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Human resource and green port implementation: Legal findings from the Belawan Port case study

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Abstract

Indonesia's maritime environmental governance confronts a critical regulatory vacuum: despite the enactment of Law No. 66 of 2024 amending the Shipping Law for the third time, no study has systematically evaluated the legal vacuum this law has created through its failure to establish explicit Green Port standards or mandatory human resource (HR) competency requirements. This study addresses that gap. Although existing scholarship has examined environmental policy and port sustainability in Indonesia separately, no prior research has integrated international maritime environmental law with national environmental legislation under a unified regulatory-theoretical framework to assess the legal basis for Green Port implementation. This study employs a juridical-empirical approach combining qualitative and quantitative analysis, collecting data through questionnaires and structured interviews with 31 port workers at Belawan Port, supported by documentary analysis of implementing regulations including Government Regulation No. 21 of 2010 and Government Regulation No. 22 of 2021. The analysis applies a descriptive-analytical method linking legal norms to empirical realities. The findings reveal three dimensions of legal fragmentation: vertical incoherence between national law and implementing regulations, horizontal fragmentation across ministerial jurisdictions, and temporal discontinuity arising from the absence of transitional provisions in Law No. 66 of 2024. The law introduced institutional restructuring without substantive environmental commitments, constituting what regulatory theory identifies as symbolic regulation. As a result, Belawan Port's 2023 Green Port certification lacks an explicit statutory basis, and existing environmental programs face legal uncertainty. This study is the first to integrate MARPOL, the IMO GHG Strategy, and the Paris Agreement with Indonesia's national statutory framework to map this normative vacuum. It concludes that the gap between positive law and operational maritime governance practice directly threatens the continuity of Green Port initiatives in Indonesia and undermines the country's commitments under the Paris Agreement and the Sustainable Development Goals.

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Keywords

Green port, Legal fragmentation, Belawan port, Regulatory vacuum, Maritime environmental law

Introduction

Indonesia, as one of the world's largest archipelagic states, relies heavily on maritime transportation, which accounts for more than 90% of its international trade volume (Maruf, 2023). As global sustainability agendas intensify, particularly through the International Maritime Organization's Greenhouse Gas (GHG) Strategy, the Paris Agreement, and the United Nations Sustainable Development Goals (SDGs), Indonesian ports are under increasing pressure to implement the Green Port concept as an integrated framework for environmental protection and energy efficiency (Heikkilä et al., 2022).

However, Indonesia's regulatory framework for Green Port implementation is fundamentally fragmented, and Law No. 66 of 2024, which amends Law No. 17 of 2008 on Shipping, has deepened rather than resolved this fragmentation. The law restructured port governance nomenclature and administrative arrangements but introduced no substantive standards for environmental performance, HR competency, or Green Port certification. This legislative omission constitutes the central legal problem examined by this study: the absence of an integrated statutory basis for Green Port implementation at Indonesian ports, with Belawan Port serving as the primary case study.

The empirical consequences of this regulatory failure are documented at Belawan Port, Indonesia's second-largest international port and a designated Green Port since 2023. Sulaiman et al. (2021) report an institutional and legal sustainability index of 50.74 at Belawan, categorised as sustainable, reflecting weak legal certainty and (Wang et al., 2025). document severe water pollution at Belawan characterised by abnormal pH levels, elevated heavy metal concentrations, and pathogenic microorganisms exceeding legal thresholds, yet no systematic enforcement response has been recorded. The 2023 Green Port certification at Belawan now lacks an explicit statutory anchor under the new law, and the absence of transitional provisions leaves existing environmental programs in legal uncertainty.

The academic literature has not yet addressed this problem systematically. Existing studies have examined environmental policy (Philipp, 2020) independently, without integrating them into a coherent regulatory-theoretical analysis of (Guerrero-Molina et al., 2024). through a systematic literature review, demonstrate that Green Port research is a sustained area of inquiry, yet they also observe that policy engagement lags behind industry adoption, particularly regarding innovative technologies (Song & Fabinyi, 2022). Further note requires support from regulatory frameworks and financial incentives; without these, environmental commitments remain aspirational rather than enforceable. No prior study has mapped vertical and horizontal inconsistencies in Indonesia's maritime environmental governance using integrated legal-theoretical tools.

This study fills that gap through three analytical contributions. First, it provides the first comprehensive legal mapping of regulatory fragmentation in Indonesia's Green Port governance, integrating MARPOL, the IMO GHG Strategy, and the Paris Agreement with national legislation. Second, it applies regulatory theory explain the persistence of policy lag and institutional incoherence. Third, it draws on comparative analysis of integrated Green Port legal frameworks in Singapore, the Netherlands, and the European Union to identify reform pathways for Indonesia. The study contributes to broader scholarship (Basuki et al., 2023) and state-owned enterprise accountability within the context of Indonesia's port governance reform.

Results and discussion

Legal fragmentation as a structural impediment to green port implementation

The enactment of Law No. 66 of 2024 exemplifies what Maruf (2023b) identifies as symbolic regulation: legislative action that produces institutional restructuring without substantive policy change. While the law modernised administrative nomenclature and updated port governance mechanisms, it conspicuously failed to establish explicit Green Port standards, environmental performance benchmarks, or enforcement provisions. This omission reflects what Baldwin et al. (2011) characterise as regulatory retreat, whereby governments prioritise procedural reforms over substantive environmental commitments, particularly when facing pressure to maintain economic competitiveness and attract foreign direct investment.

The empirical findings from Belawan Port illuminate a fundamental paradox in Indonesia's maritime environmental governance. Despite the proliferation of environmental regulations spanning multiple ministerial domains, the absence of an integrated legal framework creates a vacuum that undermines Green Port implementation. This finding confirms and extends the regulatory fragmentation thesis advanced by Young (2002) and Oberthur and Gehring (2006), who argue that fragmented governance structures produce institutional overlap, regulatory gaps, and enforcement paralysis. The Indonesian case demonstrates that regulatory proliferation without hierarchical coherence and cross-sectoral harmonisation does not strengthen environmental protection; instead, it creates competing jurisdictions and normative ambiguity that port operators exploit to minimise compliance costs (Notteboom & Lam, 2018).

Three dimensions of legal fragmentation collectively impede Green Port implementation. First, vertical incoherence manifests in the disconnect between broad environmental mandates in Law No. 32 of 2009 on Environmental Protection and Management and the sector-specific regulations under the Ministry of Transportation, which prioritize operational efficiency over environmental sustainability. Second, horizontal fragmentation is evident in overlapping authority among the Ministry of

Transportation, the Ministry of Environment and Forestry, and the Ministry of Public Works and Housing, creating jurisdictional ambiguity over environmental monitoring, enforcement, and standard setting. Third, temporal discontinuity arises from the failure to include transitional provisions in Law No. 66 of 2024, leaving previously established environmental programs, including Belawan's 2023 Green Port certification, without apparent statutory authority.

From a normative standpoint, Indonesia possesses several environmental regulations, including Government Regulation No. 21 of 2010 on Maritime Environmental Protection, Government Regulation No. 22 of 2021 on Environmental Protection and Management, and Ministerial Regulation No. 21 of 2021 on Green Building Standards. Nevertheless, none of these instruments defines, regulates, or operationalizes Green Ports as a distinct legal regime. Each operates in a sectoral, isolated manner, failing to constitute a dynamic legal framework for sustainable port governance (Sulaiman et al., 2021; Baldwin et al., 2011). The consequence is regulatory uncertainty: port operators at Belawan face a choice among marine pollution prevention standards under PP No. 21 of 2010, green building standards under Permen PUPR No. 21 of 2021, and general environmental management requirements under PP No. 22 of 2021, with no statutory guidance on which takes precedence. This condition produces the selective compliance pattern identified in the international literature as a key driver of governance failure (Notteboom & Lam, 2018; Oswald et al., 2025).

Human resource capacity as a critical determinant of green port sustainability

Legal fragmentation alone does not fully explain the failure of Green Port implementation at Belawan. The study identifies a structural mismatch between Green Port certification and the institutional capacity required to sustain environmental performance over time. Survey data from the 31 port workers at Belawan Port indicate insufficient specialised training in environmental management systems, emission-monitoring technologies, and sustainability reporting frameworks. This finding aligns with Ugrinov et al. (2025), who observe that green technology adoption requires not only regulatory frameworks and financial incentives but also systematic capacity-building within port organisations. The absence of mandatory HR competency standards in Law No. 66 of 2024 perpetuates this capacity deficit, allowing ports to pursue Green Port certification as a symbolic achievement without developing the institutional capabilities necessary for long-term environmental stewardship.

Comparative analysis with international best practices underscores the scale of Indonesia's capacity gap. Singapore's Maritime Port Authority mandates specific training modules for personnel involved in environmental management, waste handling, and emission control, supported by certified professional development programs and periodic competency assessments. The European Union's TEN-T Regulation establishes minimum qualifications for port environmental officers and requires ports to demonstrate adequate staffing levels for environmental monitoring and compliance reporting (The Netherlands' Green Deal North Sea Canal Area includes

capacity-building provisions requiring port stakeholders to participate in knowledge-sharing networks and technology transfer programs

Indonesia's regulatory framework contains no equivalent provisions. Government Regulation No. 21 of 2010 and Government Regulation No. 22 of 2021 specify technical standards and procedural requirements but neither mandates HR competency standards, training obligations, nor institutional capacity benchmarks for port environmental management. This gap reflects a broader pattern in Indonesia's environmental governance: the regulatory focus on technical standards without addressing the organisational capabilities required to implement and enforce them. The result is a structural mismatch that undermines the credibility and sustainability of Green Port initiatives. Valioniene et al. (2024) similarly highlight that the acceleration of green port transitions depends substantially on organisational ecosystem resilience, which in turn requires deliberate investment in human capital development that must be anchored in legal obligation rather than voluntary practice.

Policy incoherence, normative vacuums, and the path toward integrated governance

The findings of the two preceding subsections converge on a single central legal conclusion: regulatory fragmentation and the absence of HR competency norms produce a normative vacuum in which Green Port implementation lacks both legal authority and institutional capacity. This vacuum has three concrete manifestations at Belawan Port. First, the 2023 Green Port certification has no explicit statutory basis under Law No. 66 of 2024, rendering its continuity legally uncertain. Second, there are no rules governing compensation for communities affected by port-related marine pollution, leaving traditional fishermen without effective remedies despite strict liability provisions under Law No. 32 of 2009 (Suhaidi et al., 2021; Maruf et al., 2025). Third, enforcement responses to documented environmental violations, such as those recorded by Tarigan et al. (2024), are absent, reflecting the enforcement paralysis produced by overlapping jurisdictional authority.

A systematic comparison with jurisdictions that have resolved this problem clarifies the reform pathway. Table 1 maps the legal instruments, indicators, and outcomes across four regulatory contexts:

Tabel 1. Maps the legal instruments, indicators, and outcomes across four regulatory contexts

Country/Region	Green Port Legal Instrument	Key Indicators	Outcome
Singapore	Maritime Singapore Green Initiative (MSGI)	Emissions, energy efficiency, fiscal incentives, mandatory audits	Comprehensive and enforceable implementation
Netherlands	Green Deal North Sea Canal Area	Legally binding environmental targets	High compliance, binding on all port stakeholders

European Union	TEN-T Regulation; Fit for 55 Package	Mandatory emissions and energy performance indicators	Binding regional standards with enforcement mechanisms
Indonesia	No national Green Port regulation	None defined	Regulatory fragmentation and legal uncertainty

The contrast illustrated in the Table 1 is not merely descriptive. It reveals a structural deficiency in Indonesia's legal architecture: whereas Singapore, the Netherlands, and the EU have each created enforceable frameworks that bind port operators to measurable environmental standards, Indonesia's current statutory regime provides no comparable legal anchor. Port operators at Belawan and elsewhere are therefore left to determine their own compliance standards, which produces the selective compliance pattern documented in the empirical data. The Singapore Maritime Singapore Green Initiative integrates fiscal incentives, emission standards, and mandatory audits under a single instrument (The Netherlands' Green Deal establishes legally binding environmental targets that apply across the North Sea Canal area (Port of Amsterdam, 2019). The EU TEN-T Regulation imposes mandatory environmental performance indicators across the trans-European transport network (None of these models can be transplanted directly into the Indonesian context, but each demonstrates that a unified regulatory instrument governing standards, monitoring, enforcement, and capacity-building is a prerequisite for effective Green Port governance.

The normative implication is significant. Without an integrated legal framework specifying enforceable Green Port standards and mandatory HR competency requirements, Indonesia's environmental commitments under the Paris Agreement and the SDGs, particularly SDG 9, SDG 13, and SDG 14, remain aspirational rather than legally operationalised. Indonesia has committed to a 29% unconditional and 41% conditional reduction in greenhouse gas emissions by 2030 under its Nationally Determined Contributions. The absence of enforceable port-level environmental standards directly constrains the country's capacity to deliver these commitments through the maritime sector. Jalali and Tei (2025) demonstrate that Green Port development is a sustained area of global policy inquiry, but also that policy engagement consistently lags industry adoption, particularly in developing economies. Indonesia's current regulatory posture exemplifies this pattern. Issa et al. (2025) and Zhang et al. (2025) highlight those emerging technological solutions for port sustainability, such as smart microgrids, digital twin energy management, and IoT-enabled environmental monitoring, require supportive regulatory environments to progress beyond pilot initiatives; without legal obligation, these innovations remain experimental rather than systemic.

The path forward requires legislative action on three fronts. First, Indonesia should enact a dedicated national Green Port regulation, consolidating standards currently dispersed across PP No. 21 of 2010, PP No. 22 of 2021, and Permen PUPR No. 21 of 2021 into a single, port-specific legal instrument with clear jurisdictional attribution. Second,

this regulation must include mandatory HR competency requirements, specifying training obligations, certification standards, and periodic assessment mechanisms for port environmental personnel. Third, the regulation must contain transitional provisions that explicitly preserve the legal validity of existing Green Port certifications and environmental programs during the transition to the new statutory framework. Without these three elements, Green Port initiatives at Belawan and across Indonesia risk becoming symbolic compliance exercises rather than substantive instruments of sustainable maritime governance.

Conclusion

This study has demonstrated that the root causes of Green Port implementation failure in Indonesia are structural and legal rather than merely technical or infrastructural. Law No. 66 of 2024 increased institutional complexity without introducing substantive environmental standards, HR competency requirements, or transitional provisions to safeguard existing programs. This constitutes a normative vacuum that threatens the legal continuity and enforceability of Green Port initiatives, including Belawan Port's 2023 certification. The absence of an integrated legal framework creates conditions for selective compliance, investment deterrence, and enforcement paralysis that collectively undermine Indonesia's maritime sustainability commitments.

The study's comparative analysis confirms that integrated regulatory instruments, such as Singapore's Maritime Singapore Green Initiative, the Netherlands' Green Deal North Sea Canal Area, and the EU's TEN-T Regulation, are prerequisites for effective Green Port governance. Indonesia must enact a dedicated national Green Port regulation that consolidates existing standards, mandates HR competency development, and establishes enforceable monitoring and enforcement mechanisms. Without such a framework, Green Port policies will continue to devolve into fragmented administrative practices rather than functioning as binding instruments of sustainable maritime governance, and Indonesia's commitments under the Paris Agreement and the SDGs will remain structurally unenforceable at the port level.

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