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The Effect of Service Quality and Facility Utilization on Operational Performance Mediated by the ISPS Code Implementation Process at Jakarta International Container Terminal (JICT), Tanjung Priok

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Abstract: This study aims to analyze the effect of service quality and facility utilization on port operational performance through the implementation process of the ISPS Code at JICT Tanjung Priok. The study integrates the variables of service quality, facility utilization, ISPS Code implementation, and port operational performance, which have been discussed in previous related studies. The survey was conducted using a questionnaire distributed to 186 respondents involved in operational activities at JICT Tanjung Priok. This research employed a quantitative approach using the Structural Equation Modeling (SEM) analysis technique with the assistance of SmartPLS 4.0 software. The results of the study indicate that service quality and facility utilization have a positive and significant effect on both the ISPS Code implementation process and port operational performance. In addition, the ISPS Code implementation process was also proven to have a positive and significant effect on operational performance and to mediate the influence of service quality and facility utilization on port operational performance. The findings reveal that facility utilization has the most dominant influence on the implementation of the ISPS Code, while service quality plays an important role in supporting the effectiveness of port operations. The study concludes that improving service quality, optimizing facility utilization, and strengthening the implementation of the ISPS Code are essential factors in enhancing port operational performance effectively and sustainably. Therefore, port management is recommended to improve service quality, strengthen port security systems, optimize the use of operational facilities, and develop technology-based monitoring and coordination systems to support operational efficiency and port security.

Keywords: service quality, facility utilization, ISPS Code, operational performance

INTRODUCTION

The challenging global economic environment and the decline in Indonesia's Logistics Performance Index (LPI) highlight the urgent need to improve efficiency and reliability in the logistics sector, particularly in port operations. As major nodes in national and international supply chains, ports play a strategic role in facilitating the movement of goods, supporting industrial activities, and strengthening international trade competitiveness. The World Bank (2024) emphasizes that logistics performance is influenced by several dimensions, including customs, infrastructure, international shipments, logistics competence, timeliness, and tracking and tracing. In this context, port efficiency is not only determined by physical infrastructure but also by the quality of services, the utilization of available facilities, and the effectiveness of operational and security management. Therefore, improving port performance requires an integrated approach that is capable of balancing service efficiency, facility utilization, operational productivity, and maritime security.

Tanjung Priok Port, as Indonesia's principal international gateway, has a strategic position in supporting domestic distribution and international trade. Within this port complex, Jakarta International Container Terminal (JICT) plays an important role in handling container flows and supporting the continuity of logistics activities. The increasing volume of international trade has created substantial operational challenges, particularly related to vessel queues, cargo-handling efficiency, terminal capacity, and *dwelling time*. *Dwelling time* refers to the period during which containers remain within the port or temporary storage area from the time they are unloaded until they leave the port. An increase in *dwelling time* may disrupt the flow of goods, increase logistics costs, and reduce the competitiveness of ports. Consequently, the improvement of JICT's operational performance requires not only adequate infrastructure and equipment but also effective service delivery, optimal utilization of facilities, and the consistent implementation of international port security standards.

Service quality represents one of the important factors influencing port operational performance because it reflects the extent to which port users receive services that are reliable, responsive, timely, accessible, and secure. In the context of JICT, port users include shipping lines, freight forwarders, exporters, importers, and other stakeholders involved in container transportation and handling. High service quality can facilitate cargo movement, reduce waiting times, improve coordination among stakeholders, and ultimately contribute to operational productivity. Conversely, delays, limited responsiveness, uncertainty in service processes, and inadequate availability of operational equipment may reduce user satisfaction and disrupt terminal performance. This condition indicates that service quality should be viewed not merely as a customer-oriented concept but also as an operational factor that can influence the effectiveness and efficiency of port activities.

Another important factor is facility utilization, which concerns the extent to which available infrastructure, equipment, storage areas, container-handling facilities, information technology systems, and other operational resources are used effectively and efficiently. Optimal facility utilization enables terminals to handle increasing cargo volumes without necessarily requiring proportional expansion of physical capacity. The data from the Tanjung Priok Main Port Authority indicate that JICT's Yard Occupancy Rate (YOR) fluctuated during 2020–2024 and remained below the established 65% reference level, despite equipment readiness consistently exceeding 97%, which was above the 80% standard (Kantor KSOP Utama Tanjung Priok, 2025). This condition indicates a gap between equipment readiness and actual facility utilization. In other words, facilities may be technically ready for operation, but their contribution to overall operational performance can remain suboptimal when capacity allocation, workload distribution, storage management, and coordination among operational units are not effectively managed.

The operational performance of JICT also demonstrates several issues that require further attention. Data from the Tanjung Priok Main Port Authority show that *dwelling time*

increased from 2.83 days in 2021 to 3.76 days in 2024, indicating that containers required a longer period to move through the terminal (Kantor KSOP Utama Tanjung Priok, 2025). At the same time, the B/C/H (Box/Crane/Hour) indicator declined from 28.58 in 2020 to 23.87 in 2024, while B/S/H (Box/Ship/Hour) decreased from 69.36 to 56.10 during the same period. These changes suggest that increasing cargo flows have not always been accompanied by proportional improvements in handling productivity. Although some operational indicators remain within or above their respective standards, the increase in *dwelling time* and decline in cargo-handling productivity demonstrate that JICT continues to face challenges in achieving consistently optimal operational performance. This phenomenon strengthens the argument that service quality and facility utilization need to be examined simultaneously within a broader operational and security framework.

The *International Ship and Port Facility Security Code* (ISPS Code) provides an important framework for ensuring the security of ships and port facilities against potential threats, including terrorism and other forms of maritime crime. Its implementation involves security assessments, access control, verification of ships and port facilities, security exercises and drills, training, and continuous monitoring. At Tanjung Priok, ISPS Code-related activities during 2024 included temporary International Ship Security Certificates (ISSC), ship verification, port facility verification, exercises, drills, training, and ISSC endorsement (Kantor KSOP Utama Tanjung Priok, 2025). These activities demonstrate that port security is not an isolated function but is closely connected with operational processes. Effective implementation of the ISPS Code may establish standardized procedures, strengthen coordination, improve control over access and cargo flows, and reduce security-related disruptions. Nevertheless, excessive procedural complexity or weak coordination may also create additional operational constraints. Therefore, the implementation process of the ISPS Code needs to be examined not only from the perspective of security compliance but also from its potential contribution to operational effectiveness.

The existing literature has predominantly examined the ISPS Code from the perspectives of maritime security, regulatory compliance, security awareness, risk management, and the preparedness of personnel and port facilities. Previous studies, including Sukhma (2022), Fadilah and Hadi (2024), and Alfian and Puspitawati (2023), have highlighted various challenges associated with security supervision, compliance, and the protection of ships, cargo, and port facilities. Other studies, such as Bagasdianto and Basuki (2023) and Giri Seno and Rahayu (2024), have emphasized challenges related to supervision, personnel training, and the implementation of security procedures. However, these studies have not sufficiently explained how the implementation process of the ISPS Code can function as a mediating mechanism connecting service quality and facility utilization with port operational performance. This represents an important research gap because security implementation may influence operational outcomes through improved coordination, standardized procedures, resource control, and risk reduction. The uniqueness of the present study therefore lies in positioning the ISPS Code implementation process as a mediating variable rather than merely as an independent measure of security compliance, thereby integrating the dimensions of service quality, facility utilization, security implementation, and operational performance within a single empirical model at JICT Tanjung Priok.

Based on the identified phenomenon and research gap, this study aims to examine the influence of service quality and facility utilization on operational performance through the ISPS Code implementation process at Jakarta International Container Terminal (JICT), Tanjung Priok. Specifically, the study seeks to answer the following research questions: (1) Does service quality influence operational performance at JICT Tanjung Priok? (2) Does facility utilization influence operational performance at JICT Tanjung Priok? (3) Does service quality influence the ISPS Code implementation process? (4) Does facility utilization influence the ISPS Code implementation process? (5) Does the ISPS Code implementation

process influence operational performance? and (6-7) Does the ISPS Code implementation process mediate the effects of service quality and facility utilization on operational performance? By addressing these questions, the study is expected to provide an empirical contribution to the development of port management literature by integrating operational efficiency and maritime security perspectives, while also offering practical implications for improving service quality, optimizing facility utilization, strengthening ISPS Code implementation, and enhancing the operational performance and competitiveness of JICT Tanjung Priok.

METHODS

This study employed a quantitative research approach with a structured and systematic research design to examine the relationships among service quality, facility utilization, ISPS Code implementation, and operational performance at Jakarta International Container Terminal (JICT), Tanjung Priok. The research stages consisted of preliminary observation, problem identification, literature review, theoretical framework development, research instrument preparation, questionnaire distribution, data collection, data analysis, hypothesis testing, and conclusion formulation. Primary data were collected through a structured questionnaire distributed online using Google Forms to users involved in JICT operational activities, while secondary data were obtained from relevant institutional records, academic journals, books, and other supporting documents. The questionnaire employed a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The research population comprised 346 JICT service users in 2024, including shipping companies, freight forwarders, freight forwarding and customs clearance companies, trucking companies, exporters/importers, and cargo owners. Using the Slovin formula with a 5% margin of error, the required sample size was 186 respondents. The sampling procedure applied probability sampling through stratified random sampling to ensure that respondents from the relevant user groups were appropriately represented (Sugiyono, 2019; Sekaran & Bougie, 2020).

The research examined four main constructs: service quality (X1), facility utilization (X2), ISPS Code implementation (Z) as the mediating variable, and operational performance (Y) as the dependent variable. Service quality was operationalized through service speed, facility accessibility, user convenience, and information quality. Facility utilization was measured through berth utilization, efficiency of heavy equipment use, storage-area management, and supporting infrastructure utilization. ISPS Code implementation was assessed through access control, inspection and supervision, security training, and coordination among relevant parties. Operational performance was measured through cargo-handling speed, resource utilization, facility capacity, and service time. In addition to the quantitative assessment, service quality was evaluated using the Service Quality (SERVQUAL) approach, which compares customer perceptions with expectations across the dimensions of *tangibles*, *reliability*, *responsiveness*, *assurance*, and *empathy* (Parasuraman et al., 1988). Importance Performance Analysis (IPA) was subsequently applied to identify service attributes requiring priority improvement based on their importance and performance levels. Descriptive statistics, including minimum, maximum, mean, and standard deviation, were also used to describe respondents' perceptions and the distribution of the research data (Ghozali, 2021; Bougie & Sekaran, 2020).

The quantitative data were analyzed using Structural Equation Modeling with the Partial Least Squares approach (SEM-PLS) through SmartPLS software. SEM-PLS was selected because it enables simultaneous analysis of complex relationships among latent constructs and is suitable for predictive research models involving direct and indirect relationships (Ghozali, 2017; Hair et al., 2019). The analysis consisted of two stages: evaluation of the *outer model* and evaluation of the *inner model*. The *outer model* was assessed through *convergent validity*, *discriminant validity*, *Average Variance Extracted*

(AVE), *Composite Reliability*, *Cronbach's Alpha*, the Fornell–Larcker criterion, and *cross-loadings*. The *inner model* was evaluated using R-square (R^2), Q-square (Q^2), model fit indicators, and hypothesis testing through *bootstrapping*. Hypotheses were evaluated at a 5% significance level, with statistical significance determined when the *p-value* was below 0.05. The mediation analysis examined both direct and indirect effects to determine whether ISPS Code implementation mediates the relationships between service quality and operational performance and between facility utilization and operational performance. This analytical procedure enabled the study to assess not only the direct effects of the independent variables but also the mechanism through which ISPS Code implementation contributes to operational performance at JICT Tanjung Priok.

RESULTS AND DISCUSSION

Result

Outer Model

Table 1. Summary of Measurement Model Evaluation

Variable	Indicator Range	Loading Factor Range	AVE	$\sqrt{AVE}$	Cronbach's Alpha	Composite Reliability	Validity	Reliability
Service Quality (X1)	X1.1–X1.8	0.759–0.895	0.686	0.828	0.934	0.937	Valid	Reliable
Facility Utilization (X2)	X2.1–X2.8	0.813–0.908	0.768	0.876	0.957	0.957	Valid	Reliable
Operational Performance (Y)	Y1–Y8	0.806–0.909	0.781	0.884	0.960	0.960	Valid	Reliable
ISPS Code Implementation (Z)	Z1–Z8	0.821–0.885	0.738	0.859	0.949	0.950	Valid	Reliable

Discriminant Validity: All indicators have their highest *cross-loading* on their respective constructs, and each $\sqrt{AVE}$ value is greater than the inter-construct correlations.

Criteria: Loading Factor > 0.70; AVE > 0.50; Cronbach's Alpha > 0.70; Composite Reliability > 0.70.

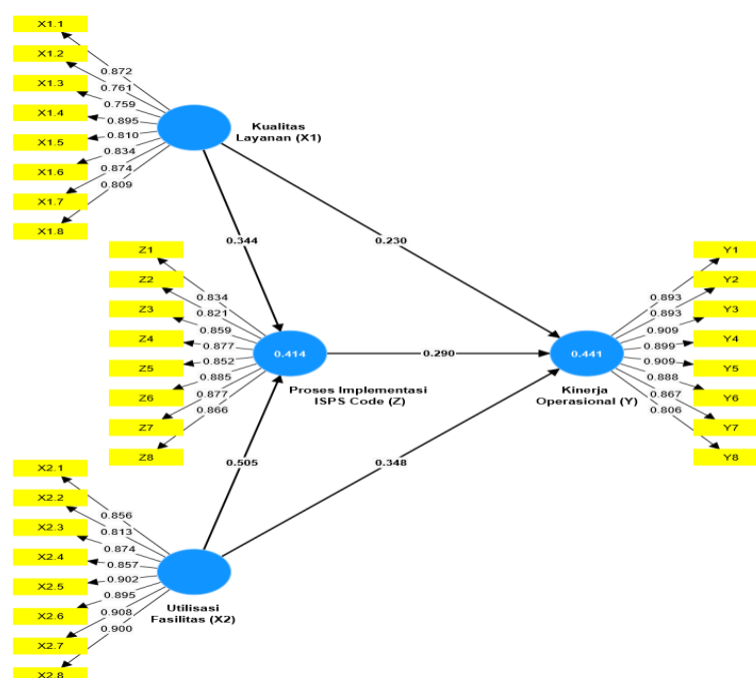


Figure 1 Structural Model of the Outer Model

The results presented in Table 1 and figure 1. demonstrate that all constructs satisfy the required criteria for the *measurement model*. The loading factors for all indicators range from 0.759 to 0.909, exceeding the recommended threshold of 0.70, while all AVE values range from 0.686 to 0.781 and are above the minimum criterion of 0.50. The *discriminant validity* test also confirms that each indicator has its highest loading on its respective construct and that the square root of AVE for each construct is greater than its correlations with other constructs. Furthermore, the *Cronbach's Alpha* values range from 0.934 to 0.960 and the *Composite Reliability* values range from 0.937 to 0.960, all exceeding 0.70. Therefore, the four constructs—service quality, facility utilization, operational performance, and ISPS Code implementation—demonstrate adequate validity and high internal consistency, indicating that the measurement model is appropriate for subsequent structural model analysis.

Inner Model

Table 2. R-Square Results

Endogenous Variable	R-Square	Adjusted R-Square	Interpretation
ISPS Code Implementation (Z)	0.414	0.407	Moderate
Operational Performance (Y)	0.441	0.431	Moderate

The results in Table 2 show that the R-square value for ISPS Code implementation is 0.414, meaning that service quality and facility utilization jointly explain 41.4% of the variance in ISPS Code implementation, while the remaining 58.6% is explained by other factors outside the model. Meanwhile, the R-square value for operational performance is 0.441, indicating that service quality, facility utilization, and ISPS Code implementation jointly explain 44.1% of the variance in operational performance, while the remaining 55.9% is explained by other variables not included in the model. Based on these values, the explanatory power of the structural model is classified as moderate.

Table 3. F-Square (f^2) Results

Structural Relationship	f^2	Effect Size
Service Quality (X1) → ISPS Code Implementation (Z)	0.200	Medium
Facility Utilization (X2) → ISPS Code Implementation (Z)	0.429	Large
Service Quality (X1) → Operational Performance (Y)	0.078	Small
Facility Utilization (X2) → Operational Performance (Y)	0.150	Medium
ISPS Code Implementation (Z) → Operational Performance (Y)	0.088	Small

Table 3 shows that the structural relationships have different effect sizes. Service quality has a medium effect on ISPS Code implementation with an f^2 value of 0.200, while facility utilization has a large effect with an f^2 value of 0.429. Service quality has a small effect on operational performance ($f^2 = 0.078$), whereas facility utilization has a medium effect ($f^2 = 0.150$). ISPS Code implementation has a small effect on operational performance ($f^2 = 0.088$). Thus, facility utilization provides the strongest substantive contribution, particularly to ISPS Code implementation.

Table 4. Goodness-of-Fit Results

Fit Index	Saturated Model	Estimated Model
SRMR	0.049	0.049
d ULS	1.283	1.283
d G	1.564	1.564
Chi-Square	1,430.460	1,430.460
NFI	0.790	0.790

The results in Table 4 indicate that the SRMR value for both the saturated and estimated models is 0.049, which is below the 0.05 threshold and indicates an acceptable

model fit. The d_ULS and d_G values are 1.283 and 1.564, respectively, while the Chi-square value is 1,430.460. The NFI value of 0.790 is below the commonly recommended value of 0.90, indicating that the model does not achieve an optimal level of fit according to this particular criterion. Nevertheless, the SRMR result indicates an acceptable level of residual fit, and the measurement model has demonstrated satisfactory validity and reliability. Therefore, the structural model remains sufficiently adequate for hypothesis testing, although further model refinement may be considered.

Table 5. Direct and Indirect Effect Hypothesis Testing

Hypothesis	Structural Relationship	Original Sample (O)	T-Statistics	P-Values	Decision
H1	Service Quality (X1) → ISPS Code Implementation (Z)	0.344	4.812	0.000	Supported
H2	Facility Utilization (X2) → ISPS Code Implementation (Z)	0.505	5.649	0.000	Supported
H3	Service Quality (X1) → Operational Performance (Y)	0.230	3.225	0.001	Supported
H4	Facility Utilization (X2) → Operational Performance (Y)	0.348	3.442	0.001	Supported
H5	ISPS Code Implementation (Z) → Operational Performance (Y)	0.290	2.753	0.006	Supported
H6	Service Quality (X1) → ISPS Code Implementation (Z) → Operational Performance (Y)	0.100	2.167	0.030	Supported
H7	Facility Utilization (X2) → ISPS Code Implementation (Z) → Operational Performance (Y)	0.146	2.881	0.004	Supported

The results in Table 5 demonstrate that all five direct-effect hypotheses are supported. Service quality has a positive and significant effect on ISPS Code implementation ($\beta = 0.344$; $t = 4.812$; $p < 0.001$), while facility utilization has a positive and significant effect on ISPS Code implementation ($\beta = 0.505$; $t = 5.649$; $p < 0.001$). Service quality also positively affects operational performance ($\beta = 0.230$; $t = 3.225$; $p = 0.001$), as does facility utilization ($\beta = 0.348$; $t = 3.442$; $p = 0.001$). Furthermore, ISPS Code implementation has a positive and significant effect on operational performance ($\beta = 0.290$; $t = 2.753$; $p = 0.006$). Because all t-statistic values exceed 1.973 and all p-values are below 0.05, H1–H5 are supported.

The mediation results in Table 5 indicate that ISPS Code implementation significantly mediates both relationships examined in the model. The indirect effect of service quality on operational performance through ISPS Code implementation is positive and significant ($\beta = 0.100$; $t = 2.167$; $p = 0.030$), supporting H6. Similarly, the indirect effect of facility utilization on operational performance through ISPS Code implementation is positive and significant ($\beta = 0.146$; $t = 2.881$; $p = 0.004$), supporting H7. These findings demonstrate that ISPS Code implementation functions as an important mediating mechanism through which service quality and facility utilization contribute to improved operational performance at JICT Tanjung Priok.

Discussion

The Effect of Service Quality on the ISPS Code Implementation Process

The results show that service quality has a positive and significant effect on the ISPS Code implementation process. This finding is evidenced by a path coefficient of 0.344, a t-statistic of 4.812, which exceeds the critical t-value of 1.973, and a p-value of 0.000, which is below 0.05. This result indicates that improvements in service quality contribute to more effective implementation of the ISPS Code at JICT Tanjung Priok. High-quality services reflect the port's ability to provide secure, reliable, responsive, and professional services to

port users, while simultaneously supporting compliance with established security procedures. Professional, timely, and procedurally consistent services indicate the readiness of human resources, operational systems, and interdepartmental coordination to support port security. In this context, service quality is not merely related to user satisfaction but also represents an operational mechanism that supports the consistent implementation of international maritime security standards. This finding is consistent with Sukhma (2022), who reported that although the ISPS Code had been implemented, its effectiveness was still constrained by crew negligence and security-service aspects. Bagasdianto and Basuki (2023) emphasized that ISPS Code implementation requires security-risk identification and adequate operational support, while Giri Seno and Rahayu (2024) found that supervision and personnel training are important factors in ISPS Code implementation at Tanjung Priok Port. Fadilah and Hadi (2024) further identified gaps in port security supervision and procedures that may affect the effectiveness of ISPS Code implementation, whereas Alfian and Puspitawati (2023) found that ISPS Code implementation can improve port security and operational efficiency. In addition, Iskam Febrizal found that service quality influences both ISPS Code implementation and port operational performance. Therefore, improving service quality can strengthen the effectiveness of ISPS Code implementation by ensuring that security procedures are integrated into daily port service and operational activities.

2. The Effect of Facility Utilization on the ISPS Code Implementation Process

The results demonstrate that facility utilization has a positive and significant effect on the ISPS Code implementation process, as indicated by a path coefficient of 0.505, a t-statistic of 5.649, which is greater than the critical t-value of 1.973, and a p-value of 0.000, which is below 0.05. This finding indicates that optimal utilization of port facilities contributes substantially to the effective implementation of the ISPS Code. The implementation of international port security standards does not depend solely on regulations and procedures but also requires security facilities that are available, functional, and properly utilized. Facilities such as CCTV, access-control systems, X-ray scanners, metal detectors, perimeter fences, security posts, communication systems, patrol facilities, and inspection areas for vehicles and cargo support the identification of threats, control of restricted areas, access management, and incident response. The magnitude of the coefficient also indicates that facility utilization represents an important practical factor in strengthening ISPS Code implementation at JICT Tanjung Priok. This finding is consistent with Wira and Arif (2024), who stated that ISPS Code implementation requires adequate security facilities to support port security and capacity. Bagasdianto and Basuki (2023) emphasized the importance of supporting facilities in conducting security-risk assessments, while Ma'ruf Efendi et al. (2024) found that limitations in port facilities were among the factors contributing to suboptimal implementation of port security standards. Therefore, the findings suggest that port management should focus not only on adding new infrastructure but also on ensuring that existing security facilities are utilized effectively, continuously maintained, and integrated into operational security procedures. Optimal facility utilization can consequently strengthen the implementation of the ISPS Code and improve the overall effectiveness of port security management.

3. The Effect of Service Quality on Operational Performance

The results indicate that service quality has a positive and significant effect on operational performance, with a path coefficient of 0.230, a t-statistic of 3.225, which exceeds the critical t-value of 1.973, and a p-value of 0.001, which is below 0.05. This finding demonstrates that improvements in service quality contribute directly to better operational performance at JICT Tanjung Priok. High-quality services facilitate faster, more accurate, responsive, and efficient operational processes, thereby reducing potential delays and supporting the continuity of port activities. In the context of port operations, service quality is closely associated with the effectiveness of cargo handling, documentation, communication,

coordination, and the provision of services to port users. Professional service also reflects the readiness of human resources and operational systems to respond to users' requirements while maintaining service reliability. These findings are supported by Rumata, Idrus, and Amansah (2024), who stated that inadequate facilities and service quality contribute to low levels of port-user satisfaction. Wahyuni and Kurniawan (2023) explained that increasing cargo and passenger volumes require improvements in the quality of port operational services. Jusman, Ashury, and Palippui (2021) found that customer satisfaction and internal processes influence port operational performance, while Syayuti et al. (2023) reported that workforce quality and facilities affect terminal productivity and operational performance. Erlangga et al. (2024) similarly found that port-user satisfaction remained relatively low because facilities and services were not yet optimal. In addition, Iskam Febrizal found that service quality has a positive effect on operational performance through ISPS Code implementation. Thus, improving service quality should be regarded as a strategic operational priority because it can enhance service efficiency, user satisfaction, and the continuity of port activities.

4. The Effect of Facility Utilization on Operational Performance

The results show that facility utilization has a positive and significant effect on operational performance, as reflected by a path coefficient of 0.348, a t-statistic of 3.442, which is higher than the critical t-value of 1.973, and a p-value of 0.001, which is below 0.05. This finding indicates that more effective utilization of port facilities contributes to improved operational performance at JICT Tanjung Priok. Adequate and optimally utilized facilities support the smooth execution of cargo handling, storage, distribution, and other port activities. Facilities such as berths, cargo-handling equipment, container yards, and supporting operational systems play an important role in reducing waiting time, increasing productivity, and minimizing operational disruptions. Therefore, the availability of facilities alone is insufficient; their utilization, reliability, and alignment with operational requirements are equally important. This finding is supported by Mentari, Widyawati, and Agustin (2023), who stated that limitations in port facilities can hinder operational activities. Mansur (2023) also found that facilities that are not optimally utilized can reduce operational effectiveness. Raekhan, Djakfar, and Pujiraharjo (2020) explained that operational delays may be associated with equipment failures and logistics inefficiencies, while Aryanti et al. (2021) found that low cargo-handling productivity is influenced by equipment limitations and port-facility capacity. Ashury (2024) further demonstrated that operational facilities, particularly cargo-handling equipment, directly influence the effectiveness of port operating time. In addition, Iskam Febrizal found that facility utilization significantly affects port operational performance. Consequently, JICT management needs to ensure that operational facilities are not only available but also utilized according to their capacity and operational requirements to improve productivity, efficiency, and overall port performance.

5. The Effect of the ISPS Code Implementation Process on Operational Performance

The findings demonstrate that the ISPS Code implementation process has a positive and significant effect on operational performance, with a path coefficient of 0.290, a t-statistic of 2.753, which exceeds the critical t-value of 1.973, and a p-value of 0.006, which is below 0.05. This result indicates that effective implementation of the ISPS Code contributes to improved operational performance by creating a safer, more orderly, and better-controlled port operating environment. The ISPS Code provides a framework for controlling access, identifying and mitigating security threats, strengthening surveillance, and establishing security procedures that support continuity of port operations. Effective security management can reduce the likelihood of disruptions caused by unauthorized access, security incidents, and operational risks, thereby supporting the reliability and efficiency of port activities. These findings are consistent with Sukhma (2022), who found that ISPS Code implementation requires improvements in crew discipline and security supervision. Bagasdianto and Basuki (2023) emphasized that ISPS Code implementation based on security risk assessment

strengthens port security-risk control, while Fadilah and Hadi (2024) highlighted the importance of strengthening supervision and security procedures to improve ISPS Code effectiveness. Alfian and Puspitawati (2023) found that ISPS Code implementation can improve port security and operational efficiency, while Wira and Arif (2024) reported that ISPS Code implementation can increase port capacity and reduce operational security risks. In addition, Iskam Febrizal found that ISPS Code implementation significantly contributes to improved port operational performance. Therefore, consistent implementation of the ISPS Code should be viewed not only as a regulatory obligation but also as an operational strategy for maintaining security, continuity, efficiency, and sustainable port performance.

6. The Indirect Effect of Service Quality on Operational Performance through the ISPS Code Implementation Process

The results show that service quality has a positive and significant indirect effect on operational performance through the ISPS Code implementation process. This is demonstrated by an indirect path coefficient of 0.100, a t-statistic of 2.167, which exceeds the critical t-value of 1.973, and a p-value of 0.030, which is below 0.05. This finding indicates that service quality contributes to operational performance not only directly but also indirectly by strengthening the implementation of the ISPS Code. High-quality services can improve the consistency of security supervision, access control, communication, coordination, and compliance with operational security procedures, which subsequently creates a safer and more efficient operating environment. The significant mediation effect demonstrates that the ISPS Code implementation process functions as an important mechanism linking service quality with operational performance. This finding is supported by Alfian and Puspitawati (2023), who found that ISPS Code implementation improves port security and operational efficiency. Sukhma (2022) emphasized that the effectiveness of ISPS Code implementation is associated with service quality and operational readiness, while Giri Seno and Rahayu (2024) identified service coordination and security supervision as important factors in ISPS Code implementation. Fadilah and Hadi (2024) also stated that improving security-service quality can strengthen ISPS Code implementation, while Jusman et al. (2021) demonstrated that operational service quality influences the effectiveness of internal port processes. In addition, Iskam Febrizal found that ISPS Code implementation mediates the effect of service quality on operational performance. Because the direct effect of service quality on operational performance is also significant, the findings indicate that ISPS Code implementation provides an additional pathway through which service quality contributes to operational performance.

7. The Indirect Effect of Facility Utilization on Operational Performance through the ISPS Code Implementation Process

The results indicate that facility utilization has a positive and significant indirect effect on operational performance through the ISPS Code implementation process. This is evidenced by an indirect path coefficient of 0.146, a t-statistic of 2.881, which is greater than the critical t-value of 1.973, and a p-value of 0.004, which is below 0.05. The finding indicates that optimal utilization of port facilities contributes to improved operational performance partly through more effective implementation of the ISPS Code. Security and operational facilities that are available and properly utilized support surveillance, inspection, access control, threat identification, and security incident management, which subsequently contribute to safer and more efficient port operations. This relationship demonstrates that facility utilization has a broader operational contribution because its benefits extend beyond direct support for cargo-handling and other operational activities to the strengthening of port security systems. The finding is consistent with Wira and Arif (2024), who stated that ISPS Code implementation requires adequate facilities to improve port capacity and security. Bagasdianto and Basuki (2023) emphasized that ISPS Code implementation requires security facilities that support port-risk control, while Ma'ruf Efendi et al. (2024) found that gaps in basic facilities can affect port operational effectiveness. Triyono et al. (2024) reported that infrastructure and

facility inadequacies can reduce terminal performance, while Ashury (2024) found that operational facilities influence the effectiveness of port operating time. In addition, Iskam Febrizal found that ISPS Code implementation mediates the effect of facility utilization on operational performance. Since facility utilization also has a significant direct effect on operational performance, the findings suggest that the ISPS Code implementation process provides an additional pathway through which effective facility utilization contributes to improved operational performance.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

This study concludes that service quality and facility utilization are important determinants of the ISPS Code implementation process and operational performance at Jakarta International Container Terminal (JICT), Tanjung Priok. The findings demonstrate that improvements in service quality and facility utilization strengthen the implementation of the ISPS Code, while service quality, facility utilization, and ISPS Code implementation each contribute positively to operational performance. Furthermore, the ISPS Code implementation process serves as a significant mediating mechanism through which service quality and facility utilization contribute to operational performance. These findings indicate that port security and operational effectiveness should not be managed as separate functions; rather, service delivery, facility utilization, security compliance, and operational processes need to be integrated within a single management framework. The principal contribution of this study to port management and industrial engineering is the development of an integrated perspective in which the effectiveness of security-standard implementation becomes an operational mechanism connecting service and facility management with port performance. From a practical and scientific perspective, the findings reinforce the importance of integrating service quality improvement, optimal facility utilization, and systematic implementation of the ISPS Code to create safer, more efficient, reliable, and sustainable port operations.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the research was conducted specifically at JICT Tanjung Priok and involved port-service-user companies within the defined study population and observation period; therefore, the findings cannot automatically be generalized to other ports, regions, or transportation sectors with different operational and institutional characteristics. Second, the research model included service quality, facility utilization, ISPS Code implementation, and operational performance, while other potentially relevant factors, such as human-resource competence, safety culture, technology adoption, organizational governance, security risk management, and regulatory factors, were not examined. Third, the study employed a cross-sectional quantitative approach, meaning that the relationships identified represent conditions during the period of data collection and do not fully capture changes in port operations, security practices, infrastructure utilization, or service quality over a longer period. Finally, the use of questionnaire-based perceptions may introduce respondent-specific subjectivity. Accordingly, the findings should be interpreted within the specific organizational, operational, and temporal context of JICT Tanjung Priok.

Recommendations

Future research should broaden the scope by examining multiple container terminals or ports across different regions and increasing the sample size to improve the generalizability of the findings. A longer observation period and longitudinal research design are also recommended to identify changes in service quality, facility utilization, ISPS Code implementation, and operational performance over time. In addition, future studies should

incorporate other relevant variables, such as human-resource competence, safety culture, digitalization, security risk management, technology readiness, organizational governance, and regulatory compliance, to develop a more comprehensive model of port operational performance. Methodologically, future researchers may employ advanced analytical approaches such as Structural Equation Modeling (SEM), System Dynamics, Artificial Intelligence, or longitudinal modeling to examine more complex relationships, dynamic interactions, and predictive patterns. For JICT and other port operators, the findings recommend an integrated management strategy that simultaneously improves service accessibility, optimizes operational and security-facility utilization, strengthens access control and security supervision, and integrates ISPS Code compliance into daily operational management. Such an approach can support continuous improvement in port security, efficiency, productivity, service reliability, and sustainable operational performance.

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