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# Roles And Responsibilities of Port Engineers In Coal Carrying Ship Operations

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## Abstrak

Sektor logistik batubara sangat bergantung pada kesiapan teknis fasilitas pelabuhan dan keandalan peralatan bongkar muat. Studi ini bertujuan untuk mendeskripsikan peran dan tanggung jawab teknis Insinyur Pelabuhan, dan menganalisis kontribusi mereka terhadap efektivitas operasional pengangkut batubara, dengan objek penelitian Adaro Logistics, Kalimantan Selatan. Metode penelitian yang digunakan adalah deskriptif kualitatif yang didukung oleh data kuantitatif. Pengumpulan data primer dilakukan melalui wawancara mendalam, observasi lapangan, dan kuesioner yang didistribusikan kepada berbagai pihak terkait, sedangkan data sekunder diperoleh dari dokumen operasional pelabuhan. Hasil penelitian menunjukkan bahwa Insinyur Pelabuhan memiliki peran penting sebagai manajer teknis dan penghubung antar fungsi operasional pelabuhan. Implementasi tanggung jawab administratif dan koordinatif yang baik oleh Insinyur Pelabuhan telah terbukti menstabilkan tingkat pemuatan, mengurangi waktu henti peralatan, memastikan keberangkatan kapal tepat waktu, dan mengurangi risiko keterlambatan pengiriman. Kesimpulannya, optimalisasi peran Insinyur Pelabuhan dan sistem pemeliharaan peralatan berdampak langsung pada peningkatan kelancaran operasional dan keselamatan kerja dalam proses transportasi batubara.

**Kata kunci:** *Insinyur Pelabuhan, Manajemen Pelabuhan, Efektivitas Operasional, Logistik Batubara.*

## Abstract

*The coal logistics sector is highly dependent on the technical readiness of port facilities and the reliability of loading and unloading equipment. This study aims to describe the role and technical responsibilities of Port Engineers, and analyze their contribution to the operational effectiveness of coal carriers, with the research object being Adaro Logistics, South Kalimantan. The research method used is descriptive qualitative supported by quantitative data. Primary data collection was conducted through in-depth interviews, field observations, and questionnaires distributed to various related parties, while secondary data were obtained from port operational documents. The results of the study indicate that Port*

*Engineers have a crucial role as technical managers and liaisons between port operational functions. The implementation of good administrative and coordinative responsibilities by Port Engineers has been proven to stabilize loading levels, reduce equipment downtime, ensure timely ship departures, and reduce the risk of shipping delays. In conclusion, optimizing the role of Port Engineers and the equipment maintenance system has a direct impact on improving operational smoothness and occupational safety in the coal transportation process.*

**Keywords:** *Port Engineer, Port Management, Operational Effectiveness, Coal Logistics.*

## Introduction

### Background

The energy sector, particularly the coal industry, remains a key pillar supporting the Indonesian economy, both as a primary source of electricity generation and as a strategic export commodity that contributes significantly to national income. Data from the Ministry of Energy and Mineral Resources shows that national coal production continues to show a strong trend to meet domestic and export demand. Within this supply chain, transportation from mining sites to ports and then to cargo ships is a crucial step. Ports serve as key nodes connecting mining operations with the maritime transportation system, making operational efficiency at the port level crucial for maintaining supply continuity.

The effectiveness of coal shipping operations at ports depends heavily on the technical readiness of port facilities and the reliability of loading equipment such as conveyor systems, ship loaders, floating cranes, and tugboats, as well as the implementation of occupational safety management. Equipment operating under continuous heavy loads is highly susceptible to technical disruptions, where even minor failures can lead to operational downtime, shipping delays, and increased costs due to late penalties. In this context, the role of Port Engineers becomes highly strategic, as they are responsible for ensuring the reliability, safety, and efficiency of port equipment while coordinating across operational, maritime, and managerial functions.

However, empirical conditions in coal port operations, particularly at PT Adaro Logistics in South Kalimantan, indicate that operational challenges remain significant. Issues such as equipment breakdowns, fluctuating loading rates, delayed maintenance schedules, and constraints on spare parts availability

continue to impact operational performance. Furthermore, the demanding work environment, characterized by remote locations, dynamic weather conditions, and high production targets, places additional pressure on Port Engineers, requiring quick decision-making and high technical competence.

These challenges are closely related to the selection of maintenance strategies and operational priorities. Preventive maintenance is widely recognized as effective in improving equipment availability and operational capacity. However, overly rigid maintenance schedules can reduce operational flexibility and increase costs, leading some companies to adopt more adaptive approaches such as condition-based maintenance (CBM). On the other hand, excessive focus on achieving high load levels without adequate engineering controls can accelerate equipment failure. These differing approaches highlight the need for a more comprehensive evaluation using a range of indicators, including load stability, minimizing downtime, safety performance, and reducing the cost of delays.

Despite the crucial role of Port Engineers in ensuring operational efficiency and preventing significant financial losses, empirical studies specifically focusing on their operational practices at PT Adaro Logistics are limited. This indicates a gap between theoretical perspectives on maintenance management and their real-world implementation in coal port operations.

Considering these conditions, this study aims to examine the roles and responsibilities of Port Engineers in coal shipping operations, specifically within the context of PT Adaro Logistics in South Kalimantan. This study seeks to analyze how the technical, administrative, and coordination functions performed by Port Engineers contribute to operational effectiveness and efficiency at the port.

**Research Questions**




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Based on the background and objectives of the research, this study seeks to answer the following questions:

1. To what extent does the technical role of Port Engineers influence the operational effectiveness of coal shipping at PT Adaro Logistics?
2. How do maintenance strategies implemented by Port Engineers affect equipment reliability and loading performance?
3. How do administrative responsibilities and coordination contribute to the smooth operation of port activities?
4. How does equipment downtime impact the efficiency of coal shipping operations?
5. What are the challenges faced by Port Engineers in managing port operations under high production pressure?
6. How do the operational practices of Port Engineers contribute to reducing demurrage costs?
7. To what extent do the roles and responsibilities of Port Engineers collectively impact the overall operational performance of the port?

## Literature Review

### 1. Port Operations Management

Port operational management is a key pillar of the maritime logistics ecosystem, focusing on the efficient planning, organization, and control of ship and cargo service activities. In coal-fired ports, operational characteristics are particularly complex due to the heavy reliance on heavy equipment and significant safety risks (Notteboom & Winkelmans, 2001). The success of this sector is measured not only by loading and unloading speeds *but* also by management's ability to minimize technical *downtime* and reduce *demurrage costs* due to delays (Rahman, 2022).

### 2. Operational Effectiveness of Coal Carrier Ships

Operational effectiveness is defined as the extent to which port resources can be optimized to achieve predetermined output targets, both in terms of time and productivity (Slack et al., 2010). In the context of coal transportation, this effectiveness is reflected in stable *loading rates* , low frequency of equipment breakdowns, and punctuality of vessel departures according to schedule ( *vessel turnaround time* ). Technical readiness is a key determinant in maintaining the smoothness of this workflow (Yulianto & Setiawan, 2020).

## 3. Role and Strategy of Port Engineer

*Port Engineers* play a vital role as a bridge between technical and managerial functions. Conceptually, this role encompasses three main dimensions:

- Technical Role: Ensure the reliability of mechanical and electrical systems of equipment such as *ship loaders* and *conveyors* .
- Managerial Role: Planning maintenance strategies ( *preventive maintenance*) to extend the life of assets (Sari & Nugroho, 2023).
- Coordinating Role: Being a cross-divisional communicator (Marine, HSE, and Operations) to ensure that technical decision-making does not hinder shipping schedules (Hasanah & Aditya, 2021).

## 4. Maintenance Responsibilities and Management

*Port Engineer's* responsibilities include accountability for safety *and* operational sustainability. This is achieved through rigorous *maintenance management , accurate technical documentation, and adherence to international standards such as the International Safety Management* (ISM) Code. Systematically




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planned maintenance has been shown to be more effective in reducing operational costs than reactive repairs (Kumar & Singh, 2019).

## Previous Research and Research Position

Extensive research on port operations has been conducted with various focuses. Notteboom & Winkelmans (2001) emphasized resource coordination, while Kumar & Singh (2019) demonstrated that *preventive maintenance* significantly reduced equipment failures at coal terminals. More specifically, Rahman (2022) found that active technical supervision by *port engineers* was directly proportional to reduced *downtime . However, a research gap* exists , with most previous studies addressing technical aspects separately. This study aims to fill this gap by integrating the technical, managerial, and coordinating roles *of port engineers* into a unified framework to improve operational effectiveness, particularly at PT Adaro Logistics.

## Framework

This research framework positions the Role of Port Engineers (technical, managerial, and coordinative aspects) and the Responsibilities of Port Engineers (maintenance, safety, and administrative aspects) as the primary drivers in achieving Ship Operational Effectiveness. Theoretically, this relationship can be formulated as follows:

1. Role Optimization: The better the coordinating role and technical decision-making, the more operational stability will increase.
2. Accountability of Responsibility: Execution of maintenance responsibilities in accordance with SOPs will minimize *downtime and demurrage* risks .
3. Effectiveness Output: Good integration of roles and responsibilities will result in punctuality of ship departure and high loading productivity.

**Research Indicators**

Based on the review above, the research variables are measured through the following indicators:

| Variables | Key Indicators |
|---|---|
| Role of Port Engineer | Technical readiness, operational oversight, cross-functional coordination, decision making. |
| Port Engineer Responsibilities | *Preventive maintenance* , logbook documentation, HSE supervision, regulatory/SOP compliance. |
| Operational Effectiveness | Stability *of loading rate* , minimization *of downtime* , accuracy of ship schedule, reduction of *demurrage costs* . |

**Research methods**

This study uses a qualitative descriptive approach reinforced with descriptive quantitative data ( *mixed-methods* ) to explore the roles and responsibilities *of Port Engineers* at PT Adaro Logistics, specifically in the Taboneo Anchorage and Kelanis Terminal areas. Data collection was conducted through in-depth interviews, field observations of vital equipment such as *ship loaders* and *conveyors* , and the distribution of questionnaires to key informants selected through *purposive sampling techniques* . To ensure the validity of the findings, source triangulation was conducted involving the operational division, *maintenance , and Health, Safety, and Environment (HSE)* personnel to obtain a comprehensive technical and managerial perspective.

Data analysis was conducted through an interactive model that includes data reduction, data presentation, and conclusion drawing, which were then




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synthesized with descriptive statistical results from the questionnaire data. This study focuses on how the effectiveness of coordination and maintenance management carried out by *Port Engineers* directly contributes to key port performance indicators. The evaluation focuses on *loading rate stability* , minimizing technical *downtime* , and punctuality of vessel departures to reduce potential *demurrage costs* , thus providing a complete picture of operational optimization at the coal terminal .

## Results And Discussion

### 1. Research Findings

Coal port operations at PT Adaro Logistics are highly intensive and highly dependent on the reliability of technical systems. Based on in-depth interviews, field observations in Taboneo and Kelanis, and documentation studies, this study confirms that all research instruments used to measure the roles and responsibilities of Port Engineers meet the criteria of credibility and qualitative dependability.

The main findings of the study indicate that the role of a Port Engineer is multidimensional, encompassing technical aspects (inspection and early identification), managerial (preventive maintenance scheduling), and coordinative (inter-divisional liaison). Responsibilities include technical accountability for vital equipment (such as conveyors and ship loaders) and administrative accountability through accurate logbook maintenance. In summary, the Port Engineer's contribution to operational effectiveness is categorized into three main areas: loading process stability, reducing downtime, and preventing financial penalties (demurrage).

### 2. Discussion

- The Role of Multidimensional Port Engineer

Research shows that port engineers serve as both the frontline and the operational communication hub. Technically, early detection of hydraulic system anomalies or excessive vibration in heavy equipment relies heavily on active monitoring of this position. This finding aligns with Operational Management theory that system reliability is key to port effectiveness. Coordinating, the Port Engineer's ability to bridge information between maritime and technical teams ensures all elements work at a unified pace, minimizing miscommunication, which often leads to inefficiency.

- Technical and Administrative Responsibilities

Technically, Port Engineers bear full responsibility for ensuring that *Preventive Maintenance* (PM) is carried out to a high standard to prevent sudden breakdowns. Interestingly, this study found that administrative documentation (logbooks) have a strategic role as a basis for long-term managerial decision-making, not just a formality.

Although the high administrative burden is a challenge, the integration of safety (HSE) aspects into every technical action proves that compliance with international regulations (ISM Code) is an integral part of their professional responsibilities.

- Contribution to Operational Effectiveness and Efficiency

There is a direct correlation between the quality of Port Engineer supervision and the achievement of target loading rates. High equipment availability allows for consistent fulfillment of operational window times. From an efficiency perspective, planned maintenance management can prevent massive financial losses due to demurrage fines. These findings confirm that operational effectiveness at PT Adaro




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Logistics' coal port relies not only on throughput but also on ensuring the reliability of equipment strategically managed by Port Engineers.

## Conclusion

Based on research findings regarding the roles and responsibilities *of Port Engineers* at PT Adaro Logistics, the following conclusions can be drawn:

1. Multidimensional Strategic Role: *Port Engineers* perform roles that go beyond purely technical functions, encompassing managerial dimensions in maintenance planning as well as a coordinating role as a cross-functional communication hub.
2. Operational Control: The success of port operations depends heavily on *the Port Engineer's control* of the readiness and suitability of key loading and unloading facilities such as *ship loaders* and *conveyor systems* .
3. Integrity of Responsibility: Integrated responsibility ranging from technical execution, administrative discipline (logbook), to compliance with maritime safety standards is a key factor in minimizing *downtime* .
4. Measurable Effectiveness: Optimizing *Port Engineer performance* contributes significantly to the stability *of loading rates* and the accuracy of ship departure schedules according to the specified *window time .*
5. Financial Efficiency: Responsive and planned maintenance management has been proven to be able to reduce the risk of financial losses for companies due to late shipping fines ( *demurrage* ).
6. Conceptual Contribution: The operational reliability of heavy industrial ports does not only rely on mechanical capacity, but also on the integration between maintenance management and human resource coordination engineering.
7. System Transformation: These findings drive the need for a transition from conventional preventive maintenance to a more adaptive *condition-based maintenance system.*

## Recommendations

Based on the research results, several recommendations can be given to improve operational effectiveness in the future:

For Companies (Management)

1. Digitalization of Maintenance Systems: Companies are advised to start adopting IoT (*Internet of Things* ) based monitoring technology to support the transition to *condition-based maintenance* , so that equipment damage detection can be done in *real-time* .
2. Optimizing Administrative Workload: Considering the high administrative burden *of Port Engineers* , companies need to provide an integrated digital reporting system (E- Logbook) to increase reporting time efficiency without reducing the quality of the tool's historical data.
3. Enhanced Continuous Technical Training Program: Given the complexity of the equipment at Taboneo and Kelanis, continuous training is required for *Port Engineers* and technical teams on the latest hydraulic and mechanical system technologies to maintain *equipment reliability* .
4. Strengthening Cross-Functional Coordination Protocols: There is a need for standardization of formal communication flows between *Port Engineers, Port Captains,* and HSE to accelerate the technical decision-making process under the pressure of operational targets.

**For Further Research**

1. External Variable Analysis: Future research could evaluate the influence of external factors such as extreme weather conditions or coal material characteristics on the effectiveness of maintenance management managed by *Port Engineers.*




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2. Comparative Cost Efficiency Study: It is recommended to conduct a quantitative study on *the cost-benefit comparison* between the current preventive maintenance system and the proposed condition-based maintenance implementation.
3. Exploration of Technical Leadership Aspects: Considering the crucial coordinating role, further research can examine the influence of engineering leadership style *on* safety culture and *maintenance team performance* in the field.
4. Development of New Performance Indicators: Further researchers can develop more specific Key Performance Indicators to measure the contribution of individual *Port Engineers* to overall terminal productivity.

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