Digital Transformation for Protected Forest Governance: A Policy Reform Framework for Land-Use Licensing in Indonesia

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Abstract: Digital transformation has increasingly been discussed as a potential driver of reform in natural resource governance, particularly in the management of protected forests through land-use permitting systems. In practice, however, the digitalization of licensing processes has largely emphasized administrative efficiency and procedural simplification, while its function as a legally institutionalized instrument of environmental control remains limited. This study examines the regulatory and institutional configuration of land-use permitting in protected forest areas in Indonesia and develops a policy reform framework that positions digital transformation within governance and legal reform. Employing a normative legal approach combined with qualitative policy analysis, the research reviews statutory frameworks, institutional arrangements, and policy documents related to forestry regulation, spatial planning, and digital licensing systems. The analysis indicates that protected forest governance continues to face regulatory fragmentation, overlapping institutional mandates, limited spatial data integration, and accountability constraints within existing digital licensing structures. In response, the study formulates a sector-specific reform framework structured around four interconnected pillars: regulatory harmonization, institutional integration and accountability, integrated digital licensing architecture, and environmental justice and public participation. Rather than proposing a demonstrated policy outcome, the framework provides a normative and institutional proposition for embedding digital transformation within preventive (ex ante) environmental control and legally coherent governance structures. The results reinforce the conceptual development of digital governance reform in protected forest management while outlining directions for future empirical and socio-legal research.

Keywords: digital governance, protected forest, land-use licensing, policy reform.

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Introduction

In developing nations with high development pressures, such as Indonesia, protected forest areas are normatively designated as instruments for environmental protection and long-term public interest. In Indonesia, the management of protected forests continues to face structural challenges that are closely linked to fragmentation within the regulatory framework and inconsistencies among responsible institutions. Although protected forests are formally designated under national forestry law to maintain ecological functions, in practice their governance is shaped by the interaction of multiple sectoral regimes, including forestry regulation, spatial planning policy, and business licensing arrangements. These regimes do not always operate in a harmonized manner (Kraus et al., 2021; Vial, 2021). The introduction of electronic-based licensing systems has not entirely resolved this issue, particularly because spatial data and forest area designation databases are not yet fully integrated. As a result, land-use permits may be issued without sufficiently reflecting the designated protective function of certain forest areas, thereby creating legal uncertainty and weakening the preventive character of the licensing system (Zaoui & Souissi, 2020).

Therefore, the issue of permits is not just an administrative matter but a legal and governance issue that directly affects environmental sustainability. In the past ten years, digital transformation in public administration has started to be viewed to improve the governance of natural resources. The use of geographic information systems, the digitalization of permits, and the integration of spatial data are all thought to be capable of improving the accountability, efficiency, and transparency of public decision-making. Research on digital governance shows that, when supported by a suitable regulatory framework, digital systems can strengthen inter-agency coordination, reduce information asymmetry, and limit the scope for abuse of power (Vochozka, 2020). However, most studies continue to treat digital transformation as a managerial or technical innovation, without thoroughly analyzing its normative and legal implications. The relationship between government digital instruments and these environmental law principles is still largely unexplored, especially when it comes to land use permits in protected forest areas. Environmental law studies highlight the importance of enforceable legal norms, clear accountability mechanisms, public access to information, and environmental justice (Fontaine et al., 2022)

This study posits that digital transformation ought not to be perceived merely as administrative modernization, but rather as a catalyst for policy and legal reform. A digital-based licensing system could be a legally binding way to govern, limit the power of administrators, and make it easier to challenge licensing decisions in court.The primary contribution of this article is the formulation of a policy reform framework that regards digital

transformation as a normative legal instrument in the governance of protected forests. Unlike previous research that concentrated on the technical aspects of digitalization, this article highlights the need for regulatory harmonization, institutional integration, and the strengthening of environmental justice within digital-based licensing systems (Pomaza-Ponomarenko et al., 2023). This research poses the central question, which is pertinent given the growing urgency of environmental protection amid development and investment pressures: how can digital transformation be designed through the land use permit system in Indonesia. Furthermore, strengthening the governance of protected forests through digital transformation requires a shift in perspective toward the permitting system as an instrument of legal control rather than merely a public service mechanism; the literature on environmental governance suggests that effective permitting should serve as a preventive measure, proactively reducing the risk of environmental damage through data integration, ongoing monitoring, and the traceability of administrative decisions (Sani et al., 2024).

This article briefly reflects on selected governance experiences from the European Union and ASEAN regions to provide contextual perspective for Indonesia's policy development. These references are illustrative and do not constitute a formal comparative legal analysis. To achieve the goals of protecting protected forests in a sustainable and equitable manner, a policy reform framework that explicitly places digital instruments within the administrative and environmental legal regimes is required (Ahrens & Khalifa, 2013; Pal, 2004). Based on this description, this study positions digital transformation as an integral part of policy and legal reform in protected forest governance, particularly through the system for land use permits. Although this article engages with broader debates on digital transformation, environmental justice, and comparative governance experiences, its analytical focus remains specifically confined to the legal-institutional configuration of land-use permitting within protected forest governance in Indonesia. The references to European Union and ASEAN contexts serve only as illustrative reflections rather than as a formal comparative legal analysis.

In this context, a digital-based licensing system opens opportunities to systematically embed the principles of prudence, transparency, and accountability into the decision-making process. Nevertheless, digital transformation has the potential to replicate old issues in a more complex way. This research uses a normative-juridical approach and qualitative policy analysis to investigate how forestry regulations, spatial planning, and digital government initiatives shape more transparent, accountable, and equitable control mechanisms. The analysis is therefore anchored in the interaction between Indonesia's Forestry Law framework, spatial planning authority under ATR/BPN, and the OSS-based centralized licensing regime, rather than addressing digital governance reform in a general or comparative sense. To this end, the article starts with a review of the literature and a conceptual framework on digital

transformation, forest governance, and environmental justice; it then analyzes the regulatory challenges in Indonesian protected forest licensing; it develops a framework for reforming digital policies from a normative legal perspective; it also looks at comparative experiences from the European Union and ASEAN regions for reflection; and, in the final section discusses policy implications and research limitations.

Research Method

This section describes the research design and approach used to examine digital transformation as an instrument of policy reform in protected forest governance through the system for land use permits. Given that the research focus lies in analyzing legal norms, public policy, and institutional design, this study is not aimed at empirically testing causal relationships but rather at assessing the coherence of regulations, normative implications, and the policy rationality underlying the implementation of a digital-based licensing system. Therefore, the research method is designed to ensure that the analysis conducted can answer the research questions systematically and consistently with the legal and policy approach.

Types and Approaches of Research

This research is normative legal research combined with qualitative policy analysis. Normative legal research is used to examine the legal norms, principles, and regulations governing the management of protected forests and the land use permit system, particularly in the context of digital transformation. This approach is relevant because the research focus lies on analyzing the substance of regulations and policy design, rather than on quantitatively measuring empirical impacts or actor behavior.Within the framework of this research, a normative-juridical approach is applied to examine the coherence and consistency of legislation governing forestry, spatial planning, business licensing, and digital governance (Taherdoost, 2022; Zimmerman et al., 2010). Qualitative policy analysis complements this approach by assessing the rationality of the policy, its institutional implications, and the normative consequences of implementing a digital permit system in the governance of protected forests. Thus, the combination of these two approaches allows for a comprehensive assessment of the relationship between digital transformation, regulatory design, and environmental protection goals. This research is not intended as an evaluative study based on empirical data or a field survey. Conversely, the research focuses on developing a conceptual and normative policy reform framework, based on an analysis of existing laws and policies. This approach was chosen to ensure that the recommendations generated have a strong legal basis and are relevant for strengthening legal certainty, administrative accountability, and environmental justice in the management of protected forests (Machar et al., 2016; Parviainen & Frank, 2003).

Research Approach

The analysis combines several approaches to examine digital transformation in the governance of protected forests, particularly in relation to land-use permitting. A statutory analysis is undertaken to review the regulatory framework governing forestry, spatial planning, business licensing, and digital governance. Through this examination, the study maps the existing legal foundations, the distribution of authority, and areas where regulatory overlap or inconsistency may weaken the operation of digital licensing systems. The way digital transformation is discussed in protected forest governance often assumes that regulatory change follows automatically from technological adoption. That assumption is not taken for granted in this study. The analysis looks at how land-use permitting is structured within Indonesia's legal framework and asks whether digital systems operate within, or merely alongside, existing statutory arrangements. Rather than separating forestry regulation, spatial planning, business licensing, and digital governance into distinct domains, the study reads them together to see how authority is distributed and exercised in practice. Conceptual discussions on digital transformation, digital governance, and environmental justice are used here as interpretive references, not as abstract classifications. They help clarify how digital systems may alter administrative judgment, institutional coordination, and the conditions under which permits are granted (Zhu & Song, 2021). The concern is less about defining these concepts and more about understanding their legal consequences. The policy dimension is approached in a similar manner. Instead of assuming that digital licensing necessarily improves governance, the study considers the reasoning behind its adoption and the institutional effects that follow. It asks whether the chosen regulatory instruments support environmental protection objectives and whether they remain accountable to the broader public interest. By combining these three approaches, this study can provide a comprehensive analysis of the relationship between regulatory design, digital transformation, and the strengthening of protected forest governance (Johnston, 2014; Moen, 2006).

Source and Scope of Analysis

This research is based on an analysis of various legal and policy sources relevant to the governance of protected forests and digital land use permits. The primary sources analyzed include the legal and regulatory framework in the fields of forestry, spatial planning, business licensing, and digital government policies governing the use of electronic systems in public administration. An analysis of these sources was undertaken to clarify the legal foundations, authority structures, and normative relationships among regulatory regimes shaping protected forest governance. The instruments examined were selected considering their hierarchical position within the national legal system, their substantive relevance to protected

forest management, and their institutional implications for land-use licensing and digital administrative systems (Blackman & Villalobos, 2019).

Particular attention is given to statutory provisions and implementing regulations that define institutional authority, spatial validation procedures, and accountability mechanisms. Adopting a critical legal-institutional perspective, the study moves beyond the formal structure of regulatory texts to consider the normative tensions, institutional ambiguities, and governance gaps embedded in digital land-use licensing arrangements. Digital transformation is thus analyzed within its broader legal and institutional setting, with emphasis placed on structural coherence and accountability design rather than on a descriptive account of regulatory content. In addition to normative sources, this research also utilizes academic literature and policy documents as analytical references. The literature includes scientific journal articles, academic books, and reports from national and international institutions that discuss digital governance, natural resource management, and environmental justice.

These sources are used to enrich conceptual and policy analysis, as well as to place research findings within the broader context of academic discourse. The scope of analysis in this study is limited to the legal and policy aspects related to the design and implementation of the land use permit system in protected forest areas. The analysis focuses on governance norms, principles, and institutional mechanisms, without including empirical measurements of policy effectiveness in the field. Given the legal-institutional focus of the research question, a normative legal methodology is appropriate for examining regulatory coherence, institutional configuration, and governance architecture in protected forest management. Rather than measuring implementation outcomes, the study critically evaluates how digital licensing systems are embedded within binding legal norms and accountability structures. The analysis is based on the most recent versions of statutory and implementing regulations in force at the time of writing, including post–Job Creation Law regulatory adjustments relevant to digital licensing and protected forest governance (Rodríguez-Rodríguez & Martínez-Vega, 2018).

Techniques for Collecting and Searching Sources

The collection and review of sources in this study were conducted through a systematic document study of regulations, policies, and literature relevant to protected forest governance and digital land use permit systems. The search focused on laws and regulations and policy documents that have a direct connection to the regulation of authority, licensing procedures, and the use of electronic systems in government administration. This approach allows for the identification of the normative structures and policies that shape the licensing governance framework in protected forest areas. Additionally, the academic literature search was conducted selectively, utilizing databases of scientific journals, academic publishers, and reports from international organizations

The literature studied was selected based on thematic relevance, academic authority, and its connection to issues of digital transformation, digital governance, natural resource management, and environmental justice. This search is not intended to compile a comprehensive literature review but rather to provide an adequate conceptual and policy foundation for the normative analysis being conducted. All the sources obtained were then classified and reviewed based on relevant themes and regulatory regimes, making it easier to analyze the interconnections between legal norms, policies, and principles (Strategy & Plan, 2009). This source collection and tracing technique is designed to ensure that the analysis conducted is focused, consistent with the normative-legal approach, and capable of supporting the development of the policy reform framework discussed in the next section.

Technical Analysis

The investigation proceeds through a comprehensive analysis of the legal framework governing protected forest management and land-use licensing in Indonesia, with particular emphasis on the integration of digital governance systems into existing regulatory structures. Rather than examining statutory provisions in isolation, the discussion evaluates the practical interactions among forestry regulations, spatial planning laws, corporate licensing regimes, and digital administrative systems. When analyzed collectively, these regulatory instruments reveal overlapping jurisdictions, institutional ambiguities, and uneven distributions of authority, which become increasingly apparent within the implementation of digital licensing systems. Conceptual debates on digital transformation, digital governance, and environmental justice are drawn upon to clarify the broader implications of introducing digital systems into permitting processes. In this setting, digital transformation is treated not merely as a technical upgrade but as part of an evolving legal and policy environment that shapes discretion, accountability, and preventive environmental control. Attention is also directed to the coherence of regulatory design and the configuration of accountability mechanisms within digital licensing structures. The analysis considers whether these arrangements align with principles of administrative legality and environmental protection, and whether they support effective ex ante oversight. The resulting assessment provides the basis for identifying structural gaps and outlining directions for institutional and regulatory refinement.

Result and Discussion

This section presents the results of normative and policy analysis regarding protected forest governance through a digital land use permit system. The discussion focuses on identifying regulatory and institutional challenges that affect the effectiveness of licensing, as well as the limitations of the current digitalization applied in controlling the utilization of protected forest areas. Next, this section examines digital transformation as an instrument for policy and legal

reform that has the potential to strengthen legal certainty, administrative accountability, and environmental protection. The analysis was then compiled into a policy reform framework relevant for strengthening protected forest governance in Indonesia.

Regulatory Challenges in Land Use Licensing in Protected Forest Areas

In Indonesia, the challenges in protected forest permitting are therefore not limited to technological capacity but relate more fundamentally to the coherence of legal norms, institutional coordination, and the integration of spatial and administrative data systems. Under Law No. 41 of 1999 on Forestry, the designation and management of protected forest areas fall under the authority of the Ministry of Environment and Forestry. Spatial planning responsibilities are governed by Law No. 26 of 2007 on Spatial Planning and institutionally administered by the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN). Land-use licensing procedures are processed through the Online Single Submission (OSS) system under Law No. 11 of 2020 on Job Creation and its implementing regulations. The current institutional arrangement shows why maintaining coherence in digital permitting is not straightforward. Forestry authority, spatial validation, and electronic licensing are handled by different bodies, each operating under its own mandate. As a result, digital systems do not replace fragmentation; they function within it. In practical terms, forest designation and ecological assessment remain under the Ministry of Environment and Forestry. Spatial conformity is reviewed by ATR/BPN, while licensing approval is processed through the centralized OSS platform. Because these responsibilities are divided, digital permitting depends heavily on coordination across institutions (Strategy & Plan, 2009). Where alignment is weak, gaps may appear in oversight and preventive environmental control. For this reason, the effectiveness of digital permitting cannot be assessed solely in technical terms. Its performance is shaped by how well the surrounding legal framework connects these institutional roles. This raises broader questions about whether digital transformation is being used merely to streamline procedures or to address deeper regulatory inconsistencies.

Limitations of Digital-Based Licensing Systems in Protected Forest Management

A digital licensing system in protected forest governance is expected to improve efficiency and transparency. In Indonesia, land-use permits are processed through the OSS platform under the Job Creation Law, while forest designation and ecological safeguards continue to follow the Forestry Law under the Ministry of Environment and Forestry. This arrangement places electronic licensing and environmental control in different institutional settings. As a result, digital systems mainly function as tools for administrative processing. The mechanisms for ecological validation, spatial conformity checks, and legal oversight remain anchored in

sectoral regulations and are not fully integrated into the digital licensing structure. This separation shapes how preventive environmental control operates in practice.

One key limitation concerns the integration of spatial and environmental data systems. Although the OSS platform enables centralized processing of permit applications, spatial validation of protected forest areas depends on forest area designation maps and sectoral determinations administered by KLHK and spatial planning authorities under the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN). The absence of a fully harmonized single spatial reference framework illustrates the coordination challenges between digital licensing platforms and sectoral environmental governance regimes. From an accountability standpoint, the regulatory framework governing digital licensing does not comprehensively institutionalize structured transparency regarding the legal basis, ecological evaluation, and procedural reasoning underlying permit decisions. Digital systems can make licensing procedures easier to track. However, questions about who is responsible for supervision and legal oversight may arise when licensing administrators and sectoral ministries divide authority. This division can create uncertainty in practice. Differences in institutional capacity and access to digital tools also matter, especially in Indonesia. Many forest-dependent communities have traditionally relied on face-to-face participation and non-digital procedures. If digital permitting is introduced without clear legal guarantees of transparency and access, certain groups may find it harder to engage with the process. In such circumstances, digital reform does not automatically advance environmental justice. Its impact depends on how accountability and inclusivity are secured within the broader regulatory framework.

Digital Transformation as an Instrument for Governance Reform

The previous section's analysis demonstrated that the primary challenge in the governance of protected forests is not the lack of technology, but rather the manner in which that technology is integrated within the legal and policy framework. Consequently, digital transformation must be perceived as a mechanism for governance reform, rather than merely the digitization of administrative processes. From this perspective, a digital-based licensing system serves as a governance architecture capable of reshaping power relations, decision-making flows, and mechanisms for controlling the use of protected forest areas. As an instrument of governance reform, digital transformation has the potential to strengthen the legal function of licensing as an ex-ante control mechanism.

The integration of digital systems with spatial data, environmental protection regulations, and structured evaluation standards allows the permitting process to be carried out more objectively and consistently. Permitting decisions are no longer solely dependent on individual administrative discretion but on a system that is normatively binding and whose basis for

consideration can be traced. In this context, digital systems can function as an extension of legal norms, limiting the scope for deviation while simultaneously increasing legal certainty. Digital transformation also plays a role in strengthening administrative accountability and public oversight. A digital-based permitting system allows for the systematic recording of processes, decisions, and changes in permit status, thus creating an auditable administrative trail. When legally recognized as part of state administrative actions, decisions made through the digital system can be tested through internal oversight mechanisms and legal efforts. Thus, digital transformation contributes to increased justiciability of licensing decisions, which have often been difficult to substantively test.

The Job Creation Law in Indonesia created the OSS platform to manage land-use permits through a single digital system. The goal was clear: to make things easier and cut down on the number of steps in the administrative process. In real life, applications are sent and processed online, which makes the steps easier to understand. But the core environmental functions haven't changed to fit into the same structure. The Ministry of Environment and Forestry is still in charge of designating forest areas and reviewing their ecology. ATR/BPN is in charge of making sure that everything is in the right place. These roles keep going because they have been given specific tasks by their institutions. So, digital licensing goes beyond existing sectoral boundaries instead of replacing them. The platform itself doesn't matter as much as how well these organizations work together to do their jobs.

However, this potential can only be realized if digital transformation is institutionalized within a coherent regulatory framework and institutional design. Without clear legal recognition of the status of digital systems, the division of authority among institutions, and data management responsibilities, technology actually risks weakening accountability. Therefore, digital transformation must be positioned as part of a policy reform that includes cross-sectoral regulatory harmonization, institutional integration, and the strengthening of legal oversight and accountability mechanisms. In the Indonesian context, the interpretation of digital transformation as an instrument for governance reform is becoming increasingly relevant given the complexity of protected forest regulations and the high pressure on land use. From a normative perspective, the evaluation of permit digitalization should not be limited to improvements in service speed but should instead consider its potential capacity to reinforce the protection of protected functions, enhance legal certainty, and strengthen accountability in decision-making processes. Based on this understanding, the next section develops a policy reform framework that outlines how digital transformation may be operationalized within the legal-institutional structure of protected forest governance.

Policy Reform Framework for Digital-Based Protected Forest Governance

Based on the analysis results in the previous section, this section formulates a policy reform framework that operationalizes digital transformation as a governance instrument for land use permits in protected forest areas. This framework is intended to bridge the gap between the administrative digitalization that has been implemented so far and the need for substantive governance reform. So, this reform framework doesn't focus on the technical parts of technology. Instead, it focuses on making sure that the legal rules, institutional design, and governance principles that support the digital licensing system are all in line with each other. The first part of this policy reform framework is making rules the same across the board. Digital transformation in licensing can only work well if forestry rules, spatial planning, business licensing, and digital government policies are all in line with each other. To make sure that the digital licensing system is legal, that the decisions made are legally binding, and that environmental protection rules are always part of licensing standards, regulatory harmonization is needed. In Indonesia, this kind of harmonization needs to happen between the Forestry Law framework, the Job Creation Law regime, the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN) spatial planning rules, and the OSS-based digital licensing system. If regulations aren't in line, digital systems could end up being just procedural tools that don't help protect forests. The second pillar is making institutions work together and making them more accountable.

This reform approach emphasizes the importance of a clear distribution of power among organizations and levels of government in the management of digital permits. This includes explaining the specific roles of the Ministry of Environment and Forestry in identifying forest areas and checking their ecological validity, the ATR/BPN in assessing spatial conformity, and the centralized licensing agencies that work within the Online Single Submission (OSS) system. Institutional integration must be accompanied by the clarification of legal responsibility for data management, system operation, and licensing decision-making. In addition, decisions made through digital systems need to be explicitly recognized as acts of state administration that can be tested through internal oversight mechanisms as well as the judiciary. This recognition is a prerequisite for strengthening accountability and the testability of laws in licensing governance. The third pillar is an integrated digital licensing architecture. Within this framework, digital systems are positioned as a preventive (ex ante) instrument of legal control, rather than merely a means of administrative service. Digital licensing architecture needs to connect the licensing system to reliable spatial and environmental data so that every licensing decision is based on clear proof of the area's status and ecological boundaries. In practice, this means that OSS-based permit processing and authoritative forest

area maps and environmental datasets managed by sectoral agencies under the Forestry Law framework need to be officially linked.

This integration makes it possible to limit the discretion of administrators, make decision-making criteria more consistent, and make the management of protected forests more legally certain. The fourth pillar is fairness to the environment and getting people involved. This policy reform framework makes access to information, openness in the permitting process, and the protection of affected communities all important parts of digital governance. Digital transformation should make it easier for people to get involved and keep an eye on things, not make it harder for some people to do so because they don't have access to technology. A digital permitting system can help make sure that environmental benefits and burdens are shared more fairly by following the principles of environmental justice. It can also make protected forest management policies more legitimate. A digital permitting system can help make the distribution of environmental benefits and burdens more fair by following the rules of environmental justice. It can also make protected forest management policies more legitimate.

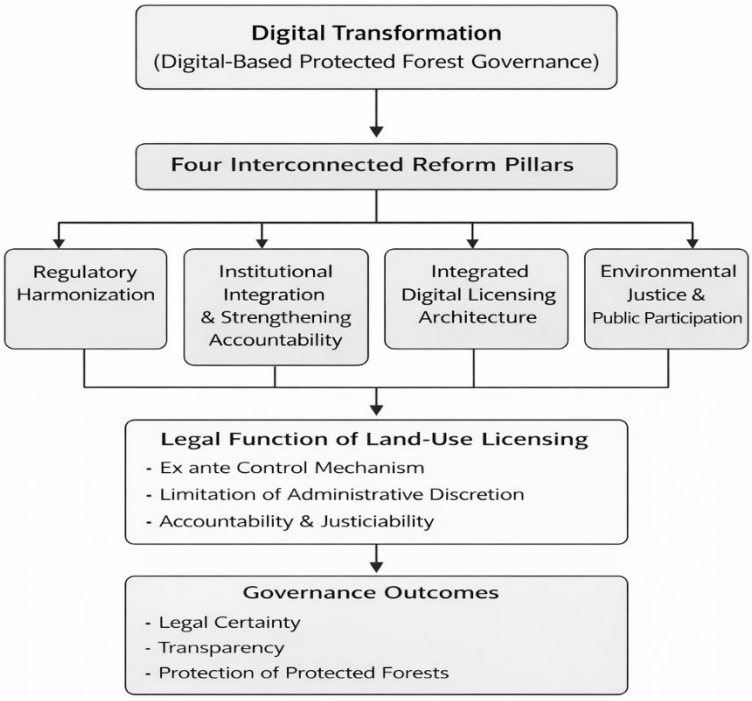

Figure 1 Policy Reform Framework for Digital-Based Protected Forest Governance

Digital transformation is being used to change how the land-use permitting system works for protected forest areas, as shown in Figure 1. Digital transformation is not just about making administrative tasks digital. It is also about creating a governance structure around four connected reform pillars: regulatory harmonization, institutional integration and accountability, integrated digital licensing architecture, and environmental justice and public participation. Digital transformation acts as a coordinating framework that brings together

legal norms, institutional authority, spatial and environmental data systems, and participatory safeguards at the most basic level. By putting these two things together, land-use licensing can be used to stop problems before they happen (ex ante control mechanism). This makes it easier to follow the decision-making process and limits the power of administrators to make choices. When decisions made through digital systems are made legal, they are open to review by the courts and by the government. This makes people more responsible and keeps protected forests safer.

Policy Implications, Risks, and Limitations

The use of the digital transformation-based policy reform framework in the management of protected forests has many important effects on how public policy is made and how the government runs. The first implication pertains to alterations in institutional roles and responsibilities, especially regarding the relationship between the central government and local governments. The formalized digitalization of permits can enhance intersectoral and intergovernmental coordination, while necessitating clear delineation of authority for data administration, decision-making, and permission oversight. In this context, digital transformation affects both the processes and the organizational structure and culture of bureaucracy. The second conclusion is to enhance the efficacy of administrative law. The integration of a digital licensing system into verifiable administrative actions can improve accountability and legal clarity in digital governance reform. Systematically recorded and data-integrated license decisions facilitate enhanced internal oversight, public scrutiny, and court testing. However, these beneficial outcomes can only occur if the digital system is supported by explicit legislation and sufficient institutional capability.

Nonetheless, the transition toward digital governance must be assessed critically because it also introduces several potential risks. One significant concern is the persistence of the digital divide, both across geographic regions and among different social groups. Heavy reliance on digital platforms may unintentionally produce new forms of exclusion for communities that have limited access to technological infrastructure or insufficient digital literacy, particularly local and indigenous populations living in or near protected forest areas. In addition, challenges related to data reliability, system security, and the potential manipulation of information may undermine confidence in digital licensing mechanisms if these issues are not effectively managed. Beyond these implementation challenges, the policy reform framework proposed in this study also faces certain conceptual and practical constraints. The study does not intend this framework to resolve all the long-standing structural conflicts inherent in forestry and land use governance. Institutional capacity, political commitment, and the accompanying regulatory readiness heavily influence the reform's success. The transition from a conventional licensing system to an integrated digital-based system requires significant

time and adjustment, so we cannot expect the impact of the reform to happen instantly. By acknowledging these implications, risks, and limitations, this research confirms that digital transformation in protected forest governance is not an instant technocratic solution but rather a complex process of policy and legal reform. Recognizing the potential challenges and risks associated with policy reform is crucial to ensure that digital transformation genuinely contributes to stronger protection of protected forests, improves administrative accountability, and supports sustainable environmental governance.

This research examines regulatory frameworks and institutional architecture. It does not utilize fieldwork, interviews, or case-based evidence. Consequently, the discourse does not assess the functionality of digital licensing in routine administrative operations. The analysis is confined to the national level. This analysis does not address variations in implementation among provinces or districts. While environmental justice shapes the paradigm, empirical assessment of community participation and local socio-economic implications is lacking, particularly in how these factors influence the effectiveness of the legal and institutional framework at the national level. These borders are deliberate. The objective is to elucidate the construction of the legal and institutional framework, rather than to assess policy achievements. Subsequent research could investigate the operational dynamics of the OSS system in particular regions and the practical coordination among ministries.

Conclusion

This study suggests that the primary challenges in protected forest governance within land-use permitting stem from regulatory fragmentation, institutional coordination gaps, and the limited normative strength of licensing as a preventive control instrument, rather than from technological deficiencies alone. From a regulatory design perspective, the ongoing digitalization of permits remains predominantly oriented toward administrative simplification and has not yet been fully institutionalized as a substantive governance instrument for strengthening forest conservation functions. This analysis indicates that, in the absence of coherent legal alignment and institutional integration, digital systems risk reproducing structural governance weaknesses in electronic form. Based on this normative legal assessment, the study proposes a policy reform framework that positions digital transformation as a potential instrument of governance reform rather than merely an administrative enhancement. Through regulatory harmonization, institutional integration and strengthened accountability, the development of an integrated digital licensing architecture, and the incorporation of environmental justice and public participation principles, digital transformation may be normatively oriented toward reinforcing legal certainty and preventive control in protected forest management. The findings of this research

are grounded in a normative legal analysis conducted at the national regulatory level and therefore do not constitute an empirical evaluation of implementation effectiveness or institutional feasibility. Accordingly, the proposed framework should be understood as an analytical and institutional proposition rather than a demonstrated policy outcome. Future research may complement this study through empirical, case-based, or socio-legal approaches to examine the practical implementation dynamics and operational constraints of digital governance reform in forest and land-use administration.

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