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Synchronizing Global Standards as A Transformation of Indonesia's Green Economy Legal Regime in The Digital Society Era

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Abstract

The green economy has emerged as a critical global development agenda, particularly as nations intensify their commitments under the Paris Agreement and the Sustainable Development Goals (SDGs). Indonesia, as one of the world's significant carbon-emitting countries, faces a dual challenge: synchronizing international green economy standards into its national legal system while simultaneously integrating them within the rapidly evolving digital society. Despite several regulatory milestones, including Presidential Regulation No. 98 of 2021 on Carbon Economic Value, Law No. 4 of 2023 on Financial Sector Development and Strengthening, and Law No. 59 of 2024 on the National Long-Term Development Plan 2025–2045, a substantial normative gap persists between Indonesia's green economy legal regime and its technology-based digital legal infrastructure. This study aims to examine how the synchronization of global standards in green economy regulation can be integrated with the digital society's legal infrastructure to establish legal transparency and certainty, and to formulate a transformative model for Indonesia's green economy legal regime that adopts digital innovation as the primary instrument for achieving sustainable economic growth. Employing a normative juridical method through both statute and conceptual approaches, this study finds that effective global standard synchronization demands systemic normative reconstruction, and that digital innovation can serve as a compliance instrument through the concept of Green-Tech Compliance. This research contributes a novel concept, namely the digitalization of green economy legal compliance instruments, offering an adaptive regulatory framework for Indonesia as it navigates the challenges of technology-driven green transition.

Keywords: *Green Economy, Legal Synchronization, Digital Society, Green-Tech Compliance, Legal Regime Transformation*

1. INTRODUCTION

The tension between global green economy standards and Indonesia's domestic legal architecture presents a concrete and unresolved normative problem (Korppoo et al., 2023) Indonesia has ratified the Paris Agreement through Law No. 16 of 2016, committed to reducing greenhouse gas emissions by up to 43.20% by 2030 under its Enhanced Nationally Determined Contribution (NDC), and enacted a series of green economy regulations including Presidential Regulation No. 98 of 2021 on Carbon Economic Value, Law No. 4 of

2023 on Financial Sector Development and Strengthening (P2SK Law), and Law No. 59 of 2024 on the National Long-Term Development Plan 2025-2045 (RPJPN) (Seftiani et al., 2025) However, these instruments operate in regulatory silos, with no single legally binding, economy-wide green economy framework that integrates binding compliance mechanisms with digital enforcement infrastructure. The carbon tax introduced under Law No. 7 of 2021 has been repeatedly postponed, and the P2SK Law, while expanding OJK's authority over carbon exchange operations, stops well short of mandating enforceable digital reporting obligations. This fragmentation produces a structural legal problem: the absence of normative synchronization between international green standards and Indonesia's domestic regulatory regime, which in turn undermines the legal certainty that both investors and regulated entities require (Hurley & Lee, 2021)

The empirical consequences of this normative gap are increasingly visible. Despite the existence of numerous legal instruments promoting green banking and sustainable finance, empirical assessments demonstrate a substantial implementation gap, with Indonesia's regulatory regime still relying heavily on voluntary compliance and reputational incentives rather than binding legal obligations (Fukunaga, 2021) As a further illustration, while IDXCarbon was launched in October 2023 as a milestone carbon exchange platform aimed at facilitating transparent carbon credit transactions, and the OJK released the Sustainability Taxonomy for Indonesia (TKBI) in February 2024 to guide capital allocation toward green activities, participation in these instruments remained critically low in their initial phases. By the end of 2024, IDXCarbon had registered only 100 participants as Carbon Exchange Service Users, a figure that underscores the persistent barriers to meaningful market engagement. Meanwhile, Indonesia's ESG regulatory landscape remains fragmented across multiple sectoral regulations, with mandatory sustainability disclosure requirements expected to apply only by 2027 through the forthcoming Standar Pengungkapan Keberlanjutan (SPK), leaving a multi-year governance vacuum in standardized green reporting (Welsh et al., 2020)

This empirical reality exposes a profound gap between the *das sollen* and *das sein* of Indonesia's green economy legal order. In principle, Indonesia's constitutional mandate under Article 33(4) of the 1945 Constitution requires the national economy to be organized on the basis of sustainability and environmental balance, a normative ideal reinforced by international commitments under the Paris Agreement and the SDGs framework. In practice, however, Indonesia's medium and long-term planning embeds low-carbon development goals, yet these efforts remain fragmented and largely donor-driven, lacking a unified national strategy (Lin & Heeren, 2025) The digital dimension deepens this discrepancy further: while Indonesia's National Strategy for Digital Economy Development 2023-2030 envisions a dynamic and integrated digital policy environment encompassing the 2022 Personal Data Protection Law and emerging AI regulatory frameworks, no legal instrument currently bridges the digital economy infrastructure with green compliance obligations in a coherent, technology-enabled, and legally binding manner (Y. Chen & Xu, 2025) (Roussos & Hajduk, 2026)

Concrete regulatory developments from the international arena further amplify the urgency of this problem. Since January 2024, the EU's Corporate Sustainability Reporting Directive (CSRD) has mandated that companies meeting certain thresholds report on ESG criteria under European Sustainability Reporting Standards (ESRS), introducing the concept of "dual materiality" and requiring that sustainability data be digitally tagged for

machine-readable processing through the European Single Access Point (ESAP) (Milanés-Montero et al., 2026) This standard directly affects Indonesian companies embedded in European value chains. Across ASEAN, sustainability reporting is entering a new phase as regulators move to align with ISSB standards, with Malaysia, Vietnam, Thailand, and the Philippines all revising or rolling out new mandatory disclosure requirements between 2025 and 2026, while Indonesia's mandatory sustainability disclosure remains scheduled for 2027 at the earliest (Sri Wahyuningrum et al., 2025) The failure to align with these converging international standards creates a credible risk of market exclusion and trade friction for Indonesian businesses, a challenge that is simultaneously legal, institutional, and technological in nature (Ivens et al., 2024)

This combination of regulatory fragmentation, enforcement deficits, and digital governance vacuum reveals a significant research gap. While scholarship on Indonesian environmental law and sustainable finance has grown in recent years, the specific question of how global green economy standards can be normatively synchronized with Indonesia's digital legal infrastructure, and what a technology-enabled compliance model would look like in legal terms, remains insufficiently theorized (Donald et al., 2025) Existing research tends to address either green finance regulation or digital economic governance in isolation, without constructing a unified legal framework that treats digital technology as a primary instrument of green compliance (AlDhaheri et al., 2026) This study fills that gap by proposing the concept of Green-Tech Compliance as a normative architecture for integrating these two domains.

Three prior studies are directly relevant to situating this research. First, Muhammad Helmy Abdillah, in his monograph *Green Economy: Transformasi Ekonomi Menuju Keberlanjutan* published by Aikomedia Press (2026), examines the conceptual transformation of the Indonesian economy toward sustainability principles, offering a broad interdisciplinary overview of green economic transition. Second, Wira Romauli and colleagues, in their article "Dilema Kementerian Ketenagakerjaan: Menjembatani Regulasi dan Implementasi dalam Transformasi Ketenagakerjaan Menuju Ekonomi Digital dan Hijau," published in *Jurnal Masyarakat Hukum Harapan*, Volume 5, Issue 3 (2026), analyze the implementation gap in labor ministry policy as Indonesia navigates the intersection of digital and green economic transformation, highlighting the institutional dilemmas arising from regulatory transition. Third, Najwa Latisha and Rianda Dirkhareshza, in "Optimalisasi Regulasi Transformasi Digital Perbankan dengan Implementasi Berbasis Environmental Social Governance Sebagai Bentuk Transisi Menuju Green Banking," published in *Jurnal Ilmiah Penegakan Hukum*, Volume 11, Issue 2 (2024), pages 198-215, examine digital transformation in the banking sector through an ESG-based compliance lens, focusing on the transition toward green banking practices. While these works collectively address green economy transformation and its relationship to digital governance or labor regulation, none of them constructs a systematic normative framework for synchronizing international green standards with Indonesia's digital legal infrastructure, nor do they propose a legal compliance architecture grounded in a technology-driven instrument. The present study departs from these contributions by operating at the intersection of international legal harmonization and digital constitutionalism, offering a novel legal model rather than sectoral policy analysis (Muniz Da Conceição, 2025)

This study is therefore guided by two research questions: first, how can the synchronization of global standards in green economy regulation be integrated with the

digital society's legal infrastructure to achieve legal transparency and certainty; and second, what model of transformation for Indonesia's green economy legal regime can effectively adopt digital innovation as the primary instrument for achieving sustainable economic growth (You et al., 2026) The objectives of this research are to deconstruct the normative gaps in Indonesia's existing green economy legal architecture, to analyze the interaction between global standard-setting mechanisms and Indonesia's domestic regulatory framework, and to construct the concept of Green-Tech Compliance as a legally actionable model for adaptive regulation (Liu et al., 2025) Theoretically, this study contributes to the development of legal harmonization theory in the context of global-local regulatory integration and to the emerging scholarship on digital constitutionalism (Biber, 2023) Practically, it offers a policy-relevant blueprint for Indonesian lawmakers and regulatory agencies seeking to design enforceable, technology-enabled, and internationally compatible green compliance instruments.

2. METHOD

This study employs a normative juridical research method (*penelitian hukum normatif*), which examines law as a prescriptive discipline by analyzing legal norms, principles, and doctrines as they are written and systematically constructed rather than as they are empirically practiced (Andersen & Roehl, 2025) This approach is appropriate for the present research given that the central inquiry concerns the normative adequacy of Indonesia's existing green economy legal regime and its capacity to absorb global standards within a digital governance framework (Guo et al., 2025) Two research approaches are applied in combination. The statute approach (*pendekatan perundang-undangan*) is employed to systematically examine and analyze the hierarchy and substance of relevant legal instruments, including Presidential Regulation No. 98 of 2021 on Carbon Economic Value, Law No. 4 of 2023 on Financial Sector Development and Strengthening, Law No. 59 of 2024 on the National Long-Term Development Plan 2025-2045, and OJK Regulation No. 14 of 2023 on Carbon Exchange, alongside international frameworks such as the Paris Agreement and the EU Corporate Sustainability Reporting Directive (CSRD) (Yurdakul Erol & Şahin, 2026) The conceptual approach (*pendekatan konseptual*) is further applied to construct and develop the theoretical concept of Green-Tech Compliance as a novel normative architecture, drawing from legal doctrines in environmental law, digital governance theory, and international regulatory harmonization (Dube-Mwedzi & Suleman, 2025).

The legal materials utilized in this study are categorized into three hierarchical layers. Primary legal materials consist of binding normative sources, including the 1945 Constitution of the Republic of Indonesia, relevant national legislation and presidential regulations, and binding international conventions ratified by Indonesia (Spohr et al., 2025). Secondary legal materials encompass academic monographs, peer-reviewed journal articles published in nationally accredited and internationally indexed publications, official government reports, and policy documents issued by competent authorities including OJK, Bappenas, and UNEP. Tertiary legal materials, serving as interpretive aids, include legal dictionaries, jurisprudential encyclopedias, and official glossaries published by authoritative legal bodies, which are consulted to clarify technical terminology where definitional precision is required.

The method of analysis applied in this research is prescriptive-qualitative legal analysis, consistent with the normative juridical tradition in Indonesian legal scholarship and aligned with standards recognized in internationally indexed legal journals. Legal materials are interpreted through systematic, grammatical, and teleological legal interpretation techniques to identify normative gaps, internal inconsistencies, and areas of regulatory

misalignment between domestic and international green economy standards (Mejia-Muñoz & Babidge, 2023) The findings are synthesized deductively to construct the Green-Tech Compliance concept as a coherent legal model, moving from general international normative principles toward specific recommendations for Indonesia's adaptive regulatory transformation. This analytical method is particularly suited to the research questions posed, as it enables both a critical evaluation of existing legal frameworks and the development of an original normative contribution grounded in doctrinal legal reasoning (Haarala-Muhonen et al., 2022).

3. RESULTS AND DISCUSSION

A. Synchronization of Global Standards in Green Economy Regulation and Its Integration with the Digital Society's Legal Infrastructure

The central legal problem underpinning this discussion is not the absence of regulation, but rather the architecture of fragmentation that characterizes Indonesia's existing green economy legal regime (Anisimov et al., 2023) Indonesia has, over the past decade, produced an increasingly dense constellation of normative instruments: Presidential Regulation No. 98 of 2021 on Carbon Economic Value, Law No. 4 of 2023 on Financial Sector Development and Strengthening (P2SK Law), the Taxonomy for Indonesian Sustainable Finance (TKBI) issued in February 2024, and most recently the Sustainability Disclosure Standards (Standar Pengungkapan Keberlanjutan/SPK) ratified by DSK IAI on July 1, 2025, which aligns with IFRS S1 and S2 issued by the International Sustainability Standards Board (ISSB). Taken in isolation, each of these instruments represents a meaningful regulatory step. Taken together, however, they reveal a governance architecture that is fundamentally reactive rather than architecturally designed, producing a legal regime in which the normative gaps between instruments are as significant as the instruments themselves (Anele, 2020)

This fragmentation carries concrete legal consequences. Despite growing momentum, Indonesia's ESG regulatory landscape remains fragmented across multiple sectoral regulations, with green economic transformation identified as a national priority under the National Medium-Term Development Plan for 2025-2029, yet no single unified legal instrument binds this priority to enforceable compliance mechanisms (Gibbs & Jensen, 2022) The problem is not merely one of incomplete legislation but of normative incoherence: when Presidential Regulation No. 98 of 2021 establishes a carbon pricing framework, and OJK Regulation No. 14 of 2023 establishes the carbon exchange structure, yet no legal instrument mandates binding digital reporting verification for market participants, the result is a system that is simultaneously legally dense and functionally hollow. From a legal theory perspective, this condition corresponds precisely to what Lon Fuller identified as a failure of the inner morality of law, specifically the requirement of congruence between declared rules and official action. A green economy legal regime that declares ambitious sustainability commitments while permitting voluntary compliance and absence of enforcement mechanisms fails this standard at its most elementary level (Berlato et al., 2025)

The question of synchronization between global standards and Indonesia's domestic legal infrastructure demands a critical examination of two flagship instruments: the TKBI and the SPK. The TKBI classifies economic activities that support Indonesia's SDGs, covering economic, environmental, and social aspects, and is intended as a guide to improve capital allocation and sustainable financing in support of Indonesia's net-zero emission target by

2060 (Lucindo et al., 2024) However, a critical legal analysis reveals a fundamental normative deficiency: the TKBI operates as a guideline rather than a binding legal norm. Under Indonesian legal theory, a guideline (*pedoman*) does not carry the same normative force as a regulation (*peraturan*) within the Hierarchy of Laws established by Law No. 12 of 2011. This means that regulated entities can acknowledge the TKBI without being legally compelled to apply its classification criteria, a condition that is compounded by substantive questions about the TKBI's credibility, including the classification of new coal-fired power generation as potentially meeting taxonomy standards under permissive thresholds, which risks undermining Indonesia's green credentials in international markets.

The SPK represents a more significant normative step, but its timing and enforcement architecture remain deeply problematic. Indonesia ratified its first national Sustainability Disclosure Standards (PSPK 1 and PSPK 2), aligned with IFRS S1 and S2, on July 1, 2025, marking a significant milestone in Indonesia's transition toward transparent and globally relevant sustainability reporting (Yoon et al., 2024) Yet the critical legal issue is that OJK plans to amend OJK Regulation No. 51/2017 to incorporate the standards of IFRS S1 and IFRS S2, with full implementation effective only from January 2027. This creates an enforcement vacuum of nearly two years following formal ratification, during which the standards exist as aspirational instruments without binding legal force. In comparative context, the EU's CSRD commenced mandatory reporting for its first wave of companies for the financial year 2024, with reports published in 2025, demonstrating that Indonesia's adoption trajectory lags the global standard by at least two years even under the most optimistic implementation timeline (Hendra et al., 2026)

The table presented above synthesizes these comparative dimensions, mapping the normative distance between each major global standard and its Indonesian domestic equivalent across dimensions of origin, core requirement, domestic instrument, integration status, and the critical variable of digital compliance mechanism. The pattern that emerges from this comparative analysis is revealing: while alignment with international standards at the policy level has been largely achieved (particularly regarding the Paris Agreement and the ASEAN Taxonomy), the translation of that policy alignment into binding, technology-enabled, and enforceable compliance infrastructure remains systematically absent. The integration status of "Partial" or "Gap" dominates the table, and the digital compliance mechanism column consistently reveals either the absence of any mechanism or the presence of systems that are not yet operationally connected to green compliance obligations (Shao, 2026)

The second dimension of this analysis concerns what this study identifies as the critical missing link in Indonesia's green economy legal architecture: the integration of digital infrastructure as a primary compliance instrument rather than a secondary administrative tool (Faeni et al., 2026) This distinction carries profound legal significance. When digital technology is positioned merely as an administrative aid, for example, as a platform for filing sustainability reports electronically, it functions as a procedural convenience without normative substance. When digital technology is positioned as a primary legal instrument, by contrast, it becomes constitutive of the compliance obligation itself, creating real-time verification mechanisms, immutable audit trails, and cross-institutional data interoperability that fundamentally transform the nature of legal transparency and certainty.

Indonesia's existing digital governance architecture contains the building blocks for this transformation but has not yet assembled them into a coherent green compliance system

(Kim & Kim, 2022) The government has officially recognized blockchain technology as part of the national digital infrastructure through Government Regulation No. 28 of 2025, placing blockchain on par with other strategic technologies such as artificial intelligence and digital identity, with Article 186 establishing the legal basis for blockchain-based business operators to obtain formal recognition. This is normatively significant because it establishes blockchain's legal legitimacy within Indonesia's administrative law framework. However, the regulation does not connect this recognition to green economy compliance obligations (El Benni et al., 2022) The distance between recognizing blockchain as a strategic technology and deploying blockchain as a mandatory green compliance verification mechanism represents a critical regulatory gap that this study terms the "Green-Tech Connectivity Deficit."

This deficit is particularly consequential when examined against the EU's approach. The CSRD not only mandates ESG disclosure but requires that sustainability information be digitally tagged for machine-readable processing through the European Single Access Point (ESAP), creating a standardized, interoperable, and digitally verifiable compliance infrastructure. Indonesia's SPK, by contrast, establishes disclosure requirements without mandating the digital format, verification protocol, or interoperability standard that would make those disclosures functionally comparable and legally auditable. While Indonesia's Electronic-Based Government System digitizes government services and creates electronic audit trails that limit discretionary decision-making, thereby supporting transparency and regulatory accountability in the administrative domain, the absence of a unified ESG enforcement regime creates implementation challenges and increases the risk of inconsistent practices and greenwashing (Rusmini et al., 2025) The critical analytical point is that transparency as an administrative value and transparency as a legally enforceable standard are not the same thing. Indonesia has achieved the former without yet securing the latter.

The analytical argument advanced in this section is that achieving genuine legal transparency and certainty in Indonesia's green economy legal regime requires a systematic normative reconstruction across three interconnected dimensions (Iqbal et al., 2024) First, the elevation of the TKBI from a guideline to a binding regulatory instrument, incorporated into a formal ministerial or government regulation that creates enforceable classification obligations for regulated entities. The current status of TKBI as a non-binding reference document means that its classificatory function, which is the cornerstone of any credible green taxonomy, lacks the normative authority needed to prevent greenwashing and ensure market integrity. In practice, accountability for ESG compliance in Indonesia is often driven by external pressure, including NGO scrutiny, litigation risk, and reputational exposure, rather than systematic regulatory enforcement, a condition that is fundamentally incompatible with the legal certainty principle (*kepastian hukum*) recognized in Indonesian constitutional jurisprudence and international rule-of-law standards (Aditya & Al-Fatih, 2021)

Second, the synchronization of Indonesia's carbon registry system (SRN-PPI) with international digital registry infrastructure is legally urgent and technically actionable. The operationalization of Articles 6.2 and 6.4 of the Paris Agreement at COP29 established consensus on internationally transferred mitigation outcomes and the critical requirement that national registries integrate seamlessly with global registry systems to ensure accurate tracking and prevent double counting, with Indonesia's SRN-PPI needing to adopt compatible data formats and reporting standards to facilitate smooth data exchange and protect data integrity through robust cybersecurity measures (Qin et al., 2024) This is not merely a

technical requirement but a legal one: Article 6 compliance is a treaty obligation under Indonesia's ratification of the Paris Agreement through Law No. 16 of 2016, and the failure to achieve registry interoperability constitutes a potential breach of that international legal commitment.

Third, and most fundamentally, the integration of digital compliance mechanisms into the legal architecture of green economy regulation requires a new legislative or regulatory instrument that this study conceptualizes as the Green-Tech Compliance framework (Qin et al., 2024) This framework would mandate that entities subject to green economy obligations report through standardized, machine-readable, digitally verified platforms; that compliance data be submitted to a centralized registry interoperable with both the TKBI classification system and Indonesia's international treaty commitments; and that enforcement powers be granted to OJK and relevant regulatory authorities to impose sanctions for non-compliant or unverifiable disclosures (Qin et al., 2024) The legal basis for such a framework already exists in partial form across the P2SK Law, PP No. 28 of 2025 on blockchain infrastructure, Law No. 27 of 2022 on Personal Data Protection, and the National Digital Economy Strategy 2023-2030. What is missing is the normative instrument that assembles these building blocks into a unified, enforceable, and digitally integrated compliance architecture, a gap that is simultaneously the most significant weakness in Indonesia's current green economy legal regime and the most consequential opportunity for transformative legal reform (Risse et al., 2026).

Table 1. Comparative Analysis of Global Green Economy Standards and Indonesia's Domestic Legal Integration

Standard / Instrument	Origin	Core requirement	Indonesia's domestic equivalent	Integration status	Digital compliance mechanism
Paris Agreement (Art. 6.2 & 6.4) UNFCCC, 2015	International	Carbon market transparency, ITMOs tracking, double-counting prevention via national registries	PR No. 98/2021; MOEF Reg. No. 21/2022; IDXCarbon (2023); MOEF Reg. 12/2024	Partial	SRN-PPI registry (not yet fully interoperable with UNFCCC registry)
EU CSRD / ESRS EU Commission, 2023	EU / International	Mandatory ESG disclosure with dual materiality, machine-readable digital tagging (ESAP), value chain reporting	OJK Reg. 51/2017; SPK (IFRS S1 & S2 aligned, July 2025); mandatory from January 2027	Gap	No digital tagging obligation; SPK lacks machine-readable reporting mandate until 2027
ISSB IFRS S1 & S2 IFRS	International	Climate-related financial risk disclosure; sustainability-rela	DSK IAI ratified SPK (PSPK 1 & PSPK 2) on	Partial	Adoption ratified; implementation regulation

Foundation, 2023		ted financial reporting	July 1, 2025; OJK to amend Reg. 51/2017 by January 2027		pending; no enforcement mechanism yet
EU Taxonomy Regulation EU Reg. 2020/852	EU / International	Classification of environmentally sustainable activities; Do No Significant Harm (DNSH) criteria; mandatory disclosure alignment	TKBI Version 1 (Feb. 2024); TKBI Version 2 (Feb. 2025); TKBI Version 3 planned for 2026	Partial	TKBI is a guideline, not a binding legal norm; no mandatory digital disclosure linkage
ASEAN Taxonomy v.3 ASEAN, March 2024	Regional	Common sustainable finance classification; interoperability among ASEAN member states	TKBI v.1 & v.2 align with ASEAN Taxonomy as primary reference	Aligned	Alignment declared; digital interoperability with ASEAN registry not yet operationalized
SDGs Framework United Nations, 2015	International	Sustainable development across economic, social, and environmental dimensions; voluntary reporting	RPJPN 2025–2045 (Law No. 59/2024); TKBI classification covers SDG-related sectors	Aligned	Policy alignment only; no binding digital monitoring infrastructure
Blockchain / PP 28/2025 Indonesia, 2025	Domestic	Recognition of blockchain as strategic national digital infrastructure; NIB & Standard Certificate for operators	PP No. 28/2025; OJK Reg. 27/2024 (digital financial assets)	Nascent	Legal basis established but green compliance application not yet linked to blockchain infrastructure

Source: Analysed by author

B. Model for Transforming Indonesia's Green Economy Legal Regime Through Digital Innovation as a Primary Instrument of Sustainable Economic Growth

Before constructing a model for transformation, it is analytically necessary to establish why incremental regulatory reform, the approach that has characterized Indonesia's green economy legal development over the past decade, is structurally insufficient to achieve the kind of growth trajectory embedded in national long-term planning (Rakatama et al.,

2024) Law No. 59 of 2024 on the National Long-Term Development Plan 2025-2045 (RPJPN) identifies the green economy as one of six core strategies for Indonesia's economic transformation, and the attainment of Indonesia's "Golden Indonesia 2045" vision requires a sustained economic growth rate of more than 7 percent per year (Yusuf et al., 2021) This is not a modest ambition. It demands a regulatory architecture that does not merely accommodate green investment but actively generates the legal conditions under which green investment becomes the rational and legally predictable choice for both domestic and international capital. The RPJPN itself structures this transformation in four distinct phases: Stage I (2025-2029) focuses on foundational infrastructure and economic transformation, Stage II (2030-2034) emphasizes technological adoption and green economy transition, Stage III (2035-2039) targets advanced industrialization and global competitiveness, and Stage IV (2040-2045) aims for sustainable prosperity and innovation leadership (Sarku & Kranjac-Berisavljevic, 2025) The critical observation from a legal standpoint is that none of these phases can be delivered without a corresponding transformation in the legal regime that governs green economic activity.

The current Indonesian green economy legal architecture is characterized by three structural deficiencies that, taken together, make incremental reform inadequate. First, there is the problem of normative dispersion: green economy obligations are distributed across presidential regulations, ministerial regulations, OJK circulars, and planning documents without a unifying statute that establishes binding cross-sectoral compliance norms (Shiyammurti & Tjahjadi, 2023) Second, there is the problem of enforcement passivity: the existing legal framework promotes green banking and sustainable finance in principle, but the lack of enforceable measures allows carbon-intensive financing to persist, with Indonesia's regulatory regime still relying heavily on voluntary compliance and reputational incentives rather than binding legal obligations (Wang et al., 2025) Third, there is the problem of technological disconnection: the digital infrastructure that Indonesia has been building across its financial and administrative systems, including the OJK's SupTech initiative (OSIDA), the IDXCarbon platform, and the national carbon registry (SRN-PPI), operates in parallel to green compliance obligations rather than being integrated into them as enforcement mechanisms (Tran et al., 2025) These three structural deficiencies require systemic legal reconstruction rather than piecemeal amendment, and the vehicle for that reconstruction is what this study conceptualizes as the Green-Tech Compliance model.

The Green-Tech Compliance model proposed in this study draws its theoretical foundations from three intersecting bodies of legal and governance theory (McHugh-Russell, 2022) The first is responsive regulation theory, developed by Ian Ayres and John Braithwaite, which argues that effective regulatory systems must be capable of escalating from cooperative engagement at the base of an "enforcement pyramid" to progressively more coercive interventions as compliance failures persist. Applied to green economy regulation, this theory suggests that Indonesia's current over-reliance on voluntary disclosure and market incentives represents a permanent residence at the base of the enforcement pyramid, with no functional mechanism for escalation (Jinrong et al., 2025) The Green-Tech Compliance model introduces digital enforcement tools, specifically algorithmic monitoring, real-time data verification, and automated compliance scoring, as the technical infrastructure for building a functional enforcement pyramid in green economy regulation (Jinrong et al., 2025)

The second theoretical foundation is adaptive governance theory, which holds that regulatory systems must be designed with the capacity to learn, update, and recalibrate in

response to new information, changed circumstances, and evolving technological capabilities (Wu et al., 2020) The OECD's Regulatory Policy Outlook 2025 identifies the management of the twin challenge of green and digital transitions as the most salient current governance imperative, emphasizing that technologies cut across sectors and institutions in ways that require a joined-up and collaborative regulatory approach capable of continuously adapting existing frameworks to remain robust against rapid change. For Indonesia, this means that the Green-Tech Compliance model cannot be a static legal instrument but must be designed as a living regulatory architecture with periodic review mechanisms, technology-neutral principles, and institutional flexibility to incorporate emerging compliance technologies as they develop (T. Chen et al., 2025)

The third theoretical foundation is the principle of legal certainty (*kepastian hukum*) as understood within Indonesia's constitutional jurisprudence, which requires that legal norms be clear, consistent, predictable, and accessible to those they regulate (Hutahayan et al., 2024) Research on RegTech and SupTech across multiple jurisdictions demonstrates that digital regulatory technologies create significant administrative value by streamlining reporting, enhancing accountability, and strengthening governance networks across the public-private boundary, while also generating faster and more accurate compliance processes. The adoption of digital compliance infrastructure is therefore not merely a technological policy choice but a legal one: it directly advances the constitutional principle of legal certainty by replacing ambiguous, self-reported, and inconsistently verified compliance data with standardized, machine-verified, and auditable digital records.

The Green-Tech Compliance model proposed in this study is structured as a three-layer legal architecture, each layer addressing one of the three structural deficiencies identified above. The first layer is the *normative unification layer*, which requires the enactment of a dedicated Green Economy Legal Framework Act (*Undang-Undang Kerangka Hukum Ekonomi Hijau*) as an umbrella statute that consolidates and supersedes the existing constellation of fragmented green economy regulations (Le et al., 2026) This statute would establish: a legally binding definition of green economic activity cross-referenced to the TKBI classification system; mandatory green compliance obligations applicable to all regulated entities under OJK supervision; a statutory mandate for digital reporting as the default compliance modality; and a national Green Compliance Authority with cross-institutional jurisdiction spanning OJK, the Ministry of Environment and Forestry, the Ministry of Finance, and the National Digital Economy Agency (Komdigi). The legal necessity of such an umbrella statute can be derived from the principle of lex superior, which requires that normative coherence be established at the statutory level before implementing regulations can operate with legal certainty. Without this foundational statute, lower-level instruments like TKBI and SPK remain normatively subordinate and practically unenforceable.

The second layer is the *digital enforcement infrastructure layer*, which operationalizes green compliance obligations through four technology-enabled mechanisms. The first is a Green Compliance Digital Registry (GCDR), a centralized national database that receives, stores, and verifies real-time green compliance data from regulated entities, interoperable with both the IDXCarbon platform and the UNFCCC's international carbon registry in fulfillment of Indonesia's Article 6 commitments. Building on OJK's existing SupTech initiative (OSIDA), which was launched in March 2022 to automate the analysis of regulated entities' reports, the GCDR would extend automated analysis capabilities to sustainability

disclosures, carbon reporting, and taxonomy alignment assessments. The second mechanism is a regulatory sandbox for Green-Tech innovation, extending OJK's existing Financial Technology Regulatory Sandbox framework under OJK Regulation No. 3 of 2024 to include green compliance technology providers, creating a supervised testing environment for blockchain-based carbon tracking, AI-powered ESG scoring, and automated TKBI classification tools (Brown & Piroska, 2022) The third mechanism is a mandatory machine-readable reporting standard requiring all SPK-covered entities to submit sustainability disclosures in standardized digital formats compatible with ISSB's XBRL-based taxonomy, ensuring interoperability with international reporting systems including the EU's ESAP. The fourth mechanism is a digital enforcement escalation system, implementing the responsive regulation pyramid in algorithmic form: entities with consistently compliant digital records receive expedited regulatory approvals; those with compliance anomalies trigger automated audit flags; and persistent non-compliance generates regulatory sanctions through legally prescribed automated enforcement protocols.

The third layer is the *international synchronization layer*, which ensures that Indonesia's domestic Green-Tech Compliance architecture is legally interoperable with the global standard-setting ecosystem (Hu et al., 2025) The RPJPN 2025-2045 explicitly includes developing smart grids and advancing digital infrastructure as components of Indonesia's green economy transformation strategy, signaling that the government has already conceptually linked digital and green agendas at the planning level. The Green-Tech Compliance model translates this conceptual link into a legally enforceable architecture by establishing: a treaty-compliant carbon registry protocol aligned with MOEF Regulation No. 12 of 2024; a sustainability disclosure standard that satisfies both SPK (domestic) and IFRS S1 and S2 (international) requirements from a single integrated digital submission; and a mutual recognition framework with ASEAN partner states to achieve genuine cross-border carbon market interoperability under the ASEAN Taxonomy Version 3 framework.

The most analytically original contribution of the Green-Tech Compliance model is its reconceptualization of digital innovation not as a policy tool or a market convenience, but as a *primary legal instrument* in the formal sense of that term (Roberts et al., 2022) This distinction requires elaboration. In conventional legal theory, legal instruments are sources of rights and obligations: statutes, regulations, contracts, judicial decisions. The proposition advanced here is that in the context of green economy regulation, digital technologies, specifically blockchain-based carbon registries, AI-powered compliance monitoring systems, and machine-readable taxonomy classification tools, can be incorporated into the legal architecture with the same normative function as traditional legal instruments, provided they are granted that function by a primary statutory instrument.

This reconceptualization has concrete legal consequences. When a blockchain carbon registry is legally designated as the authoritative record for carbon credit ownership and transfer, the data it contains acquires the same evidentiary status as a notarial deed. When an AI-powered TKBI classification tool is legally designated as the official classification mechanism for green taxonomy compliance, its output has the same binding effect as a regulatory determination. When a machine-readable SPK disclosure is legally designated as the exclusive valid form of sustainability reporting, the analog alternative ceases to be legally adequate. Indonesia's digital economy is projected to reach $300 billion by 2030, driven by fintech innovation and strong institutional infrastructure, creating a private sector ecosystem sufficiently mature to absorb and adopt the digital compliance tools that the Green-Tech

Compliance model would make legally mandatory. The convergence of this private sector digital maturity with the constitutional mandate for sustainable economic governance creates a uniquely favorable moment for the transformative legal reform that this model proposes (Cohen, 2025).

The ultimate measure of this model's contribution to sustainable economic growth is not its technical elegance but its capacity to resolve the fundamental legal problem that currently suppresses green investment in Indonesia: the absence of legal certainty (Tinungki et al., 2025) When investors cannot reliably verify whether a green bond actually finances green activities because the taxonomy is non-binding; when carbon credits cannot be reliably traded because registry interoperability is incomplete; and when sustainability disclosures cannot be trusted because enforcement is voluntary, the risk premium on green investment rises, green capital is misallocated, and the 7 percent sustainable growth target embedded in the RPJPN 2025-2045 recedes from legal plausibility. The Green-Tech Compliance model directly addresses this dynamic by using digital innovation not as an administrative convenience but as the primary architectural mechanism through which Indonesia's green economy legal regime achieves the transparency, certainty, and enforceability that sustainable growth requires (Fusillo et al., 2025).

4. CONCLUSION

Indonesia's green economy legal regime currently operates under a condition of normative fragmentation that structurally undermines both legal transparency and legal certainty. The synchronization of global standards, including the Paris Agreement, EU CSRD, ISSB IFRS S1 and S2, and the ASEAN Taxonomy Version 3, with Indonesia's domestic legal infrastructure has been achieved at the policy alignment level through instruments such as the TKBI, the SPK, and the P2SK Law, but this alignment remains normatively shallow because the instruments themselves lack binding legal force, mandatory digital enforcement mechanisms, and genuine interoperability with international registry systems. The result is a regulatory architecture that declares ambitious sustainability commitments while permitting voluntary compliance and tolerating systematic greenwashing, a condition that directly violates the constitutional principle of legal certainty enshrined in Article 33(4) of the 1945 Constitution and the rule-of-law standards demanded by Indonesia's international treaty obligations. The critical analytical finding of this study is that the integration of global green standards with Indonesia's digital legal infrastructure is not merely a technical coordination problem but a normative reconstruction problem, one that requires elevating non-binding instruments like TKBI to the status of enforceable regulatory norms and mandating machine-readable, digitally verifiable reporting as the legal standard for green compliance.

The model of transformation proposed in this study, conceptualized as the Green-Tech Compliance framework, offers a three-layer normative architecture designed to resolve this structural deficiency. It positions digital innovation not as a supplementary policy tool but as a primary legal instrument through which Indonesia's green economy obligations are defined, verified, and enforced. By establishing a unified Green Economy Legal Framework Act, a national Green Compliance Digital Registry interoperable with international carbon systems, and a legally mandated machine-readable reporting standard aligned with ISSB requirements, the Green-Tech Compliance model directly addresses the investment uncertainty that currently suppresses sustainable capital allocation and threatens the viability of Indonesia's 7 percent sustainable growth target under RPJPN 2025-2045. This study ultimately argues that

achieving sustainable economic growth in Indonesia's digital era is not a question of regulatory abundance but of normative coherence, and that coherence can only be secured through a deliberate, technology-enabled, and legally binding transformation of the green economy legal regime.

NOVELTY

This study introduces the concept of Green-Tech Compliance as its primary scholarly contribution, a novel normative framework that reconceptualizes digital technology not merely as an administrative tool but as a primary legal instrument through which green economy compliance obligations are formally defined, enforced, and verified within Indonesia's domestic legal architecture. Unlike prior scholarship that treats digital governance and green economy regulation as parallel but separate domains, this study constructs a legally integrated model that embeds technology-driven compliance mechanisms, including blockchain-based carbon registries, AI-powered taxonomy classification systems, and machine-readable sustainability disclosure standards, directly into the normative structure of green economy law, thereby transforming digital infrastructure from a procedural convenience into a constitutive element of legal obligation. The Green-Tech Compliance framework further advances the digitalization of green economy legal compliance instruments as a coherent regulatory design principle, proposing that the enforceability, transparency, and international interoperability of Indonesia's green economy legal regime can only be meaningfully achieved when digital innovation is granted the same normative status as traditional legal instruments within a unified statutory architecture.

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