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Optimizing Strategy for the Utilization of Shipping Channels and Management of Facilities at The Marunda Center Public Terminal, BUP PT. Pelabuhan Tegar Indonesia

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Abstract: This study aims to formulate strategies for optimizing the utilization of shipping channels and facility management at the Marunda Center Public Terminal operated by PT Pelabuhan Tegar Indonesia. The research addresses suboptimal channel use and terminal facility management that constrain vessel and cargo flow efficiency and reduce port competitiveness. A qualitative approach was applied through in-depth interviews with port management, operators, government agencies, and port users, complemented by Focus Group Discussions with key stakeholders. Thematic analysis was employed to identify core issues and strategic options. The findings reveal that limited channel depth and capacity, inadequate supporting infrastructure, and weak integration of inter-institutional information systems are the main constraints. The study recommends infrastructure upgrading, digital system integration, strengthened inter-agency coordination, and standardized operational procedures to improve efficiency, reduce service time, and reinforce Marunda Center Terminal's role as a strategic logistics hub in the Greater Jakarta area.

Keywords: Strategy, Optimization, Shipping Channel, Terminal Facilities, Port, Qualitative, Interviews, FGD.

INTRODUCTION

Infrastructure development requires the involvement of multiple stakeholders, notably central and local governments as well as the private sector. Private sector participation plays a critical role in accelerating infrastructure development, as projects often stagnate when relying solely on public funding mechanisms such as national or regional budgets. Saha (2024) argues that effective risk management and accountability in infrastructure development, particularly in port projects, can be significantly enhanced through private sector engagement.

Following the separation of governmental regulatory functions from port operational activities, commercial port operations have become the full responsibility of Port Business Entities (BUPs) under port concession agreements, commonly structured through a Build

Operate Transfer (BOT) scheme. Under this arrangement, port land and infrastructure are transferred back to the government at the end of the concession period. The BOT mechanism is intended to accelerate port infrastructure development in order to support and sustain port service operations more efficiently.

Marunda Center Terminal (MCT) is a public terminal located in Bekasi within the Marunda Center Industrial Estate and is owned and operated by PT Pelabuhan Tegar Indonesia (PTI), a licensed Port Business Entity. With a core business focus on cargo handling operations, PTI operates two dedicated berths that enable simultaneous port activities, thereby supporting continuous terminal operations.

On 24 May 2017, a port concession agreement for the management of Marunda Center Terminal was formally signed as part of the government's initiative to develop and enhance port infrastructure in support of economic growth, trade facilitation, and cargo distribution. However, during implementation, operational constraints emerged due to the government's limited ability to provide an optimal navigation channel at Marunda Center Terminal. Consequently, PT Pelabuhan Tegar Indonesia has been required to independently provide and maintain navigation channels and navigational aids, a condition that may create long term inefficiencies and asymmetric operational burdens if left unaddressed.

Several recurring challenges have been identified, including imbalances between service capacity and demand, high vessel waiting times, limited integration of logistics information systems, and suboptimal utilization of berths, cargo handling equipment, and warehouse facilities. In addition, external factors such as regulatory dynamics, shifts in trade patterns, and environmental issues further influence overall port operational performance.

METHOD

This study adopts a qualitative research design using descriptive-analytical and comparative approaches. This methodology is appropriate given that the primary objective of the research is to formulate optimization strategies rather than to quantitatively measure variables. Informants were selected through purposive sampling to ensure the relevance and depth of information obtained. Data collection combined primary data from in-depth interviews and focus group discussions with secondary data derived from peer-reviewed academic journals and internal company documents. The study employed NVivo version 15 as a qualitative data analysis tool to facilitate data organization, coding, and thematic classification, thereby enhancing the rigor and efficiency of the analytical process.

RESULTS AND DISCUSSION

Research Finding

Operational efficiency at Marunda Port remains suboptimal due to weak cross-system integration, insufficient intermodal coordination, and misaligned vessel scheduling and hinterland distribution, resulting in partial realization of existing optimization strategies. Environmental management also faces significant constraints arising from limited monitoring equipment, weak inter-agency coordination, and ineffective environmental oversight, causing sedimentation and pollution issues to directly affect safety and operational efficiency. From a regulatory perspective, despite the availability of a comprehensive legal framework and safety standards, implementation gaps driven by operational pressures and weak on-site discipline continue to undermine compliance consistency and port credibility. Although infrastructure upgrades and digitalization initiatives have been introduced, their effectiveness is constrained by inadequate asset maintenance, limited worker facilities, poor external connectivity, fragmented system integration, and low digital literacy among human resources. Furthermore, stakeholder coordination, while formally established, remains insufficiently inclusive and sustainable, indicating that port transformation toward an efficient, safe, and competitive

system requires a holistic approach integrating governance, infrastructure, technology, human capital, and cross-stakeholder collaboration.

1. Results of the Focus Group Discussion (FGD) and Expert Inputs Analysis

The Focus Group Discussion (FGD), held at the 7th Floor Auditorium on 2 July 2025 at the Institut Transportasi dan Logistik Trisakti, served as a strategic forum for validating the research findings and facilitating constructive multi-stakeholder dialogue.

Table 1. Summary of FGD Expert Input

Name	Results and Informations
Respondent 1	**Academic, Institute of Transportation & Logitics trisakti** Dr. Drs. Asep Suparman, M.M. **He emphasized** that Marunda Center Terminal has significant potential to serve as an alternative port to Tanjung Priok in strengthening national logistics connectivity. In his presentation, he outlined several concession-related issues in accordance with existing regulations. Beyond operational efficiency, Dr. Asep stressed that port development should generate tangible social and economic benefits rather than focusing solely on optimization strategies. This includes strengthening collaboration between the Port Business Entity (BUP), local governments, and private sector actors such as terminal operators and cargo handling companies. He also highlighted the importance of active communication between the BUP and the Ministry of Transportation, the development of connectivity with logistics companies, and the preservation of local wisdom to ensure long-term relevance and sustainability. The strategic potential of Marunda Center Terminal lies in its geographical position as an alternative to Tanjung Priok, its proximity to the eastern Jakarta industrial area and national logistics corridors, and its role in supporting the national logistics system while reducing congestion at Tanjung Priok. **Main Input:** The main operational challenges identified include imbalances between service capacity and demand, high vessel waiting times, suboptimal utilization of port infrastructure such as berths and cargo handling equipment, limited integration of digital logistics systems, and constraints in obtaining concession rights. The Build Operate Transfer (BOT) scheme was considered more appropriate for port projects requiring substantial investment and long payback periods, as it provides investment certainty while maintaining state ownership. **Analysis:** The BOT scheme should be considered as a viable option for the extension or restructuring of PTI's concession arrangement in order to attract investor interest while preserving the state's strategic control over port assets.
Respondent 2	**Head of the Class II Marunda Harbormaster and Port Authority Office (KSOP)** Agus Harijanto, ST, M.Mar, M.Si. **He emphasized** the importance of strong synergy among planning, implementation, and supervision, as well as the need for comprehensive assessments for every proposed activity submitted by the Port Business Entity (BUP) within a given port area. He highlighted the urgency of securing concession rights and strengthening multisectoral cooperation, noting that concession status is a prerequisite for long-term optimization. Strategic collaboration between BUPs, central and local governments, private logistics operators, and cargo handling companies was considered essential, along with active and continuous communication with the Ministry of Transportation. **Main Input:** Coordination between the BUP and KSOP remains weak, particularly in the allocation of responsibilities related to planning and operational supervision of shipping lanes, resulting in overlapping authority and institutional

	conflicts. He also stressed that ports must generate social and economic value by functioning as drivers of local and national economic development, through community empowerment, preservation of local values, job creation, and improvements in public welfare. **Analysis:** A clear redefinition of the governance structure between the port authority and the port operator is required, including the establishment of formal coordination mechanisms through regular inter-agency forums to reduce institutional overlap and enhance operational effectiveness.
Respondent 3	**Head of the Section for Traffic, Sea Transportation, and Port Business Directorate General of Sea Transportation, Ministry of Transportation** Agustina Prasetyaningsih, S.T., M.M **She explained** the major post-concession challenges faced by port operations, including regulatory constraints and legal, financial, social, and operational issues, which necessitate the adoption of more adaptive and sustainable concession schemes. **Main Input:** There is a critical need for clearer delineation of authority among central government, local government, and business operators, as overlapping policies continue to impede effective port management. Key priorities identified include the formulation of shipping lane optimization strategies, technical analysis for effective utilization of navigation channels, data-driven port facility management strategies, information technology innovation such as Port Community Systems and IoT applications, and governance frameworks that promote efficiency and integration within the port-centered supply chain. **Analysis:** Harmonization of central and local regulations is required through revisions of sectoral policies and the establishment of specific implementing regulations tailored to nationally strategic port areas, in order to ensure coherent governance and effective port management.
Respondent 4	**Vice Chairman of the Indonesian Port Business Association (ABUPI) Policy Acceleration and Business Development Division** Drs. Ariyanto Purboyo, M.M. **He noted** that as of April 2025, a total of 45 ports had obtained concession permits through the Online Single Submission (OSS) system, with 12 ports managed by Pelindo. However, the digitalization of port services and management remains suboptimal. Information systems are not yet fully integrated among key stakeholders, including Port Business Entities (BUP), Customs authorities, Port Authorities (KSOP), and logistics operators. **Main Input:** There is no consistent annual mechanism for evaluating port concessions. Evaluations are typically conducted only when conflicts arise or during renegotiation processes. Optimization of shipping lanes should therefore include the acceleration of nationally integrated digital port service systems in order to improve logistics efficiency and transparency. **Recommendation:** 1. Accelerate the acquisition or restructuring of concession rights through formal engagement with the Ministry of Transportation, supported by strategic justification and economic feasibility analysis. 2. Consider the Build Operate Transfer (BOT) scheme for the development of port facilities and navigation channels that require long-term investment while maintaining state control. 3. Establish a collaborative Triple Helix model involving Port Business Entities, government institutions, and the private sector to support operational integration and infrastructure investment. 4. Apply a sustainable logistics approach by incorporating environmental considerations and local wisdom into port planning and management.

	5. Integrate port information systems by developing a digital logistics platform that connects ports, operators, and logistics companies. Promote regional and national synergy by positioning Marunda Center Terminal as a logistics hub within the National Port Master Plan and the National Medium Term Development Plan (RPJMN). **Analysis:** A concession performance evaluation system based on Key Performance Indicators (KPIs) and conducted on a regular basis is required to ensure accountability, service continuity, and the long-term sustainability of port operations.
Respondent 5	**Head of the Marine Engineering Study Program, ITL Trisakti, and FGD Moderator** Ir. Wahyono Bimarso Dipl. HE **He noted** that bureaucratic authority remains limited due to the absence of a dedicated Directorate General for Transport Infrastructure within the Ministry of Transportation, which continues to constrain the delegation of authority to the Harbormaster and Port Authority Offices (KSOP) or Port Authorities (OP). Although the Transport Infrastructure Financing Center exists, its function remains suboptimal as it operates only at the echelon II level. **Main Input:** He recommended the development of Public Private Partnership (PPP) models for secondary ports, with proportional risk sharing mechanisms and transparent tendering processes. **Analysis:** The government should establish a dedicated PPP framework for port development, including fiscal incentive schemes for investors willing to invest in non primary ports, in order to improve institutional effectiveness and investment attractiveness.

Discussions

1. Challenges in Shipping Lane Management from Environmental and Efficiency Perspectives

The efficiency of shipping lane management at Marunda Port constitutes a critical issue due to its direct impact on vessel waiting time, cargo handling productivity, and intermodal coordination (Ma'ruf et al., 2024; Pramono & Saputra, 2023). Although the Port Business Entity (BUP) has adopted digital-based and maintenance-oriented strategies such as GIS-based navigation systems, berth scheduling, and periodic dredging (Djafar et al., 2023), field findings reveal a significant implementation gap, reflected in weak operational coordination, suboptimal equipment conditions, and the absence of integrated standard operating procedures for extreme weather conditions (Mahendra & Fadilah, 2023). Furthermore, limited inter-agency coordination and environmental monitoring technology exacerbate vessel congestion, fuel consumption, and carbon emissions, while sedimentation and inadequate monitoring equipment hinder the effective implementation of green port initiatives (Khoirunnisa et al., 2023; Thesya & Pakpahan, 2023). These environmental pressures directly increase operational workload and stress on port labor (Fadiansyah et al., 2022), underscoring the need for a holistic and collaborative approach that integrates operational management, technical readiness, human resource capacity building, and a strong commitment to environmental sustainability (Devianty et al., 2019).

2. Compliance with Regulatory Frameworks and Maritime Safety Standards

Compliance with regulatory frameworks and maritime safety standards represents a strategic determinant of sustainability and competitiveness for Marunda Port as a concession-based port. The national legal framework under Law No. 17 of 2008, supported by governmental oversight mechanisms, provides a comprehensive foundation for navigational safety and shipping lane management (Kamsariaty, 2024; Ningrat, 2022). However, empirical

findings indicate a persistent implementation gap between regulatory robustness and operational practice, manifested in inconsistent application of standard operating procedures, irregular use of personal protective equipment, and weak preventive supervision, particularly during high-intensity operations (Pramono & Saputra, 2023; Djafar et al., 2023). Strategically, insufficient compliance with safety standards directly affects operational risk, reputation, and access to global investment, as ports with consistent implementation of IMO and ISPS Code standards demonstrate higher levels of trust among international partners (Heilig et al., 2020; Yuliana & Fitrani, 2023). These findings highlight the necessity of a systemic approach that goes beyond administrative compliance through performance-based audits, enhanced human resource capacity, and regulatory harmonization across authorities to achieve a safe, credible, and sustainable port system.

3. Optimization of Infrastructure, Technology, and Stakeholder Coordination

Marunda Port faces structural optimization challenges arising from imbalances between physical capacity, the level of digital technology adoption, and the effectiveness of institutional coordination, resulting in partial operational efficiency (Mahendra & Fadilah, 2023; Khoirunnisa et al., 2023). Despite infrastructure improvements such as berth construction, warehouse expansion, and monitoring digitalization, port productivity remains constrained by limited cargo handling facilities, inconsistent channel depth standards, weak external connectivity, inadequate equipment maintenance, and insufficient worker facilities (Tani et al., 2024; Kamsariaty, 2024; Devianty et al., 2019). Concurrently, digital transformation through platforms such as Inaportnet, e-manifest, and Terminal Operating Systems has not yet achieved full effectiveness due to low system integration and limited digital literacy among human resources, while cross-actor coordination, although formally facilitated, remains insufficiently inclusive. These findings emphasize that improving Marunda Port's performance requires a holistic smart port approach that integrates infrastructure development, data-driven technologies, human resource capacity strengthening, and sustainable collaborative governance across sectors.

4. Results of Data Processing Using NVivo

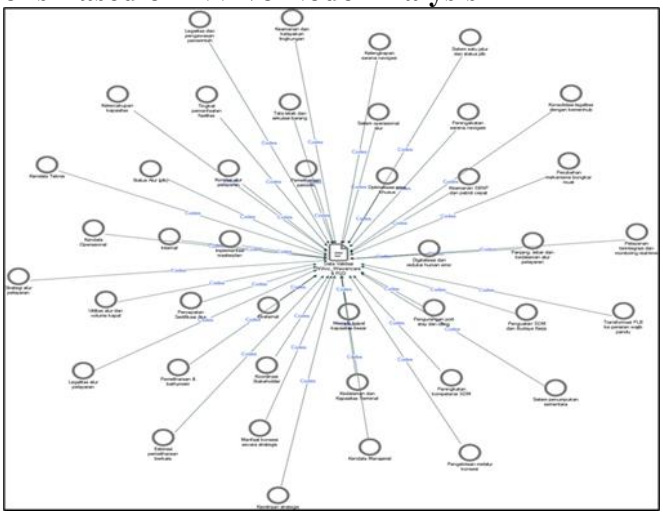
Source: Research Results

Figure 1. Word Cloud Method (NVivo 15)

Word cloud analysis conducted using NVivo 15 indicates that the primary focus of the study is concentrated on the keywords port, shipping, terminal, and vessel, confirming that the research is strongly oriented toward port infrastructure and operational aspects, the effectiveness of shipping lane management, and vessel movement control. The dominance of the term Marunda further confirms the specificity of the research location, positioning Marunda Center Terminal as the central locus of analysis. Meanwhile, the frequent appearance of terms such as management, facilities, strategy, optimization, and utilization reflects a strategic approach emphasizing the improvement of facility utilization efficiency and integrated port service performance.

Furthermore, the emergence of keywords such as logistics, national, Indonesia, as well as concession, government, and investment indicates that the scope of this study extends beyond a local context and contributes to the broader discourse on the national logistics system within a public–private partnership framework. These findings suggest that the proposed optimization strategies have the potential to enhance national logistics efficiency through concession-based port management, infrastructure upgrading, and strengthened regulator–operator collaboration. At the same time, the results provide a strategic reference for PT Pelabuhan Tegar Indonesia in formulating medium- and long-term development policies for Marunda Center Terminal.

5. Main Conclusions Based on NVivo Node Analysis



Source: Research Results

Figure 2. Node Method (NVivo 15)

Optimization of shipping lanes at Marunda Center Terminal continues to face complex challenges arising from technical and operational constraints, channel utility limitations, and increasing vessel traffic. These conditions indicate that shipping lane utilization remains suboptimal due to weak integration among technical, managerial, and stakeholder coordination aspects.

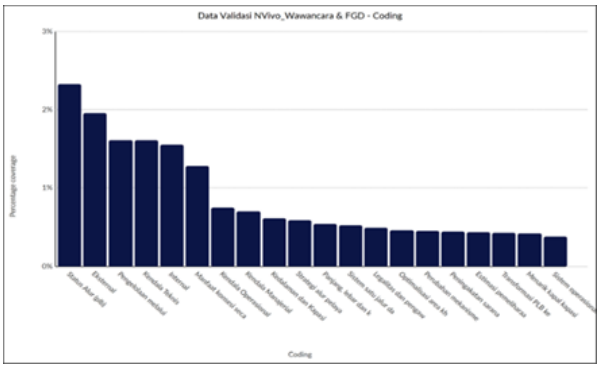
Digitalization of shipping lane management has emerged as a key strategy to enhance efficiency and reduce human error. The integration of data-driven navigation systems and traffic management is perceived as critical for improving vessel movement control while strengthening operational safety and reliability.

Infrastructure quality and navigational aids play a decisive role in successful shipping lane optimization. Strengthening navigational aids (SBNP), implementing single-lane systems, and conducting consistent bathymetric surveys are essential to ensuring navigational safety and smooth vessel traffic flow.

The management of Marunda General Terminal facilities also requires further improvement, particularly in terms of terminal capacity, human resource readiness, and the effective utilization of facilities under the concession scheme. Strong stakeholder coordination and consistent implementation of the port master plan are prerequisites for achieving integrated and efficient terminal management.

Regulatory support and government involvement remain crucial in ensuring the legality and safety of shipping operations. The transformation of Pandu Luar Biasa (PLB) status into compulsory pilotage waters, strengthened supervision, and a strategic focus on reducing port stay and dwell time reflect a long-term efficiency orientation aimed at enhancing port competitiveness.

6. Main Conclusions Based on NVivo Node Analysis



Source: Research Results

Figure 3. Node Method (NVivo 15)

The coding analysis indicates that the legal and administrative status of the *Pandu Luar Biasa* (PLB) shipping lane constitutes the most dominant issue, as reflected by the highest coverage level in stakeholder discourse. Regulatory ambiguity and uncertainty regarding the legal status of the shipping lane, together with the urgency to transform PLB into compulsory pilotage waters, underscore that regulatory clarity represents a fundamental prerequisite for shipping lane optimization at Marunda.

Beyond regulatory factors, port performance optimization is strongly influenced by the interaction between external and internal factors. Government regulations and national logistics system constraints intersect with managerial limitations, human resource capacity, and internal organizational culture within the Port Business Entity (BUP). This interaction demonstrates that performance improvement cannot rely solely on infrastructure development, but instead requires strong institutional synergy and consistent operational governance.

Furthermore, port management under a concession scheme is viewed as a strategic instrument to enhance efficiency and attract investment. However, it continues to face systemic technical and operational constraints, including channel depth limitations, facility readiness, and the effectiveness of operational systems. Although initiatives related to shipping lane optimization, digitalization, and cargo handling mechanism reforms have emerged, the findings reveal that these strategies remain fragmented. Consequently, an integrative framework is required to align regulatory restructuring, human resource strengthening, concession management, and sustainable digital transformation.

7. Solutions for Shipping Lane Optimization and Terminal Facility Management

The first key issue concerns the underutilization of shipping lane capacity due to sedimentation, limited vessel traffic management, and non-integrated scheduling, which prevents the designed channel capacity from being fully utilized. The proposed solution emphasizes strengthening vessel traffic management through coordinated berth scheduling, integrated use of navigation systems and channel data, and performance-based channel capacity management without excessive reliance on physical expansion.

The second issue relates to low port service efficiency caused by weak information system integration, unsynchronized intermodal coordination, and inconsistent implementation of operational procedures. The solution involves shifting the service paradigm from facility-based to system- and coordination-based management by integrating port systems with national logistics platforms, strengthening one-stop service mechanisms, and enhancing human resource competencies to ensure more consistent and efficient service delivery.

The third issue is the imbalance between terminal infrastructure management and the growth of vessel and cargo volumes, which results in suboptimal facility utilization and increased operational bottlenecks. The proposed solution focuses on optimizing terminal capacity management through functional reconfiguration of facilities, improvement of

operational workflows, and strengthened intermodal connectivity, enabling existing infrastructure to be utilized more effectively and sustainably.

8. Results of Triangulation Data Analysis

The following section presents validation through triangulation based on data obtained from five respondents who provided perspectives on shipping lane management and terminal facilities at Marunda Center Terminal (MCT).

Table 2. Triangulation Validation

Topic	Key Findings	Respondent	Triangulation Validation Results	Strategic Implications
Topic 1 Existing Conditions of Shipping Lanes and Terminal Facilities	▪ Shipping channel depth of –9.5 m LWS ▪ Single-vessel entry shipping lane configuration ▪ *Pandu Luar Biasa* (PLB) status ▪ Berth utilization of approximately 65 percent	R1, R2, R3, R4, R5	Consistent across all respondents: The deepest channel is at Marunda, but only one ship can enter/exit at a time. Status is still Extraordinary Pilotage (PLB)..	The flow needs to be developed to serve both directions, and be certified or concessioned immediately..
Topic 2 Technical, Operational, and Managerial Constraints	▪ Sedimentation-induced channel shallowing ▪ Limited navigational aids ▪ Interference from small vessel activities ▪ Damage to or theft of navigational aids (SBNP) ▪ Absence of an official shipping lane concession	R1, R2, R3, R4, R5	All respondents confirmed these challenges: routine silting, limited navigation facilities, and a weak legal standing.	Regular dredging, navigation modernization (AIS/VTS), and navigation protection must be prioritized.
Topic 3 Internal and External Influencing Factors	▪ **Internal factors:** human resource capacity, port infrastructure, and cargo handling equipment ▪ **External factors:** factory readiness, transporter availability, legal status of the shipping	R1, R2, R3, R5	Valid and relevant. A combination of internal & external factors affects the operational efficiency of the terminal.	Improvement of human resource competency and integration of management systems is required, as well as logistical synergy between partners.

	lane, and activities of other vessels			
Topic 4 Optimization Strategies	▪ Establishment of a shipping lane concession ▪ Routine channel maintenance and dredging ▪ Expansion of navigational aids and adoption of modern navigation technologies ▪ Reorganization of cargo distribution systems ▪ Consistent implementation of the port master plan	R1, R2, R3, R4, R5	Agreed across roles. Concessions and digitalization are key strategies. Organizing distribution of goods is also crucial.	Phased strategy: ▪ Legalization of the route, ▪ Infrastructure investment, ▪ Modernization of terminal services
Topic 5 Policy Recommendations and Strategic Actions	▪ Acceleration of shipping lane concession approval ▪ Strengthening cross-stakeholder coordination ▪ Provision of temporary storage facilities ▪ Digitalization of reporting and monitoring systems ▪ Enhanced security patrols for navigational aids (SBNP)	R1, R2, R3, R4, R5	Relevant and realistic. All respondents suggested concrete actions that could be implemented immediately.	PTI management needs to form a legalization acceleration team, a digital reporting system, and maritime security SOPs.

CONCLUSION

This study concludes that the performance of Marunda Center Terminal, operated by PT Pelabuhan Tegar Indonesia as a Port Business Entity, is determined by the strong interdependence of regulatory, operational-technical, managerial, and socio-economic factors. Consequently, port optimization cannot be achieved through technical measures or physical infrastructure development alone. The findings reveal that the shipping lane's legal status, which remains classified as *Pandu Luar Biasa* (PLB), limitations in safety infrastructure and navigation systems, weak digital integration, and insufficient cross-institutional coordination and institutional capacity constitute the main constraints on operational efficiency and service quality. In addition, the economic benefits generated by the port have not been evenly distributed to the workforce due to employment uncertainty and limited social protection. Based on interviews and focus group discussions, this study emphasizes the need for systemic

transformation through the evaluation of more adaptive concession schemes, strengthened governance and regulatory frameworks, modernization of maritime infrastructure and technology, and sustained human resource capacity development. Such an integrated approach is a prerequisite for improving operational efficiency, reducing logistics costs, and enhancing the competitiveness of Marunda Port as a strategic logistics hub within the national logistics system.

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