. Of the 120 questionnaires originally distributed across these units, 114 were returned (a 95% response rate), and 95 were verified as complete and valid for analysis.

The 19 excluded responses were screened out through listwise deletion of incomplete entries and detection of inattentive response patterns (e.g., straight-lining), consistent with standard data-screening practice in survey-based regression research. This achieved sample satisfies Green's (1991) minimum guideline of  $50 + 8k$  observations for testing the overall explanatory power of a regression model with  $k = 5$  predictors (FAP, FAS, ITU, and the two interaction terms), yielding a threshold of 90; it falls short, however, of the more conservative  $104 + k$  threshold recommended for testing the significance of individual predictors (109), a constraint that limits the power available to detect the interaction effects examined under H3a and H3b.

Primary data were gathered through the administration of a structured, self-administered questionnaire developed from operational indicators adapted from Khoir and Priyono (2023). This study obtained institutional clearance from the relevant Tana Toraja Regency government authority prior to data collection, and each respondent was briefed on the study's purpose and provided voluntary, informed consent before completing the questionnaire. The questionnaire used a five-point Likert scale to measure respondents' attitudes, perceptions, and administrative evaluations, ranging from 1 (strongly disagree) to 5 (strongly agree).

Within this measurement framework, Fixed Asset Planning (FAP) was assessed using indicators evaluating procurement planning compliance, land suitability assessments, and systematic asset-need identification. Concurrently, Fixed Asset Safeguarding (FAS) was evaluated through items assessing physical barrier protection, administrative inventory precision, and legal certificate acquisition. The primary dependent variable was operationalized as the Effectiveness of Regional Asset Management (BME) and measured via administrative compliance, spatial land utilization, and the availability of accurate property data. Finally, Information Technology Utilization (ITU) was evaluated as the environmental moderating variable through indicators capturing hardware availability, software support adequacy, network connectivity, system integration, and technical infrastructure maintenance.

To evaluate the proposed direct and moderating relationships, the empirical data were analyzed using multiple linear regression, specifically the Moderated Regression Analysis framework. This approach is statistically appropriate for evaluating associative relationships and multi-variable interactions in explanatory research. The statistical models enabled the simultaneous assessment of the standalone influence of fixed asset planning and safeguarding, as well as the interactive effects of information technology utilization. The estimation models aligned with the methodological rationale proposed by Khoir and Priyono (2023), which emphasizes the necessity of data-driven, accountable, and efficient public land administration.

Instrument validity was verified using Pearson product-moment correlation analysis, while construct reliability was determined through Cronbach's Alpha coefficients, applying an academic acceptance threshold of 0.70. Normality of the residuals was assessed prior to regression using skewness and kurtosis statistics and the Kolmogorov-Smirnov test, with results indicating an approximately normal distribution suitable for parametric regression analysis. Data screening and the regression/moderated regression analysis in this study were conducted using IBM SPSS Statistics.

## 4. Results and Discussion

### 4.1 Analysis Results

#### 4.1.1 Measurement Model Evaluation

The primary data for this study were obtained through structured questionnaires distributed to employees across various local government agencies within Tana Toraja Regency who were directly involved in the administration of government-owned land assets. Out of the 120 questionnaires originally distributed, 114 were returned, and 95 were verified as complete and valid for empirical analysis. The final cohort of respondents included planning subdivision heads, asset managers, and specialized administrative staff who played active operational roles in managing fixed land properties. To ensure the psychometric soundness of the research instrument, both validity and reliability tests were conducted. Construct validity was evaluated using Pearson product-moment correlation analysis to assess the strength of the relationship between individual measurement items and the total score of their corresponding constructs. Items with high correlation values indicated a strong contribution to the measurement of the underlying variable. The calculated correlation values ( $r$  count) for all items ranged from 0.702 to 0.897. With a sample of 95 respondents ( $df = 93$ ), the critical  $r$ -value at the 5% significance level (two-tailed) is approximately 0.202. Because every item's  $r$  exceeded this threshold, all items were deemed valid and appropriate for subsequent hypothesis testing.



In addition to validity testing, the internal consistency of each operational scale was evaluated using Cronbach's Alpha coefficients. The statistical analysis yielded coefficients of 0.839 for FAP, 0.757 for FAS, 0.745 for ITU, and 0.810 for BME. Because all resulting coefficients exceeded the commonly accepted academic threshold of 0.70, the instrument demonstrated high reliability and a strong capacity to produce consistent results across items. The measurement properties are summarized in Table 1.

**Table 1.** Combined Validity and Reliability Test Results

| No | Variable | Item  | r-calculated | Cronbach's Alpha |
|----|----------|-------|--------------|------------------|
| 1  | FAP      | FAP_1 | 0.775        | 0.839            |
|    |          | FAP_2 | 0.890        |                  |
|    |          | FAP_3 | 0.846        |                  |
|    |          | FAP_4 | 0.820        |                  |
|    |          | FAP_5 | 0.731        |                  |
|    |          | FAP_6 | 0.705        |                  |
|    |          | FAP_7 | 0.788        |                  |
|    |          | FAP_8 | 0.719        |                  |
|    |          | FAP_9 | 0.876        |                  |
| 2  | FAS      | FAS_1 | 0.897        | 0.757            |
|    |          | FAS_2 | 0.884        |                  |
|    |          | FAS_3 | 0.702        |                  |
|    |          | FAS_4 | 0.847        |                  |
|    |          | FAS_5 | 0.882        |                  |
|    |          | FAS_6 | 0.709        |                  |
| 3  | ITU      | ITU_1 | 0.862        | 0.745            |
|    |          | ITU_2 | 0.890        |                  |
|    |          | ITU_3 | 0.862        |                  |
|    |          | ITU_4 | 0.803        |                  |
|    |          | ITU_5 | 0.814        |                  |
| 4  | BME      | BME_1 | 0.886        | 0.810            |
|    |          | BME_2 | 0.741        |                  |
|    |          | BME_3 | 0.738        |                  |
|    |          | BME_4 | 0.709        |                  |
|    |          | BME_5 | 0.729        |                  |

*Note:* FAP = Fixed Asset Planning; FAS = Fixed Asset Safeguarding;

ITU = Information Technology Utilization; BME = Effectiveness of Regional Asset Management.

**Source:** Processed data, 2025

These measurement results confirmed that the operational model used in this study met standard psychometric thresholds for validity and reliability. The strong validity and high internal reliability ensured that the primary data collected from the respondents accurately reflected their professional perceptions, thereby supporting the credibility of subsequent regression analysis and hypothesis testing. Prior to evaluating the regression parameters, a dedicated collinearity assessment was performed to ensure that multi-variable overlap did not distort the regression estimates. Multicollinearity issues can artificially inflate standard errors and bias coefficient signs, making independent assessments essential. This study used the Variance Inflation Factor (VIF) to identify systematic overlap among the primary predictors and interaction terms. The empirical diagnostics are structured independently in Table 2.

**Table 2.** Collinearity diagnostics via Variance Inflation Factor (VIF).

| Predictor | Internal VIF Value | Methodological Threshold | Status          |
|-----------|--------------------|--------------------------|-----------------|
| FAP       | 1.412              | Less than 5.0            | No Collinearity |
| FAS       | 1.214              | Less than 5.0            | No Collinearity |
| ITU       | 1.558              | Less than 5.0            | No Collinearity |
| FAP * ITU | 2.451              | Less than 5.0            | No Collinearity |
| FAS * ITU | 2.102              | Less than 5.0            | No Collinearity |

Note: FAP = Fixed Asset Planning; FAS = Fixed Asset Safeguarding;

ITU = Information Technology Utilization.

Source: Processed primary data (2025)

The empirical results presented in Table 2 showed that the VIF values for all primary predictors and multiplicative interaction terms ranged from 1.214 to 2.451. Because these values remained well below the commonly accepted threshold of 5.0 (Hair *et al.*, 2019), the regression model was declared free from multicollinearity. This diagnostic outcome confirmed that the variances of the estimated coefficients were stable and appropriate for the moderated regression analysis.

#### 4.1.2 Hypotheses and Moderation Testing

The regression analysis employed the MRA approach to examine the associations of FAP and FAS, alongside ITU, with BME. This method was selected for its specific ability to explore interaction effects while preserving data quality. Prior to computing the interaction terms (FAP×ITU and FAS×ITU), FAP, FAS, and ITU were mean-centered to reduce non-essential multicollinearity and facilitate interpretation of the interaction coefficients. The estimation was conducted through three incremental modeling stages to evaluate both standalone direct associations and multiplicative interaction terms.

Model 1 evaluated only the direct effects of FAP and FAS on BME. Model fit was evaluated using the Adjusted R-Squared statistic, which indicated that the baseline specification explained 57% of the variation in BME (Adjusted R-Squared = 0.570). Additionally, the global F-test confirmed the model's overall significance, yielding an F-statistic of 63.406, which exceeded the critical threshold of 3.10. These findings validated the model's baseline explanatory power.

Model 2 introduced the direct effect of ITU into the regression framework. The inclusion of this variable improved the model's overall explanatory power, increasing the Adjusted R-Squared to 0.601. The corresponding F-test result, with an F-statistic of 50.172, exceeded the critical threshold of 2.70, confirming the continued significance of the model. Notably, ITU exerted a positive and statistically significant direct influence on BME, reinforcing the value of digital tools in enhancing public asset systems.

Model 3 added the multiplicative interaction terms between ITU and both primary independent variables. The Adjusted R-Squared value improved further to 0.655, indicating that the full interaction model explained 65.5% of the total variance in BME. The calculated F-statistic of 29.800, well above the 2.32 critical value, indicated the joint significance of all primary variables and their associated interaction terms. This final specification provided empirical evidence regarding how ITU moderated the relationships within the governance model. The complete regression statistics across the three specifications are detailed in Table 3.



**Table 3.** Moderated regression analysis results.

| Variable       | Model 1  | Model 2  | Model 3  |
|----------------|----------|----------|----------|
| Constant       | 10.730   | 7.811    | 9.674    |
| FAP            | 0.501*** | 0.461*** | 0.446*** |
| FAS            | 0.201**  | 0.113**  | 0.110**  |
| ITU            | -        | 0.146*** | 0.144*** |
| FAP * ITU      | -        | -        | 0.200*** |
| FAS * ITU      | -        | -        | 0.111    |
| Adjusted $R^2$ | 0.570    | 0.601    | 0.655    |
| F-Statistic    | 63.406   | 50.172   | 29.800   |

\*Note: \*\*\* $p < 0.01$ ; \*\* $p < 0.05$ ; \* $p < 0.10$ . FAP = Fixed Asset Planning;

FAS = Fixed Asset Safeguarding; ITU = Information Technology Utilization;

BME = Effectiveness of Regional Asset Management.

**Source:** Processed primary data (2025)

The empirical parameters illustrated in Table 3 indicate specific relationships across the three model specifications. In the first specification, both FAP and FAS exhibited positive and statistically significant relationships with BME. Specifically, FAP was positively associated with BME at the 1% significance level, while FAS was positively associated at the 5% significance level. These baseline results suggest that FAP and FAS are fundamental components of local property governance.

With the introduction of ITU in the second specification, the model's explanatory power increased. ITU presented a positive and statistically significant association with BME, indicating its essential role in facilitating asset oversight and improving operational accuracy within regional departments. The inclusion of this variable reinforces the strategic value of integrating digital platforms into government asset processes.

In the third specification, the multiplicative interaction terms were evaluated to isolate the dynamics of moderation. The interaction between FAP and ITU (FAP\*ITU) was positive and statistically significant at the 1% level, demonstrating that ITU significantly strengthens the positive association between FAP and BME outcomes. In contrast, the interaction between FAS and ITU (FAS\*ITU) did not achieve statistical significance. This finding suggests that digital tools exert a limited moderating influence on physical and legal safeguarding functions. This statistical asymmetry implies that municipal technological investments yield pronounced governance improvements in planning-related functions rather than in standalone physical security or protection mechanisms.

## 4.2 Discussion

Consistent with Kaganova and Telgarsky (2018), who identify structured planning as foundational to effective local asset management, FAP's strong association with BME in Tana Toraja Regency (not causal, given the cross-sectional design) underscores that structured planning practices establish a critical baseline for institutional resource efficiency. Systematic FAP enables local administrations to secure early legal certainty, formalize land registries, and ensure that budgetary allocations align with actual public infrastructure needs. In practice, these outcomes reflect the municipal government's commitment to regulatory compliance and thorough physical land inventories. Aligning local planning procedures with national regulatory frameworks enhances the institutional credibility and operational functionality of the regional land management architecture.

The analysis also indicates that FAS is positively and significantly associated with BME. Although its standalone association is more modest than that of the FAP construct, proactive FAS remains a vital operational mechanism to protect public land from unauthorized third-party use, illegal encroachment, and administrative oversight. These results highlight the importance of maintaining up-to-date ownership records, establishing clear physical boundaries, and conducting regular monitoring protocols. In Tana Toraja Regency, safeguarding efforts appear to be driven by preventive emulation and adherence to documentation standards, even though administrative challenges in completing data registration persist. When consistently enforced, these protective controls minimize operational risks and preserve land utility for regional development (Abdillah *et al.*, 2022).

Furthermore, the results highlight the valuable role of ITU as an operational enabler within local property governance. The direct, significant effect of ITU across the models indicates that integrating digital tools simplifies workflows and improves the accuracy of public land records. Comparable geospatial monitoring innovations, when adopted, are intended to serve this function within Tana Toraja Regency, though adoption appears to be limited to date. Such tools, where in place, improve land registry precision and provide local administrators with real-time spatial data to support strategic decisions (Park *et al.*, 2023).

The moderation analysis reveals a compelling nuance: ITU significantly strengthens the relationship between FAP and BME, yet it fails to moderate the connection between FAS and BME. The significant interaction term (FAP\*ITU) demonstrates that digital infrastructure amplifies the governance benefits of structured planning by improving data accuracy, reducing inter-departmental information asymmetry, and enabling rapid document verification (Aguiar *et al.*, 2024). This confirms that digital systems achieve their highest utility when integrated with forward-looking administrative activities such as need forecasting and asset mapping (Nübel *et al.*, 2021). Conversely, the non-significant interaction term (FAS\*ITU) indicates that the relationship between FAS and BME remains independent of technology levels. This finding suggests that physical and legal asset protection continues to rely primarily on human oversight, legal clarity, judicial enforcement, and regulatory compliance rather than digital interfaces alone.

This administrative divergence implies that while digital applications are highly effective for data mapping, logging, and registration phases, their capacity to enforce physical security remains limited without broader institutional and legal support. Therefore, the full potential of ITU in FAS can only be realized through parallel efforts in regulatory enhancement, formal inter-agency cooperation, and field-level enforcement capacity (Asif *et al.*, 2023). These insights suggest that policymakers should adopt a balanced approach that combines digital investments with institutional development. Strategic planning workflows benefit substantially from technological integration, whereas effective FAS requires robust procedural frameworks, clear statutory authority, and strict administrative compliance. This asymmetric pattern extends prior digital-governance frameworks that treat technology as a broadly uniform institutional enabler (Misuraca *et al.*, 2010): the present findings refine this view by showing that ITU's moderating capacity is stage-specific, strengthening upstream planning functions while leaving downstream, enforcement-dependent safeguarding largely unaffected.

It is also important to consider alternative explanations for the non-significant FAS\*ITU interaction beyond a purely legal-enforcement account. First, the relatively small sample size ( $n = 95$ ) limits the statistical power available to detect interaction effects, which are typically harder to detect than main effects in survey-based regression designs. Second, if utilization were already uniformly high

or low across offices, low variance in reported ITU levels among respondents would constrain the range needed to observe a moderating relationship.

Third, the FAS and ITU measures may not have fully captured the specific digital functionalities relevant to safeguarding, such as asset tracking or GIS-based monitoring, thereby attenuating the estimated interaction. Finally, local digital tools relevant to safeguarding may still be in the early or uneven stages of institutional rollout, so their potential to moderate safeguarding outcomes may not yet be fully realized. These measurement and implementation considerations should be examined in future research using larger samples and more granular indicators of technology use.

## 5. Concluding Remarks and Recommendation

This study set out to address the land administration deficiencies identified in Tana Toraja Regency by investigating three central questions: how FAP relates to BME, how FAS relates to BME, and whether ITU serves as a significant moderating variable within these relationships. To address these inquiries, a quantitative explanatory design was executed using primary data from 95 purposively sampled municipal civil servants, with the direct and interactive relationships estimated via Moderated Regression Analysis.

The empirical analysis revealed that structured FAP is positively and highly significantly associated with BME. Similarly, FAS displays a positive and statistically significant relationship with BME, though its standalone magnitude is less pronounced than that of planning. Crucially, the moderation analysis demonstrated that ITU significantly strengthens the positive relationship between FAP and BME, whereas it exerts no statistically significant interactive influence on the FAS-BME pathway.

This study contributes to theory, practice, and policy on subnational property administration in three ways. Theoretically, it extends asset life cycle theory and digital governance frameworks by showing that technology acts as an asymmetrical enabler rather than a uniform solution across administrative stages. In practice, it offers local government administrators an operational roadmap: investments in customized applications yield the greatest returns when integrated into forward-looking planning workflows rather than into physical security mechanisms. From a policy perspective, it indicates that digital transformation must be paired with manual compliance reforms and clear statutory mandates to be effective.

Despite its empirical insights, this study possesses certain limitations that provide a clear foundation for future scholarly inquiry. Because the research relied on cross-sectional primary data collected within a single regional jurisdiction, the findings may capture a specific administrative timeline. They may not fully account for institutional variations across diverse cultural or geographic settings. Furthermore, the analysis focused predominantly on internal administrative personnel, leaving out broader external stakeholders who interact with public property systems. Building on these limitations, future researchers should employ longitudinal research designs to track the long-term governance shifts induced by digital integration. Additionally, the future research agenda should explore how localized digital platforms interact with macro-level legal reforms and evolving stakeholder engagement strategies across varying administrative environments to establish a more holistic framework for sustainable public land governance.

## Statement of Use of Generative AI

During the preparation of this work, the author used generative artificial intelligence tools to support the scientific writing process. Grammarly was used to check grammar, refine writing style, and improve clarity in scientific writing. All interpretations, analyses, and conclusions presented in this study are the sole responsibility of the author.

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