International Journal of Marine Engineering Innovation and Research, Vol. 11(3), Sept. 2026. 821-830
(pISSN: 2541-5972, eISSN: 2548-1479)

Risk-Based Maritime Safety Management, Operational Efficiency, and Financial Performance

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(Received: 22 June 2026 / Revised: 22 June 2026 / Accepted: 23 June 2026 / Available Online: 1 September 2026)

Abstract— Container terminal operations involve various operational risks that may affect operational efficiency and financial performance. This study aims to examine the effect of Risk-Based Maritime Safety Management (RBMSM) on Operational Efficiency and Financial Performance at Semarang Container Terminal, as well as the mediating role of Operational Efficiency. Risk-Based Maritime Safety Management (RBMSM) was developed based on the integration of the International Safety Management (ISM) Code and the ISO 31000 Risk Management Framework. A quantitative explanatory approach was employed using data collected from 150 operational employees through purposive sampling. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results indicate that Risk-Based Maritime Safety Management (RBMSM)has a positive and significant effect on Operational Efficiency ($\beta = 0.587$; $p < 0.001$) and Financial Performance ($\beta = 0.312$; $p < 0.001$). Operational Efficiency also significantly influences Financial Performance ($\beta = 0.521$; $p < 0.001$) and mediates the relationship between Risk-Based Maritime Safety Management (RBMSM) and Financial Performance ($\beta = 0.306$; $p < 0.001$). These findings suggest that effective implementation of risk-based maritime safety management contributes to reducing operational disruptions and strengthened financial performance. This study concludes that RBMSM is a strategic organizational capability that supports operational excellence and financial sustainability.

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Keywords- Risk-Based Maritime Safety Management; Operational Efficiency; Financial Performance; Container Terminal

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I. INTRODUCTION

The maritime transportation sector plays a strategic role in facilitating international trade and supporting economic growth. As global supply chains continue to expand, container terminals have become essential logistics hubs responsible for ensuring the efficient movement of cargo and maintaining supply chain continuity [1]. As global trade continues to expand, ports and container terminals have evolved from traditional cargo handling facilities into integrated logistics platforms that support regional and international supply chains [2]. Furthermore, the transformation of port terminal operations into globally connected logistics networks has increased the importance of operational efficiency, safety management, and organizational performance in modern port management [3].

In Indonesia, the growth of maritime trade and containerized cargo has significantly increased operational activities at major container terminals. The high complexity of terminal operations, encompassing simultaneous loading and unloading activities, heavy equipment operations, ship servicing, cargo movements, and human resource interactions, makes container terminals a work environment with a high level of operational risk.As one of the strategic gateways supporting regional and national logistics distribution, Semarang Container Terminal plays an important role in maintaining cargo flow efficiency and service reliability. However, the increasing complexity of container terminal operations also exposes organizations to various operational risks, including workplace accidents, equipment failures, cargo handling disruptions, operational delays, human errors, and environmental uncertainties [4]. These risks not only impact occupational safety but also have the potential to reduce loading and unloading productivity, increase vessel turnaround time, and increase operational costs, ultimately impacting the company's financial performance [3]

In addition to financial performance considerations, container terminal operators must also account for the interplay between operational efficiency, workforce competency, and resource allocation. Efficient utilization of equipment and human resources directly affects turnaround time and cargo handling capacity, while also impacting cost control and revenue optimization. Strategic planning that integrates workload forecasting, maintenance scheduling, and contingency measures allows terminals to anticipate peak demand periods and mitigate operational bottlenecks. By aligning financial performance objectives with operational priorities, management can ensure that investments in infrastructure, technology, and training yield measurable improvements in both service quality and profitability, supporting sustainable growth over the long term.

In this context, operational risk management becomes an essential aspect of container terminal governance. Container terminal activities involve the interaction of

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various operational elements, including human resources, cargo handling equipment, vessel schedules, yard capacity, documentation systems, and coordination among operational units. When these elements are not managed in an integrated manner, even minor disruptions may develop into broader operational problems that affect service reliability and terminal productivity. Therefore, the ability of terminal operators to identify, assess, control, and monitor operational risks is highly relevant in maintaining the continuity of port. The following is operational data from the Semarang Container Terminal.

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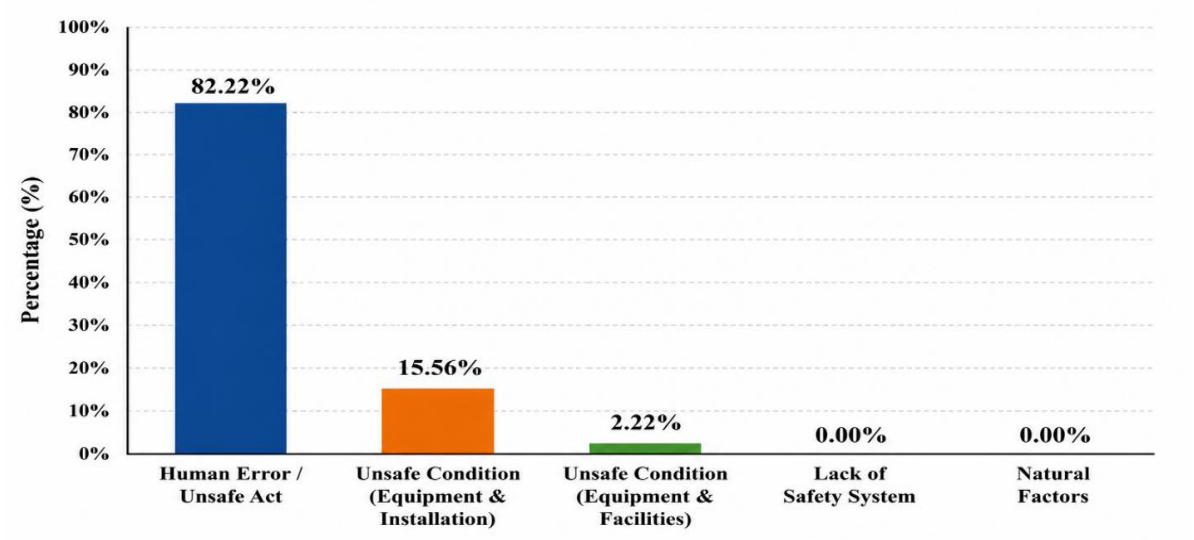

Figure 1. Operational Accident Causes at Semarang Container Terminal

The operational accident data presented in Figure 1 indicate that most incidents occurring at Semarang Container Terminal are associated with human error and unsafe actions, followed by equipment and installation-related failures. This condition suggests that operational risks remain a significant challenge in container terminal activities. Safety incidents not only threaten employee welfare but also contribute to operational disruptions, productivity losses, increased operational costs, and reduced organizational competitiveness. According to [5], operational reliability and service quality significantly influence the competitiveness of container ports. Therefore, safety-related risks continue to represent a major challenge in container terminal activities and may disrupt operational continuity and organizational performance.

In addition to safety-related concerns, increasing operational intensity has become another challenge faced by container terminal operators. The continuous growth of container throughput requires organizations to optimize operational processes while maintaining service quality and resource utilization efficiency.

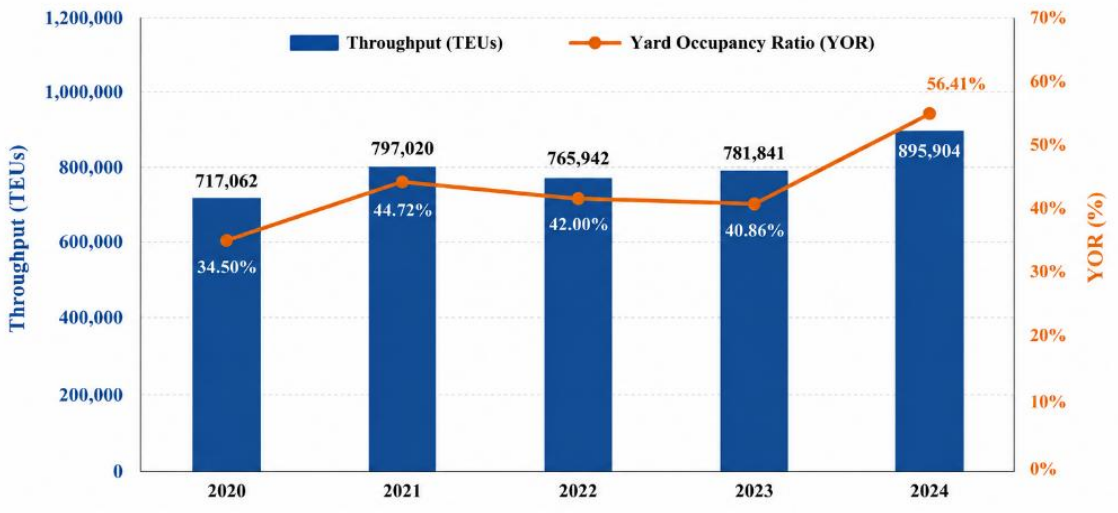

Figure 2. Throughput and Yard Occupancy Ratio Growth at Semarang Container Terminal (2020–2024)

As illustrated in Figure 2, container throughput at Semarang Container Terminal has shown a consistent upward trend over recent years, accompanied by increasing Yard Occupancy Ratio (YOR) levels. This trend reflects higher operational intensity and greater pressure on terminal facilities and resources. Cullinane and Wang [6] explain that operational efficiency is one of the primary determinants of container terminal

performance. Similarly, Miyashita [7] highlights that increasing cargo volumes and operational density may elevate operational risks and create challenges related to efficiency, congestion, and service performance. Consequently, terminal operators require systematic management approaches capable of balancing operational productivity and safety requirements.

To address these challenges, maritime organizations increasingly adopt integrated risk management approaches that emphasize proactive risk identification, assessment, mitigation, and monitoring. The International Maritime Organization (IMO) through the International Safety Management (ISM) Code [8] the International Organization for Standardization through ISO 31000 Risk Management Guidelines [9] emphasize the importance of systematic risk management practices in maintaining operational reliability and organizational sustainability. In this context, Risk-Based Maritime Safety Management (RBMSM) emerges as an integrated management approach that combines maritime safety principles with risk management frameworks to reduce operational disruptions and improve organizational performance.

Risk-Based Maritime Operational Safety Management can be defined as a ship and port operational safety management system that integrates the principles of the ISM Code with the ISO 31000 risk management process to identify, analyze, evaluate and control safety risks in order to improve operational reliability, efficiency and organizational performance in maritime operations. The implementation of Risk-Based Maritime Safety Management (RBMSM) is expected to improve operational performance by reducing accident frequency, minimizing equipment downtime, enhancing process reliability, and optimizing resource utilization. Furthermore, effective safety management contributes to improved logistics service quality, customer satisfaction, and organizational competitiveness [10].

Risk-Based Maritime Safety Management provides a systematic approach for strengthening terminal operations by linking safety practices with operational decision-making. Rather than treating safety as a separate compliance requirement, risk-based safety management positions safety as part of daily operational control. This approach enables organizations to anticipate potential hazards, minimize unsafe actions, improve equipment readiness, and strengthen coordination among operational personnel. In container terminal operations, where time efficiency and service reliability are critical, a risk-based approach is expected to reduce operational delays, prevent accident-related losses, and support more stable financial performance

From a theoretical perspective, this study is grounded in the Resource-Based View (RBV), which argues that organizational capabilities and strategic resources can become sources of sustainable competitive advantage [11]. According to RBV theory, management systems, organizational knowledge, and operational capabilities may create superior performance when they are effectively developed and utilized. In this regard, Risk-Based Maritime Safety Management can be viewed as a strategic organizational capability that contributes to operational excellence and financial sustainability. This perspective is further supported by Lubis [12], who emphasized that organizational capabilities play a crucial role in improving firm performance and competitiveness.

Previous research have highlighted the importance of operational efficiency and safety management in enhancing organizational performance. Yeo et al. [5] found that operational reliability and service quality significantly influence port competitiveness. Cullinane and Wang [6] demonstrated that operational efficiency is a critical determinant of container terminal performance. Heaver [13] emphasized that collaborative and integrated logistics practices contribute to operational effectiveness, while Karia and Wong [14] reported that effective utilization of logistics resources positively affects organizational performance. Mentzer, Stank, and Esper [15] further argued that integrated logistics and supply chain management practices improve operational sustainability and competitive advantage.

Nevertheless, several research gaps remain that require attention. First, most previous studies have only examined the relationship between safety management and operational performance or the relationship between operational efficiency and financial performance separately. Second, research integrating Risk-Based Maritime Safety Management, Operational Efficiency, and Financial Performance into a comprehensive conceptual model is still very limited, particularly in the context of container terminals. Third, the mediating role of operational efficiency in explaining the mechanisms by which maritime safety management impacts an organization's financial performance is still rarely studied in the maritime management literature. This situation indicates that the mechanisms for creating economic value through the implementation of risk-based safety management are still not comprehensively understood.

Based on these gaps, this study provides novelty in the form of developing a structural model that integrates the relationship between Risk-Based Maritime Safety Management (RBMSM), Operational Efficiency (OE), and Financial Performance (FP) within a single conceptual framework. Unlike previous studies that generally view safety management as an instrument for regulatory compliance and accident prevention, this study conceptualizes Risk-Based Maritime Safety Management (RBMSM) as a strategic organizational capability capable of creating added value through increased operational efficiency and financial performance. Furthermore, this study positions operational efficiency as a mediating variable that explains the mechanism of maritime safety management's influence on an organization's financial performance. . In particular, the mediating role of operational efficiency in linking safety management and financial results has received less attention.

This study aims to analyze the effect of Risk-Based Maritime Safety Management on Operational Efficiency and Financial Performance at the Semarang Container Terminal. In addition, this study also aims to examine the mediating role of Operational Efficiency in the relationship between Risk-Based Maritime Safety Management and Financial Performance. The results of

this study are expected to provide theoretical contributions to the development of maritime safety management and risk management literature, while providing practical implications for container terminal operators in designing integrated safety and operational strategies to improve organizational sustainability and competitiveness.

II. METHOD

A. Research Design

This study employed an explanatory quantitative research design to examine the causal relationships among Risk-Based Maritime Safety Management (RBMSM), Operational Efficiency (OE), and Financial Performance (FP) at Semarang Container Terminal. This design was selected because the study aims not only to describe operational safety practices but also to empirically test the influence of Risk-Based Maritime Safety Management (RBMSM) on operational and financial outcomes.

The research model consists of one exogenous variable, one mediating variable, and one endogenous variable. Risk-Based Maritime Safety Management (RBMSM) was positioned as the independent variable, Operational Efficiency (OE) as the mediating variable, and Financial Performance (FP) as the dependent variable. The proposed model was developed to examine both direct and indirect effects among the variables in the context of container terminal operations.

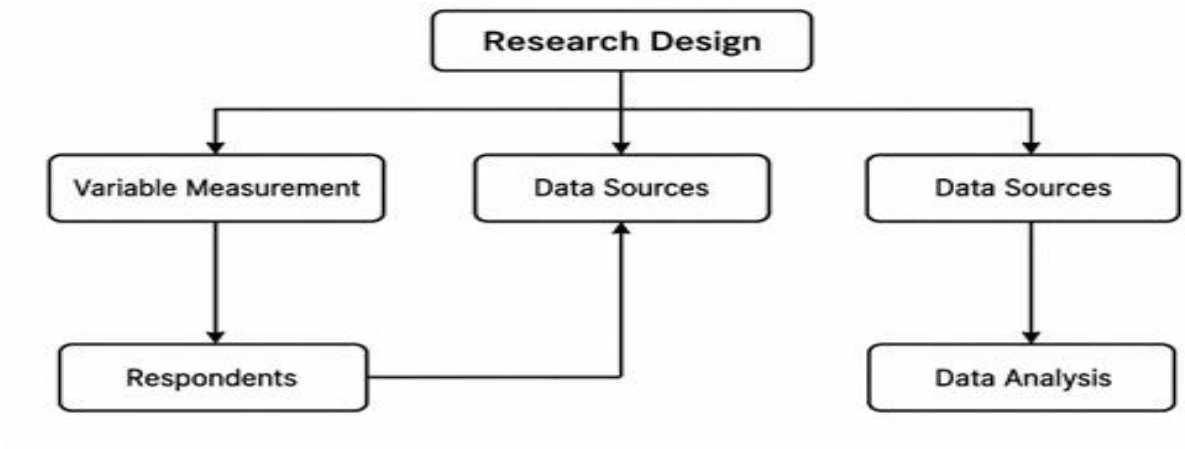

Figure 3. Research Method Flow

Figure 3 illustrates the research flow adopted in this study. The process begins with the determination of the research design, followed by variable measurement, data collection, and data analysis. Variable measurement defines the operational indicators of each construct, while data collection refers to the acquisition of empirical data from respondents involved in terminal operational activities. The data analysis stage was conducted to test the proposed structural relationships using PLS-SEM. This research flow demonstrates the consistency between the research design, variable operationalization, data collection procedures, and analytical techniques.

B. Variables and Measurement

This study used three latent variables measured through reflective indicators adapted from previous studies and contextualized to container terminal operations. All indicators were measured using a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

Risk-Based Maritime Safety Management (RBMSM) was measured using indicators related to operational risk identification, risk assessment, risk treatment and control procedures, safety monitoring, and risk evaluation. These indicators represent the organization's capability to systematically manage operational safety risks and maintain operational reliability.

Operational Efficiency (OE) was measured using indicators related to operational productivity, turnaround time efficiency, equipment utilization effectiveness, operational downtime minimization, and operational coordination effectiveness. These indicators reflect the organization's ability to optimize operational resources and maintain the continuity of container terminal operations.

Financial Performance (FP) was measured using indicators related to operational cost efficiency, profitability improvement, reduction of operational losses, financial stability, and optimization of operational resource utilization. These indicators represent the financial outcomes generated from effective safety and operational management practices.

C. Data Sources and Collection Methods

Primary data were collected through structured questionnaires distributed to operational employees, supervisors, equipment operators, and personnel directly involved in loading and unloading activities at Semarang Container Terminal. The questionnaire was developed based on the indicators of each research variable and was designed to capture respondents' perceptions of maritime safety management, operational efficiency, and financial performance.

To reduce the possibility of common method bias, respondents were informed that their responses would remain anonymous and confidential. Procedural

remedies recommended by Podsakoff et al. [16] were applied during questionnaire design and data collection.

In addition to questionnaire distribution, limited observations and informal discussions were conducted to obtain supporting information regarding operational safety practices, equipment utilization, and operational coordination within terminal activities. Secondary data were obtained from scientific literature, operational reports, maritime safety regulations, organizational documents, and previous studies related to maritime safety management, operational efficiency, and financial performance. This study also referred to the International Safety Management (ISM) Code and ISO 31000 Risk Management Framework as the conceptual basis for risk-based maritime safety management.

D. Population and Sample

The population of this study consisted of employees directly involved in operational activities at Semarang Container Terminal, including operational staff, equipment operators, supervisors, and operational support personnel. These respondents were selected because they have direct knowledge and experience regarding terminal operations and the implementation of maritime safety management practices.

This study applied purposive sampling to determine the respondents. The sampling criteria included employees who had worked for at least one year and were directly involved in loading and unloading activities, equipment operations, operational supervision, or maritime safety management practices. A total of 150 respondents were involved in this study.

The sample size was determined by referring to the minimum sample requirement for Structural Equation Modeling–Partial Least Squares (SEM-PLS), which recommends at least 5 to 10 times the number of research indicators. Since this study used 15 indicators, the minimum required sample size was 75 respondents. Therefore, the use of 150 respondents exceeded the minimum requirement and was considered adequate for model estimation.

E. Data Analysis Technique

The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4. This technique was selected because it is suitable for testing predictive and complex research models involving latent variables and mediating effects [17], [18]. PLS-SEM is also appropriate for studies with relatively limited sample sizes and does not require strict normality assumptions.

The analysis was conducted in two stages: measurement model evaluation and structural model evaluation. The measurement model was used to assess the validity and reliability of the research instruments following the recommendations of Hair et al. [19]. Convergent validity was evaluated using outer loading values and Average Variance Extracted (AVE). Discriminant validity was assessed using the Fornell–Larcker criterion [20] and Heterotrait-Monotrait Ratio (HTMT). Construct reliability was examined using Cronbach's Alpha and Composite Reliability, with values above 0.70 indicating acceptable reliability.

The structural model evaluation was conducted to test the relationships among the latent variables. Hypothesis testing was performed using path coefficients, t-statistics, and p-values generated through the bootstrapping procedure at a 5% significance level. The coefficient of determination (R^2) was used to assess the explanatory power of the model, while effect size (f^2) and predictive relevance (Q^2) were used to evaluate the strength and predictive capability of the structural model. The mediating effect of Operational Efficiency was examined through indirect effect analysis.

III. Results and Discussion

A. Respondent Characteristics

This study involved 150 respondents consisting of operational employees, supervisors, equipment operators, and personnel directly involved in loading and unloading activities at Semarang Container Terminal. The respondent characteristics are presented in Table 1

TABLE1.
RESPONDENT CHRARACTERISTICS

Characteristics	Category	Frequency (n)	Percentage (%)
Gender	Male	114	76.00
	Female	36	24.00
Age	21–30	43	28.67
	31–40	52	34.67
	41–50	39	26.00
	51–60	16	10.66
Education	High School	66	44.00
	Diploma (D-3)	32	21.33
	S1	52	34.67
Work Exp (Years)	1–5	47	31.33
	6-10	58	38.67
	>10	45	30.00
Employment Status	Contract	42	28.00
	Permanent	108	72.00

Table 1 shows that the majority of respondents were male, representing 76.00% of the total respondents, while female respondents accounted for 24.00%. Based on age, most respondents were in the 31–40 age group, indicating that the respondents were generally within a productive working age. In terms of educational

background, most respondents graduated from high school, followed by respondents with bachelor's degrees and diploma qualifications. Based on work experience, most respondents had worked for 6–10 years, indicating that the respondents had adequate operational experience. Furthermore, most respondents were permanent employees, representing 72.00% of the total sample. These characteristics indicate that the respondents were relevant to provide information regarding operational safety, efficiency, and financial performance within container terminal operations.

B. Descriptive Statistics of Research Variables

The descriptive statistics of the research variables are presented in Table 2. The analysis was conducted to describe respondents' perceptions of Risk-Based Maritime Safety Management (RBMSM), Operational Efficiency (OE), and Financial Performance (FP).

TABLE 2.
DESCRIPTIVE STATISTICS OF RESEARCH VARIABLES

	Variable	Mean	Std. Dev.	Category
1	Risk-Based Maritime Safety Management (RBMSM)	4.26	0.48	High
2	Operational Efficiency (OE)	4.18	0.44	High
3	Financial Performance (FP)	4.21	0.46	High

Table 2 indicates that all variables were categorized as high, with mean values above 4.00. Risk-Based Maritime Safety Management had the highest mean value of 4.26, indicating that respondents positively perceived the implementation of risk identification, risk assessment, risk control, safety monitoring, and risk evaluation in terminal operations. Operational Efficiency recorded a mean value of 4.18, reflecting positive perceptions of operational productivity, equipment utilization, turnaround time efficiency, and operational coordination. Financial Performance obtained a mean value of 4.21, indicating that respondents perceived the organization as capable of maintaining cost efficiency, financial stability, and operational resource optimization. These findings suggest that Semarang Container Terminal has a strong operational and safety management foundation for testing the proposed structural model.

C. Measurement Model Evaluation

The measurement model evaluation was conducted to examine the validity and reliability of the research constructs. Convergent validity was assessed using outer loading values and Average Variance Extracted (AVE). The outer loading results are presented in Table 3.

TABLE 3.
OUTER LOADING

Indicator	Loading Factor
RBMSM1	0.812
RBMSM2	0.845
RBMSM3	0.821
RBMSM4	0.857
RBMSM5	0.834
OE1	0.801
OE2	0.825
OE3	0.842
OE4	0.819
OE5	0.836
FP1	0.844
FP2	0.817
FP3	0.826
FP4	0.831
FP5	0.848

Table 3 shows that all indicators had loading factor values above 0.70. This result indicates that all indicators met the convergent validity requirement and were able to represent their respective latent constructs. Therefore, all measurement indicators were retained for further analysis.

Construct validity and reliability were further evaluated using Cronbach's Alpha, Composite Reliability, and AVE. The results are presented in Table 4.

TABLE 4.
CONSTRUCT VALIDITY AND RELIABILITY

	Construct	Cronbach's Alpha	Composite Reliability	AVE
1	RBMSM	0.912	0.926	0.681
2	OE	0.895	0.917	0.704
3	FP	0.887	0.908	0.692

As shown in Table 4, all Cronbach's Alpha and Composite Reliability values were above 0.70, indicating that the constructs had satisfactory internal consistency. In addition, the AVE values for all constructs were above 0.50, confirming adequate convergent validity. These results demonstrate that the measurement model was valid and reliable. Discriminant validity was evaluated using the Fornell–Larcker criterion and HTMT ratio. The

results are presented in Table 5 and Table 6

TABLE 5.
FORNELL–LARCKER CRITERION

	Construct	RBMSM	OE	FP
1	RBMSM	0.825		
2	OE	0.587	0.839	
3	FP	0.521	0.701	0.832

TABLE 6.
HETEROTRAIT-MONOTRAIT RATIO (HTMT)

	Construct	RBMSM	OE	FP
1	RBMSM	-		
2	OE	0.721	-	
3	FP	0.684	0.793	-

Table 5 confirms that the square root of AVE for each construct was greater than its correlations with other constructs, indicating satisfactory discriminant validity. Furthermore, Table 6 shows that all HTMT values were below the recommended threshold of 0.90. These results confirm that the constructs used in this study were empirically distinct from one another. In addition, the SRMR value of 0.071 indicated acceptable model fit, while all VIF values were below 5.00, suggesting that there was no multicollinearity problem in the model.

D. Structural Model Evaluation and Hypothesis Testing

The structural model evaluation was conducted to examine the direct and indirect relationships among Risk-Based Maritime Safety Management, Operational Efficiency, and Financial Performance. The structural model is presented in Figure 4.

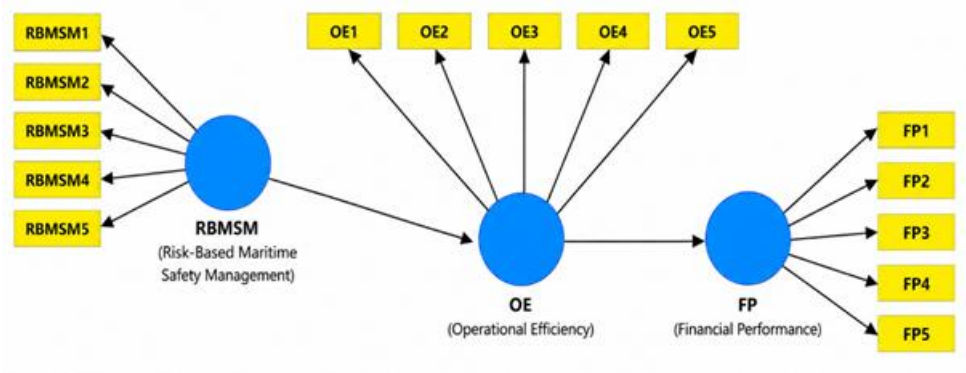

Figure 4. PLS-SEM Structural Model

Figure 4 illustrates the structural relationships among the research variables. Risk-Based Maritime Safety Management (RBMSM) was positioned as the exogenous variable, Operational Efficiency as the mediating variable, and Financial Performance as the endogenous variable. The model was designed to test the direct effect of Risk-Based Maritime Safety Management (RBMSM) on Operational Efficiency and Financial Performance, as well as the indirect effect of Risk-Based Maritime Safety Management (RBMSM) on Financial Performance through Operational Efficiency. The hypothesis testing results are presented in Table 7.

TABLE 7.
STRUCTURAL PATH COEFFICIENTS

	Relationship	Coefficient	T-Statistic	P-Value
1	RBMSM → OE	0.587	8.765	0.000
2	RBMSM → FP	0.312	4.215	0.000
3	OE → FP	0.521	6.432	0.000

Table 7 shows that all structural relationships were Risk-Based Maritime Safety Management (RBMSM) significant at the 5% significance level. Risk-Based Maritime Safety Management (RBMSM) had a positive and significant effect on Operational Efficiency, with a coefficient value of 0.587, t-statistic of 8.765, and p-value of 0.000. This finding indicates that stronger implementation of risk-based maritime safety management improves operational efficiency within container terminal operations.

Risk-Based Maritime Safety Management (RBMSM) also had a positive and significant effect on Financial Performance, with a coefficient value of 0.312, t-statistic of 4.215, and p-value of 0.000. This result indicates that effective safety management contributes directly to financial performance by reducing operational disruptions, minimizing losses, and supporting cost efficiency.

Furthermore, Operational Efficiency had a positive and significant effect on Financial Performance, with a coefficient value of 0.521, t-statistic of 6.432, and p-value of 0.000. This finding confirms that efficient operational activities contribute to stronger financial outcomes through better productivity, equipment utilization, and operational cost control.

The explanatory power of the model was evaluated using the coefficient of determination (R^2), as presented in Table 8.

TABLE 8.
COEFFICIENT OF DETERMINATION (R^2)

	ENDOGENOUS VARIABLE	R^2
1	Operational Efficiency	0.612
2	Financial Performance	0.685

Table 8 indicates that the R^2 value for Operational Efficiency was 0.612, meaning that 61.2% of the variance in Operational Efficiency was explained by Risk-Based Maritime Safety Management (RBMSM). Meanwhile, the R^2 value for Financial Performance was 0.685, indicating that 68.5% of the variance in Financial Performance was explained by Risk-Based Maritime Safety Management (RBMSM) and Operational Efficiency. These values show that the structural model has moderate to strong explanatory power.

The effect size was assessed using f^2 values, as shown in Table 9.

TABLE 9.
EFFECT SIZE (F^2)

	Relationship	f^2	Effect Size
1	RBMSM → OE	0.421	Large
2	RBMSM → FP	0.183	Medium
3	OE → FP	0.356	Large

Table 9 shows that Risk-Based Maritime Safety Management (RBMSM) had a large effect on Operational Efficiency, with an f^2 value of 0.421. Risk-Based Maritime Safety Management (RBMSM) had a medium effect on Financial Performance, with an f^2 value of 0.183. Meanwhile, Operational Efficiency had a large effect on Financial Performance, with an f^2 value of 0.356. These results indicate that operational efficiency plays an important role in strengthening financial performance within container terminal operations. Predictive relevance was evaluated using Q^2 values, as presented in Table 10.

TABLE 10.
PREDICTIVE RELEVANCE (Q^2)

	Endogenous Variable	Q^2
1	Operational Efficiency	0.421
2	Financial Performance	0.503

Table 10 shows that the Q^2 values for Operational Efficiency and Financial Performance were greater than zero. This result indicates that the structural model has adequate predictive relevance and is capable of predicting the endogenous variables.

The mediating effect of Operational Efficiency was tested through indirect effect analysis. The results are presented in Table 11.

TABLE 11.
INDIRECT EFFECTS

	Mediation Pathway	Coefficient	T-Statistic	P-Value
1	RBMSM → OE → FP	0.306	3.852	0.000

Table 11 shows that the indirect effect of Risk-Based Maritime Safety Management (RBMSM) on Financial Performance through Operational Efficiency was positive and significant, with a coefficient value of 0.306, t-statistic of 3.852, and p-value of 0.000. This finding indicates that Operational Efficiency significantly mediates the relationship between Risk-Based Maritime Safety Management and Financial Performance. Therefore, the implementation of effective maritime safety management improves financial performance not only directly but also indirectly through improvements in operational efficiency.

E. Discussion

The findings of this study demonstrate that Risk-Based Maritime Safety Management significantly improves operational efficiency and financial performance at Semarang Container Terminal. The positive effect of Risk-Based Maritime Safety Management (RBMSM) on Operational Efficiency indicates that systematic risk identification, risk assessment, risk control, safety monitoring, and risk evaluation can reduce operational disruptions and support operational continuity. In container terminal operations, where loading and unloading activities involve heavy equipment, vessel operations, and human

interaction, effective safety management becomes essential to minimize delays, equipment downtime, and operational inefficiencies.

The significant effect of Risk-Based Maritime Safety Management (RBMSM) on Financial Performance indicates that maritime safety management should not be viewed merely as a regulatory compliance instrument. Instead, safety management functions as a strategic organizational capability that contributes to cost efficiency, productivity improvement, and financial sustainability. By reducing accidents, delays, and operational losses, Risk-Based Maritime Safety Management (RBMSM) can help organizations maintain stable and efficient terminal operations.

The findings also confirm that Operational Efficiency significantly improves Financial Performance. Efficient operational systems enable terminal operators to optimize equipment utilization, reduce downtime, improve loading and unloading productivity, and control operational costs. These results support the view that operational efficiency is a key mechanism for improving financial outcomes in maritime logistics organizations.

Furthermore, the mediating effect of Operational Efficiency indicates that the relationship between Risk-Based Maritime Safety Management (RBMSM) and Financial Performance occurs not only directly but also through operational improvement. This means that safety management can generate financial benefits when it is integrated with operational efficiency strategies. In this context, operational efficiency serves as a bridge that transforms safety management practices into measurable financial outcomes.

From the Resource-Based View perspective, Risk-Based Maritime Safety Management (RBMSM) can be understood as a strategic organizational resource that supports competitive advantage and long-term sustainability. Organizations with strong safety management systems are more capable of maintaining operational stability, minimizing operational losses, and improving service reliability. Therefore, container terminal operators need to strengthen the implementation of Risk-Based Maritime Safety Management (RBMSM) through proactive risk assessment, continuous monitoring, safety-oriented culture, and integrated operational control procedures.

Overall, the results confirm that the improvement of operational and financial performance in container terminal operations depends on the organization’s capability to implement risk-based maritime safety management in an integrated and systematic manner. The practical implication of this study is that terminal operators should position safety management as part of operational strategy, not only as a safety obligation. This approach can support better productivity, lower operational risk, improved financial performance, and stronger competitiveness in the maritime logistics industry.

IV. Conclusion

Based on the research results, it can be concluded that Risk-Based Maritime Safety Management has a positive and significant impact on improving operational efficiency and financial performance at the Semarang Container Terminal. This finding answers the research objective by confirming that the implementation of risk-based maritime safety management is a management strategy capable of improving operational quality while strengthening an organization's financial performance.

Research findings indicate that the implementation of Risk-Based Maritime Safety Management (RBMSM), which involves continuous risk identification, assessment, control, safety monitoring, and risk evaluation, can create a more stable and controlled operational environment. A systematically managed safety system not only contributes to reducing the potential for accidents and operational disruptions, but also encourages increased productivity, optimized resource utilization, and enhanced the effectiveness of container terminal operational processes.

This study also shows that operational efficiency plays a significant role in explaining how maritime safety management practices generate economic benefits for an organization. Therefore, improved financial performance is not solely derived from the implementation of safety programs, but also through operational process improvements resulting from the implementation of a risk-based safety system. These findings demonstrate that occupational safety and operational efficiency are interrelated aspects in creating added value and organizational sustainability.

From a theoretical perspective, this study reinforces the Resource-Based View (RBV) which states that an organization's internal capabilities can be a source of sustainable competitive advantage. In the context of this study, RBMSM is proven to function not only as an instrument for compliance with safety regulations but also as a strategic capability capable of simultaneously improving operational efficiency and financial performance. Therefore, this study contributes to the development of maritime safety management literature by broadening the understanding of the relationship between safety, operational efficiency, and organizational performance in the context of container terminals.

The main contribution of this research lies in the development of an integrative model that links Risk-Based Maritime Safety Management, Operational Efficiency, and Financial Performance within a single conceptual framework. This model provides a more comprehensive understanding of the mechanisms by which organizational value is created through the implementation of risk-based safety management, particularly in the logistics and port industries, which face high levels of operational risk.

The practical implication is that container terminal managers need to integrate risk-based safety management into their organization's operational and business strategies. Occupational safety is no longer viewed as an administrative activity aimed at meeting regulatory requirements, but must become part of a strategy to improve productivity, efficiency, and organizational competitiveness. Therefore, companies need to strengthen the implementation of Risk-Based Maritime Safety Management (RBMSM) by improving

the quality of risk identification, operational oversight, regular risk evaluation, and developing a safety culture that involves all elements of the organization.

Furthermore, investment in safety training programs, human resource competency development, digitalization of risk monitoring systems, and the use of safety-supporting technologies should be prioritized in efforts to improve terminal operational reliability. These measures are expected to minimize operational disruptions, mitigate losses due to safety risks, and sustainably improve service quality and the organization's financial performance.

Further research is recommended to develop a broader model by incorporating other variables such as safety culture, organizational resilience, service quality, risk management maturity, or competitive advantage as mediating or moderating variables.

Furthermore, comparative research across various container terminals and ports in Indonesia and Southeast Asia is needed to increase the generalizability of research results and enrich the development of risk-based maritime safety management theory..

ACKNOWLEDGEMENTS

The authors express their appreciation and gratitude to the management of Semarang Container Terminal for granting research permission, data support, and the opportunity to conduct data collection within the company's operational environment. Appreciation is also extended to all respondents who participated and provided the necessary information for this study.

The authors also expresses his gratitude to the academic institutions and all parties who provided input, support, and facilities during the research and preparation of this article. Their contributions and support were crucial in completing this research, contributing to the development of maritime safety management knowledge and practice in the port sector.

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