

DOI: <https://doi.org/10.38035/dijemss.v8i1><https://creativecommons.org/licenses/by/4.0/>

Received: 28 April 2026 | Revised: 27 September 2026 | Accepted: 02 October 2026

The Effect of Ship Performance and Green Shipping Campaigns on Charterer Satisfaction Mediated by the Quality of Existing Fleet (PT Pertamina International Shipping)

Teguh Budiaji¹, Marihot Simanjuntak², April Gunawan Malau³, Arika Palapa⁴

¹Sekolah Tinggi Ilmu Pelayaran, Jakarta, Indonesia, pt.saatgl@gmail.com

²Sekolah Tinggi Ilmu Pelayaran, Jakarta, Indonesia, marts1528@gmail.com

³Sekolah Tinggi Ilmu Pelayaran, Jakarta, Indonesia, aprilgunawan22@gmail.com

⁴Sekolah Tinggi Ilmu Pelayaran, Jakarta, Indonesia, arikapalapa67@gmail.com

Corresponding Author: pt.saatgl@gmail.com¹

Abstract: This study aims to analyze the influence of vessel performance and Green shipping campaigns on the quality of the existing fleet and their implications for the satisfaction of charterers of vessels owned by PT Pertamina International Shipping. The research adopts a quantitative approach using a survey method with a cross-sectional design. The study population consists of all charterers of PT Pertamina International Shipping in 2024, totaling 33 companies, and the sample size of 117 respondents was determined using the Taro Yamane (Slovin) formula. Data were collected through questionnaires measured on a Likert scale and analyzed using the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method. The findings are expected to demonstrate that vessel performance and Green shipping campaigns have a positive effect on the quality of the existing fleet. Furthermore, the quality of the existing fleet is expected to have a positive influence on charterer satisfaction and to function as a mediating variable in the relationship between vessel performance, Green shipping campaigns, and the satisfaction of charterers of PT Pertamina International Shipping.

Keywords: Ship Performance, Green Shipping Campaign, Existing Fleet Quality, Charterer Satisfaction.

INTRODUCTION

Transportation plays a strategic role in supporting economic development and societal welfare by improving accessibility, regional connectivity, and the efficient movement of goods and people. An efficient transportation system contributes to productivity, economic efficiency, and balanced regional development. In the global context, transportation is therefore not merely a means of mobility but also an important component of sustainable economic development (Nur et al., 2021). Among various modes, maritime transportation remains fundamental to international trade because of its ability to transport large volumes of cargo over long distances at relatively competitive costs. Approximately 80% of global trade

is transported by sea, positioning maritime transport as a critical component of global supply chains (Asariotis et al., 2021). The expansion of global trade consequently increases the demand for shipping services that are reliable, efficient, safe, and environmentally sustainable.

PT Pertamina International Shipping (PIS), as part of the Pertamina Group, has an important role in supporting national and international energy distribution through its fleet operations. The increasing competitiveness of the shipping industry requires the company to maintain operational performance while simultaneously responding to environmental regulations and growing expectations for sustainable shipping. In this context, ship performance, fleet quality, and green shipping practices become strategically interconnected. Ship performance reflects the operational capability of vessels through indicators such as availability, utilization, fuel efficiency, and schedule reliability, while fleet quality reflects technical readiness, regulatory compliance, technological capability, and the ability of vessels to support sustainable operations.

These operational dimensions are also closely related to charterer satisfaction, which represents an important indicator of the effectiveness of shipping services and the sustainability of business relationships. Charterers generally expect vessels to provide reliable operations, adequate safety, predictable schedules, and compliance with applicable environmental standards. Although PT PIS has demonstrated relatively high fleet availability and continued efforts to improve operational efficiency, challenges remain in areas such as technological readiness, fuel efficiency, safety management, and the extent to which green shipping initiatives are recognized by charterers. Consequently, improvements in operational indicators do not necessarily translate directly into higher customer satisfaction unless they are reflected in the quality and perceived value of the fleet.

Environmental sustainability has further intensified these challenges. Maritime transportation remains dependent on fossil fuels and contributes significantly to global greenhouse gas emissions (Reusser & Pérez Osses, 2021). In response, the International Maritime Organization (IMO) has strengthened environmental requirements through MARPOL Annex VI and its long-term strategy toward net-zero greenhouse gas emissions from international shipping by or around 2050. Technological developments, including alternative fuels, energy-efficiency technologies, digital systems, and battery-electric propulsion, have consequently become increasingly relevant to the transition toward green shipping (Mallouppas & Yfantis, 2021; Bei et al., 2024; Devarapali et al., 2024). For shipping companies, however, the transition involves not only technological and financial considerations but also the ability to demonstrate tangible operational and service value to customers.

Previous studies have examined several aspects of this transition, but the relationships among ship performance, green shipping campaigns, fleet quality, and charterer satisfaction remain insufficiently integrated. Jia et al. (2024), for example, primarily examine the financial dimensions of green shipping, whereas Yu et al. (2024) focus on digitalization without explicitly connecting these developments to charterer satisfaction. Other studies, including Kumar (2022), Dwiputra et al. (2024), and Matagiwa et al. (2025), discuss aspects of shipping performance, sustainability, or operational management but do not comprehensively establish an integrated model connecting operational performance and green shipping initiatives with fleet quality and customer satisfaction. This indicates a research gap concerning how operational and environmental improvements are translated into perceived fleet quality and, ultimately, charterer satisfaction.

The novelty of this study lies in developing an integrated operational sustainability–service satisfaction model that simultaneously examines the relationships between ship performance and green shipping campaigns, existing fleet quality, and charterer satisfaction. Rather than treating operational performance, environmental sustainability, fleet condition,

and customer satisfaction as separate dimensions, this study positions existing fleet quality as a central mechanism through which ship performance and green shipping campaigns may influence charterer satisfaction. This approach extends the discussion of sustainable shipping from a predominantly technical or environmental perspective toward a service-oriented perspective, in which operational and environmental improvements are evaluated according to their implications for the quality of the fleet and the experience of charterers.

Theoretically, this study contributes to the maritime transportation and service management literature by connecting operational performance and environmental sustainability with perceived service value through fleet quality. The proposed framework provides an empirical explanation of how improvements in vessel performance and green shipping practices can be translated into customer-oriented outcomes. Practically, the findings are expected to provide PT Pertamina International Shipping with an evidence-based framework for identifying whether improvements in vessel performance and green shipping initiatives are sufficiently reflected in fleet quality and recognized by charterers. Thus, the study does not only address the efficiency and sustainability of fleet operations but also links these strategic dimensions to the continuity of business relationships and charterer satisfaction. Accordingly, this study aims to analyze the effects of ship performance and green shipping campaigns on existing fleet quality and their implications for charterer satisfaction at PT Pertamina International Shipping.

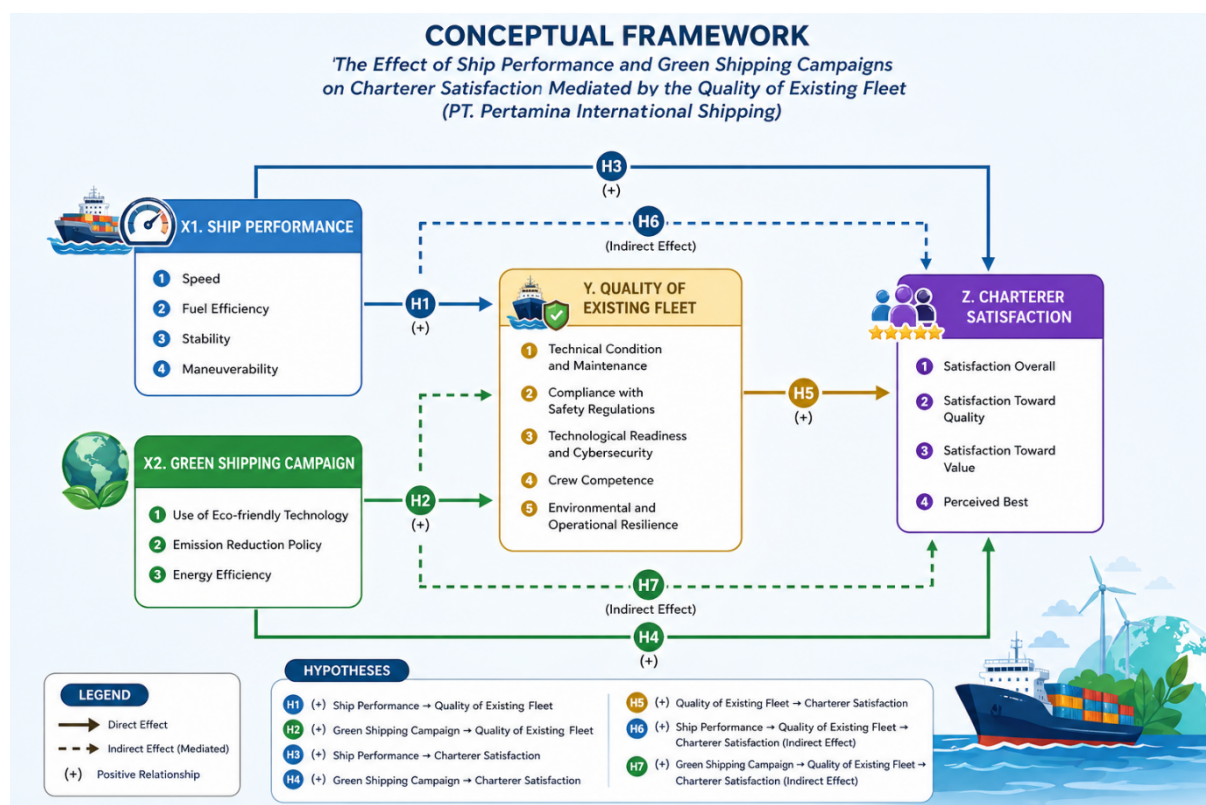


Figure 1. Conceptual Framework

METHOD

This study employs a quantitative research design using a survey approach to examine the relationships among ship performance, green shipping campaigns, existing fleet quality, and charterer satisfaction. A cross-sectional design is applied, where all variables are measured simultaneously at a single point in time. Quantitative methods are appropriate for testing hypothesized relationships systematically and empirically, while the survey approach

enables the collection of standardized responses from respondents (Sugiyono, 2024; Sekaran & Bougie, 2020). Data are collected using structured questionnaires with a Likert scale, which is widely used to measure perceptions, attitudes, and behavioral responses in social research (Likert, 1932). This approach supports consistency and objectivity in measuring respondents' evaluations of maritime service performance.

The population of this study consists of charterer companies of PT Pertamina International Shipping in 2024, totaling 33 companies from various global and domestic energy and logistics sectors. Each company is represented by five respondents, resulting in a total population of 165 respondents. The sample size of 117 respondents is determined using the Taro Yamane formula with a 5% margin of error, ensuring an adequate number of observations for empirical analysis (Ridwan & Kuncoro, 2018). The sampling procedure combines purposive sampling based on criteria relevant to the research objectives with simple random sampling among eligible respondents to reduce selection bias and improve representativeness (Sugiyono, 2019; Sekaran & Bougie, 2020). Data are collected through field research using questionnaires and observation and are supported by library research to strengthen the theoretical and empirical foundation of the study.

Data analysis is conducted using Structural Equation Modeling–Partial Least Squares (PLS-SEM) with SmartPLS software. PLS-SEM is selected because the proposed research model simultaneously examines multiple relationships and includes a mediating variable, namely existing fleet quality. In addition, PLS-SEM is appropriate when the primary objective is prediction and explanation of variance in endogenous constructs and when the research model is relatively complex (Hair et al., 2010; Ghozali, 2016). Compared with covariance-based SEM (CB-SEM), which generally emphasizes model fit and theory confirmation, PLS-SEM places greater emphasis on maximizing the explained variance of endogenous constructs and assessing predictive relationships. Therefore, PLS-SEM is considered appropriate for examining the proposed integrated relationship between operational performance, green shipping campaigns, fleet quality, and charterer satisfaction.

The measurement model (outer model) is evaluated through convergent validity, discriminant validity, and reliability. The assessment includes outer loading, Average Variance Extracted (AVE), Cronbach's alpha, and composite reliability (Hermawan & Amirullah, 2016; Ghozali, 2016). The structural model (inner model) is assessed using R-square, Q-square predictive relevance, effect size (f^2), and variance inflation factor (VIF) to evaluate explanatory power, predictive relevance, effect magnitude, and potential multicollinearity. Hypothesis testing is conducted using bootstrapping to obtain t-statistics and p-values for assessing direct and indirect effects, including the mediating role of existing fleet quality.

Because the data are obtained from a single survey at one point in time, the cross-sectional design limits the extent to which temporal precedence and definitive causal relationships can be established. Accordingly, the relationships identified through PLS-SEM should be interpreted as empirical associations consistent with the proposed theoretical model rather than definitive proof of causality. To reduce the potential for common method bias arising from the use of a single questionnaire as the primary data source, the questionnaire items are clearly defined, respondents are assured that their individual responses are confidential, and the measurement of the constructs is structured to minimize ambiguity and evaluation apprehension. In addition, common method bias is assessed statistically using collinearity diagnostics through the full collinearity VIF approach, where excessively high VIF values may indicate potential common method variance. These procedural and statistical measures are incorporated to strengthen the validity and methodological rigor of the survey-based findings.

This analytical framework provides a systematic basis for evaluating the proposed relationships while recognizing the methodological limitations associated with cross-sectional survey data. The combination of measurement-model assessment, structural-model evaluation, mediation analysis, and common method bias assessment is intended to provide a rigorous examination of the proposed operational sustainability–service satisfaction model.

RESULTS AND DISCUSSION

Results

This study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine both measurement and structural models. The analysis consists of evaluating the measurement model (outer model) and the structural model (inner model), followed by hypothesis testing using bootstrapping procedures.

Measurement Model (Outer Model)

The measurement model evaluation aims to ensure that all constructs meet the criteria of validity and reliability. The assessment includes convergent validity, discriminant validity, and internal consistency reliability.

a. Convergent Validity (Outer Loadings and AVE)

The results indicate that all indicator loadings exceed the recommended threshold of 0.70, with the lowest value at **0.833** and the highest at **0.950**, confirming that all indicators are valid. Additionally, all constructs exhibit AVE values above 0.50, indicating adequate convergent validity.

These results demonstrate that each construct explains more than 50% of the variance of its indicators, confirming strong construct representation and measurement accuracy.

Table 1. Construct Reliability and Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE	Interpretation
Ship Performance (X1)	0.951	0.952	0.653	Highly Reliable
Green Shipping Campaign (X2)	0.950	0.952	0.717	Highly Reliable
Existing Fleet Quality (Y)	0.963	0.964	0.660	Highly Reliable
Charterer Satisfaction (Z)	0.951	0.952	0.651	Highly Reliable

All constructs demonstrate excellent internal consistency, indicating that the measurement instrument is stable, robust, and suitable for empirical analysis in maritime industry research.

b. Discriminant Validity (HTMT)

Discriminant validity was assessed using the HTMT ratio, with all values below the threshold of 0.90.

Table 2. Heterotrait–Monotrait Ratio (HTMT)

Construct	X2	Z	Y	X1
Green Shipping (X2)	-			
Charterer Satisfaction (Z)	0.862	-		
Fleet Quality (Y)	0.804	0.864	-	
Ship Performance (X1)	0.807	0.865	0.838	-

All HTMT values fall within acceptable limits, confirming that each construct captures a distinct concept. This indicates strong discriminant validity and eliminates concerns of conceptual overlap.

c. Reliability Analysis

All Cronbach's Alpha and Composite Reliability values exceed 0.70, confirming high internal consistency. The high reliability values (above 0.95) suggest that the constructs are not only consistent but also exhibit strong measurement precision, which is essential for high-quality empirical modeling.

Structural Model (Inner Model)

The structural model was evaluated through multicollinearity testing, effect size, predictive relevance, coefficient of determination, and hypothesis testing. These assessments were conducted to determine the extent to which the proposed structural relationships were statistically supported and substantively meaningful.

- a. Multicollinearity (VIF)
- b.

Table 3. Variance Inflation Factor (VIF)

Relationship	VIF	Criterion	Result
X1 → Z	4.050	< 5	No multicollinearity
X1 → Y	3.916	< 5	No multicollinearity
X2 → Z	4.681	< 5	No multicollinearity
X2 → Y	3.916	< 5	No multicollinearity
Y → Z	4.106	< 5	No multicollinearity

All VIF values are below the commonly applied threshold of 5, indicating that multicollinearity does not reach a critical level in the structural model. However, several values are relatively close to the threshold, particularly X2 → Z (VIF = 4.681). Therefore, although there is no evidence of problematic multicollinearity based on the selected criterion, the relatively high VIF values suggest that some predictors may share substantial variance. This condition should be considered when interpreting the individual path coefficients.

- b. Effect Size (f^2)

Table 4. Effect Size (f^2)

Relationship	f^2	Effect Size
X1 → Z	0.195	Medium
X1 → Y	0.545	Large
X2 → Z	0.344	Medium
X2 → Y	0.195	Medium
Y → Z	0.240	Medium

The f^2 results provide additional information beyond statistical significance by indicating the substantive contribution of each predictor to the endogenous constructs. The largest effect is found for ship performance on fleet quality (X1 → Y), with $f^2 = 0.545$, indicating a large effect. This suggests that ship performance makes a substantial contribution to explaining fleet quality within the research context. The effects of green shipping campaigns on fleet quality ($f^2 = 0.195$), ship performance on charterer satisfaction ($f^2 = 0.195$), and fleet quality on charterer satisfaction ($f^2 = 0.240$) are classified as medium effects. Meanwhile, the effect of green shipping campaigns on charterer satisfaction ($f^2 = 0.344$) approaches the large-effect threshold. These findings indicate that statistical significance is accompanied by meaningful explanatory contributions, although the magnitude of the relationships varies across the structural paths. Therefore, the interpretation should not rely solely on p-values but should also consider the practical magnitude of each relationship.

- c. Goodness of Fit (GoF)

The calculated GoF value is:

$$\text{GoF} = 0.767$$

The GoF value exceeds the commonly referenced threshold of 0.36. However, this value should be interpreted cautiously. In contemporary PLS-SEM practice, GoF is not generally regarded as a primary criterion for establishing the adequacy of a PLS-SEM model. Therefore, the GoF value of 0.767 should not by itself be interpreted as definitive evidence of an "excellent" model fit. Instead, model evaluation should place greater emphasis on the quality of the measurement model, explanatory power (R^2), predictive relevance (Q^2), effect sizes (f^2), collinearity, and the significance and magnitude of the structural paths.

d. Predictive Relevance (Q^2)

Table 5. Predictive Relevance (Q^2)

Construct	Q^2
Charterer Satisfaction (Z)	0.592
Fleet Quality (Y)	0.546

Both Q^2 values are greater than zero, indicating that the model demonstrates predictive relevance for the endogenous constructs. The values suggest that the model has meaningful predictive capability for fleet quality and charterer satisfaction. Nevertheless, these values should be interpreted as evidence of predictive relevance rather than as proof that the model will perform equally well in other populations or organizational settings.

e. Coefficient of Determination (R^2)

Table 6. R-Square Values

Construct	R^2	Interpretation
Fleet Quality (Y)	0.836	Strong explanatory power
Charterer Satisfaction (Z)	0.921	Very high explanatory power

The R^2 value for fleet quality is 0.836, indicating that 83.6% of the variance in fleet quality is explained by ship performance and green shipping campaigns within the model. This represents substantial explanatory power in the context of this study.

The R^2 value for charterer satisfaction is 0.921, indicating that the predictors included in the structural model explain approximately 92.1% of the variance in charterer satisfaction. Although this represents very high explanatory power, the value should not be interpreted as evidence that the model completely explains charterer satisfaction. The exceptionally high R^2 may partly reflect the specific characteristics of the research setting, the relatively homogeneous respondent population, the conceptual proximity among the constructs, or shared variance resulting from the use of a common survey instrument.

Therefore, the $R^2 = 0.921$ should be interpreted as a sample- and context-specific result, rather than automatically generalized to other shipping companies, charterer populations, or periods. The possibility of model overfitting should also be considered, particularly because the model is estimated from a relatively limited population of respondents and uses multiple closely related constructs. The Q^2 results provide evidence of predictive relevance, but they do not by themselves eliminate the possibility that the model's explanatory performance may decline when tested on an independent sample.

Hypothesis Testing (Bootstrapping Results)

Hypothesis testing was conducted using bootstrapping at a 5% significance level. In interpreting the results, both statistical significance and effect magnitude are considered to provide a more balanced assessment of the proposed relationships.

Table 7. Direct and Indirect Effects

Hypothesis	Relationship	β	T-Statistic	P-Value	Result
H1	$X1 \rightarrow Y$	0.591	5.125	0.000	Supported
H2	$X2 \rightarrow Y$	0.354	2.819	0.005	Supported
H3	$X1 \rightarrow Z$	0.306	2.787	0.005	Supported
H4	$X2 \rightarrow Z$	0.357	3.023	0.003	Supported
H5	$Y \rightarrow Z$	0.340	2.979	0.003	Supported
H6	$X1 \rightarrow Y \rightarrow Z$	0.120	1.648	0.050	Supported
H7	$X2 \rightarrow Y \rightarrow Z$	0.201	2.566	0.010	Supported

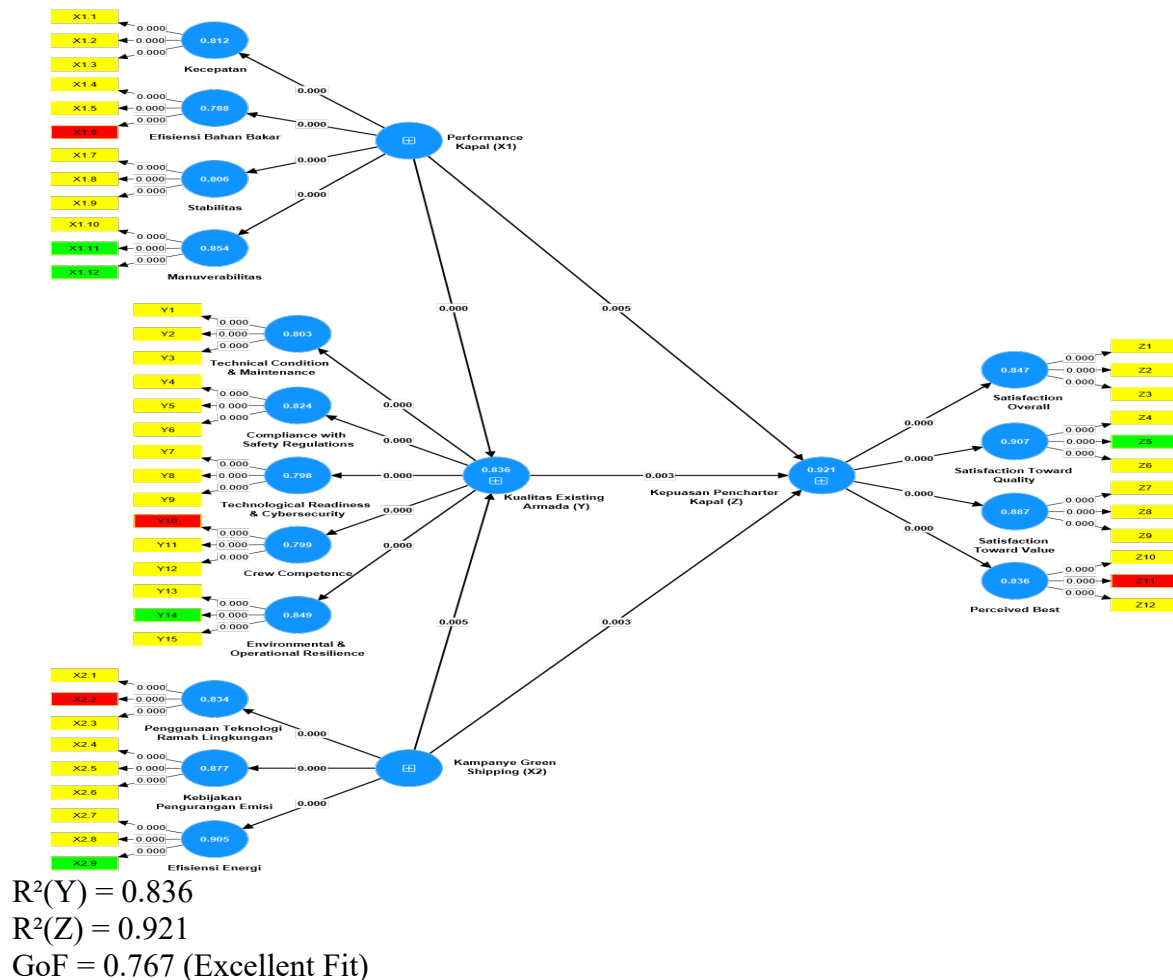


Figure 2. Result Bootstrapping

The results indicate statistically significant direct relationships for H1–H5. Ship performance has a positive effect on fleet quality ($\beta = 0.591$; $t = 5.125$; $p < 0.001$), representing the strongest direct relationship in the model. This finding is consistent with the f^2 result of 0.545, which indicates a large substantive effect. Thus, ship performance appears to make a substantial contribution to variations in fleet quality within the observed research context.

Green shipping campaigns also have a significant positive effect on fleet quality ($\beta = 0.354$; $t = 2.819$; $p = 0.005$). The corresponding f^2 value of 0.195 indicates a medium effect. This suggests that environmental initiatives are associated with improvements in perceived fleet quality, although their contribution is smaller than that of ship performance. The finding indicates that sustainability initiatives may have operational implications when they are

translated into improvements in vessel capability, technology, compliance, and operational practices.

Ship performance has a significant positive direct effect on charterer satisfaction ($\beta = 0.306$; $t = 2.787$; $p = 0.005$), while green shipping campaigns also have a significant positive direct effect on charterer satisfaction ($\beta = 0.357$; $t = 3.023$; $p = 0.003$). These results indicate that charterer satisfaction is associated not only with traditional operational performance but also with environmental and sustainability-oriented practices. However, the interpretation should consider the corresponding effect sizes rather than concluding that statistical significance alone represents a strong managerial impact.

Fleet quality also has a significant positive effect on charterer satisfaction ($\beta = 0.340$; $t = 2.979$; $p = 0.003$), with an f^2 value of 0.240 indicating a medium effect. This result supports the conceptual argument that the condition, readiness, technological capability, and regulatory compliance of the fleet are relevant to charterers' perceptions of service value.

The mediation results require more careful interpretation, particularly for H6. The indirect effect of ship performance on charterer satisfaction through fleet quality is $\beta = 0.120$, $t = 1.648$, and $p = 0.050$. Because the p-value is exactly at the conventional 5% boundary, this relationship should not be characterized as strongly supported. Instead, H6 provides borderline or weak statistical evidence of an indirect relationship.

The H6 result indicates that ship performance may contribute to charterer satisfaction partly through fleet quality, but the evidence is less robust than that observed for the other hypotheses. This finding may indicate that improvements in ship performance do not automatically translate into higher charterer satisfaction through fleet quality. Other factors not included in the model, such as service responsiveness, communication, commercial terms, schedule reliability, safety experience, contractual conditions, or individual charterer expectations, may also influence this relationship.

In contrast, the indirect effect of green shipping campaigns on charterer satisfaction through fleet quality is statistically significant ($\beta = 0.201$; $t = 2.566$; $p = 0.010$). This provides stronger evidence that fleet quality functions as a mediating mechanism between green shipping campaigns and charterer satisfaction. Nevertheless, the mediation result should be interpreted in conjunction with the direct effect rather than viewed as evidence that fleet quality is the only mechanism connecting sustainability initiatives to customer satisfaction.

Discussion

The Effect of Ship Performance and Green Shipping Campaigns on Existing Fleet Quality

The findings demonstrate that both ship performance and green shipping campaigns have positive and significant effects on existing fleet quality. Ship performance has the stronger relationship ($\beta = 0.591$; $T = 5.125$; $p < 0.001$), with a large effect size ($f^2 = 0.545$), whereas green shipping campaigns also have a significant relationship with fleet quality ($\beta = 0.354$; $T = 2.819$; $p = 0.005$), with a medium effect size ($f^2 = 0.195$). These results indicate that fleet quality is shaped by the interaction between conventional operational capability and sustainability-oriented practices. Operational reliability, technical capability, safety, and maintenance remain fundamental to fleet quality, while green technologies, energy efficiency, and emission-reduction practices provide an additional dimension of fleet improvement. These findings are broadly consistent with previous studies emphasizing the importance of operational performance and sustainability in maritime fleet management (Kumar, 2022; Yu et al., 2024; Felício et al., 2021; Pang et al., 2021; Matagiwa et al., 2025; Utomo et al., 2024).

The Effects of Ship Performance, Green Shipping Campaigns, and Fleet Quality on Charterer Satisfaction

The results further show that ship performance, green shipping campaigns, and existing fleet quality each have positive and significant relationships with charterer satisfaction. Ship performance has a significant effect ($\beta = 0.306$; $T = 2.787$; $p = 0.005$), while green shipping campaigns demonstrate a somewhat larger coefficient ($\beta = 0.357$; $T = 3.023$; $p = 0.003$). Existing fleet quality also significantly contributes to charterer satisfaction ($\beta = 0.340$; $T = 2.979$; $p = 0.003$), with a medium effect size ($f^2 = 0.240$). Collectively, these findings suggest that charterer satisfaction is not determined solely by traditional operational performance. Rather, charterers' evaluations also reflect the quality of the fleet and the extent to which shipping operations incorporate environmental sustainability. This interpretation is consistent with previous research linking maritime service performance, green logistics, operational reliability, and customer satisfaction (Timple & Shanmughapriya, 2025; Mulyadi et al., 2025; Dwiputra et al., 2024; Tjendana & Pranitasari, 2024; Christian et al., 2023; Djuliyanto et al., 2024).

The Mediating Role of Existing Fleet Quality

The mediation analysis provides an important additional insight into the mechanism connecting operational and sustainability factors with charterer satisfaction. Green shipping campaigns have a significant indirect effect on charterer satisfaction through existing fleet quality ($\beta = 0.201$; $T = 2.566$; $p = 0.010$), indicating that sustainability initiatives can generate customer value when they are translated into tangible improvements in fleet capability, technology, efficiency, and environmental performance.

The indirect effect of ship performance through fleet quality, however, should be interpreted more cautiously ($\beta = 0.120$; $T = 1.648$; $p = 0.050$). Because the p-value is exactly at the conventional 5% significance boundary, the evidence for this mediation is borderline rather than strong. Thus, the result suggests a possible indirect pathway, but it should not be interpreted as definitive evidence of a robust mediating effect. This distinction is important because charterer satisfaction may also depend on other factors not included in the model, such as communication, responsiveness, contractual conditions, schedule reliability, pricing, and service support.

Theoretical Contribution: An Integrated Operational Sustainability–Service Satisfaction Model

The principal theoretical contribution of this study is the integration of operational performance and environmental sustainability into a single framework explaining charterer satisfaction through existing fleet quality. Previous studies have often examined ship performance, green shipping, fleet management, or customer satisfaction as relatively separate dimensions. This study extends that perspective by positioning existing fleet quality as the mechanism that connects internal operational and sustainability capabilities with an external customer-oriented outcome.

The proposed framework therefore establishes a more integrated relationship: ship performance and green shipping campaigns represent organizational capabilities and strategic practices; these capabilities contribute to existing fleet quality; and improvements in fleet quality are associated with charterer satisfaction. This perspective shifts the discussion of green shipping from an exclusively environmental or compliance-oriented issue toward a broader service-value perspective. In other words, sustainability becomes relevant to customer satisfaction not only because it reduces environmental impacts, but also because it can be translated into improvements in vessel capability, reliability, efficiency, and operational value perceived by charterers.

The findings also provide a differentiated understanding of these relationships. Ship performance has the strongest contribution to fleet quality, as reflected by its large effect size, while green shipping campaigns demonstrate meaningful contributions to both fleet quality and charterer satisfaction. At the same time, fleet quality itself has a medium effect on charterer satisfaction. These results suggest that operational excellence and sustainability should not be considered competing dimensions of maritime performance; rather, they can operate as complementary dimensions within an integrated service-value framework.

CONCLUSION

This study demonstrates that ship performance and green shipping campaigns are positively associated with existing fleet quality and charterer satisfaction at PT Pertamina International Shipping. Ship performance shows the strongest contribution to fleet quality, indicating that operational reliability, safety, technical capability, and efficiency remain fundamental to maintaining fleet quality. Green shipping campaigns also contribute positively, suggesting that environmental initiatives can support fleet improvement while responding to increasing sustainability expectations in the maritime industry.

The findings further demonstrate that existing fleet quality is positively associated with charterer satisfaction. Fleet condition, technological capability, safety, and operational reliability therefore represent important elements of maritime service value. Both ship performance and green shipping campaigns also have direct relationships with charterer satisfaction, indicating that charterers may evaluate shipping services based on both operational outcomes and sustainability practices.

The main theoretical contribution of this study is the development of an integrated operational sustainability–service satisfaction framework. Rather than examining ship performance, green shipping, fleet quality, and customer satisfaction as separate dimensions, the study connects them within a single structural model. Existing fleet quality is positioned as a mechanism linking internal operational and sustainability capabilities with an external customer-oriented outcome. This perspective extends the sustainable shipping literature by demonstrating that green shipping can be considered not only an environmental or regulatory strategy but also a component of service value and customer satisfaction.

The mediation findings provide additional insight into this relationship. The indirect effect of green shipping campaigns through existing fleet quality is statistically supported, while the indirect effect of ship performance is borderline at the 5% significance level. Therefore, the mediation result for ship performance should be interpreted cautiously rather than as definitive evidence of a strong indirect effect. Overall, the findings suggest that improvements in operational and environmental practices can contribute to customer-oriented outcomes when they are translated into tangible improvements in fleet quality.

For PT Pertamina International Shipping, the findings suggest three strategic priorities. First, ship performance should be strengthened through preventive and predictive maintenance, digital monitoring, operational efficiency, and continuous crew competency development. Second, green shipping initiatives should be integrated into fleet management through energy-efficient technologies, emission reduction measures, and compliance with applicable international environmental standards. Third, fleet quality should remain a central management priority because it represents an important link between operational capabilities, sustainability initiatives, and charterer satisfaction.

These strategies should be implemented as an integrated approach rather than as separate programs. Operational performance provides the foundation for reliable fleet operations, while green shipping strengthens environmental performance. Improvements in both areas can subsequently be reflected in fleet quality and service value perceived by charterers.

Several limitations should be considered when interpreting the findings. First, the study uses a cross-sectional survey design, so the results identify statistical relationships but cannot establish temporal precedence or definitive causal relationships. Second, the respondents are drawn from the specific charterer context of PT Pertamina International Shipping; therefore, the findings may not be directly generalizable to other shipping companies, markets, or charterer populations. Third, the study relies primarily on self-reported questionnaire data, which may introduce common method variance and respondent perception effects. Finally, the relatively high R^2 value for charterer satisfaction (0.921) should be interpreted cautiously because it may reflect the specific organizational context, conceptual proximity among constructs, and characteristics of the sample. Further validation using independent samples is therefore necessary.

Future studies should extend the model through longitudinal research to examine whether improvements in ship performance and green shipping practices lead to changes in fleet quality and charterer satisfaction over time. Research involving multiple shipping companies and larger or more diverse charterer populations would also improve external validity. Future models could incorporate additional variables such as service quality, digitalization, safety management, cost efficiency, communication quality, schedule reliability, and charterer trust to explain other factors influencing customer satisfaction.

Future research may also apply PLS-SEM predictive assessment, multi-group analysis, or complementary qualitative approaches to examine whether the relationships differ across vessel types, charterer characteristics, geographic markets, or operational segments. Such extensions would help determine whether the integrated operational sustainability–service satisfaction framework observed in this study can be replicated across broader maritime contexts.

REFERENCE

- Aamir, A. (2024). *Advantages of sea transportation: Exploring cost, ease, and efficiency*.
- Adawiyah, R., & Taharuddin, T. (2024). Pengaruh kualitas pelayanan jasa keagenan kapal dan komunikasi interpersonal terhadap kepuasan dan loyalitas pelanggan pada perusahaan pelayaran PT Hasnur Internasional Shipping Tbk. *Jurnal Bisnis dan Pembangunan*, 13(2), 170–180. <https://doi.org/10.15408/jbp.v13i2.6815>
- Adilang, W., & Palapa, A. (2024). Faktor-faktor yang mempengaruhi keselamatan pelayaran: Peran syabandar, kebijakan dan alat navigasi. *Journal of Engineering and Transportation*, 2(1).
- Asariotis, R., Ayala, G., Assaf, M., Bacrot, C., Benamara, H., Chantrel, D., Cournoyer, A., Fugazza, M., Hansen, P., Hoffmann, J., Kulaga, T., Premti, A., Rodríguez, L., Salo, B., Tahiri, K., Tokuda, H., Ugaz, P., & Youssef, F. (2021). *Review of maritime transport 2021*. United Nations Publications.
- Bei, Z., Wang, J., Li, Y., Wang, H., Li, M., Qian, F., & Xu, W. (2024). Challenges and solutions of ship power system electrification. *Energies*, 17(13), 3311. <https://doi.org/10.3390/EN17133311>
- Cardama Maruxa, C., Cortez Angel, C., Cruz Nicolas, N., Medimorec, A. E., Hosek, E. H., Peet, K., Nikola, N., Steinvorth, A. S., & Yiu, A. Y. (2021). *SLOCAT transport and climate change global status report*.
- Christian, I. C., Asemota, K. U., Obalum, L., & Ifekanandu, I. C. (2023). Green logistics practices and customer satisfaction of shipping companies in Nigeria. *International Journal of Scientific and Engineering Research*, 6(5), 178–190.
- CLIA. (2024). *The International Maritime Organization (IMO) net zero emissions by 2050 target*.

- Devarapali, S., Manske, A., Khayamim, R., Jacobs, E., Li, B., Elmi, Z., & Dulebenets, M. A. (2024). Electric tugboat deployment in maritime transportation: Detailed analysis of advantages and disadvantages. *Maritime Business Review*, 9(3), 263–291. <https://doi.org/10.1108/MABR-12-2023-0086>
- Dwiputra, D. W., Amarta, P., Permana, T. A., Khumayah, S., & Lestari, A. D. (2024). Analysis of customer satisfaction survey results at the large ship mooring at PT Pelabuhan Indonesia Regional 2 Cirebon Branch. *Journal of World Science*, 3(11), 1425–1432.
- Ghozali, I. (2016). *Structural equation modeling: Metode alternatif dengan partial least square (PLS)* (4th ed.). Badan Penerbit Universitas Diponegoro.
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Pearson Education.
- Hermawan, A., & Amirullah, M. (2016). *Metode penelitian: Dasar-dasar SEM-PLS dan aplikasi dalam penelitian manajemen*. Universitas Indonesia Press.
- Jia, H., Jiang, L., & Azevedo, P. (2024). Green premium and the role of financial investors in sustainable investment in container shipping. *Transportation Research Part E*, 189, 103658. <https://doi.org/10.1016/j.tre.2024.103658>
- Kumar, K. M. (2022). The influence of sustainable logistic practices and supplier support on logistics transport performance. *Journal of Entrepreneurship, Business and Economics*, 10(1), 141–176.
- Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, 140, 1–55.
- Malau, A. G. (2023). The Effect of Work-Life Balance on Higher Education Employee Performance: Moderation of Organizational Support and Job Satisfaction Level. *Journal of Innovation in Educational and Cultural Research*, 4(2), 254–263. <https://doi.org/10.46843/jiecr.v4i2.681>
- Malau, A. G., Barasa, L., & Sumali, B. (2019). Effect of competence and ship crew discipline on performance PT. Myclin Express Offshore. *International Review of Management and Marketing*, 9(5), 39-46.
- Malau, A. G., Barasa, L., & Utami, A. P. (2021). Pengaruh kompetensi dan kompensasi terhadap kepuasan kerja awak kapal PT Amas Iscindo Utama. *International Review of Management and Marketing*, 11(3), 56-63.
- Malau, A. G., Togatorop, A. L., & Sabpatari, F. (2021). Pengaruh kompetensi dan motivasi karyawan terhadap kinerja pelayanan penerbitan sertifikat kapal di Kantor KSOP Khusus Batam. *Management Science & Marketing*, 14(2), 123-130.
- Mallouppas, G., & Yfantis, E. A. (2021). Decarbonization in shipping industry: A review of research, technology development, and innovation. *Journal of Marine Science and Engineering*, 9(4). <https://doi.org/10.3390/jmse9040415>
- Matagiwa, P., Agusinta, L., & Simarmata, J. (2025). The effect of the green shipping campaign and greenhouse gas emission reduction policy on electric vessel procurement mediated by shipowner perceptions. *Dinasti Journal of Economics and Management*, 7(1), 69–84.
- Meilinasari, N. H., Febriansyah, C., & Syahdana, R. (2021). Optimalisasi penerapan ISPS Code untuk meningkatkan keselamatan dan keamanan di atas kapal MV. CK Bluebell. *METEOR STIP Marunda*, 11(2). <https://ejournal.stipjakarta.ac.id/index.php/meteor/article/download/196/163/>
- Mulyadi, E. A., Saputra, D. H., Malau, A. G., & Simanjuntak, M. (2025). The influence of ship charter service quality and marketing strategy on customer experience that impacts customer satisfaction. *Dinasti Journal of Economics and Management*, 6(6), 4455–4470.

- Noura Ayuningsih, A., Chandra, A., Oktaviani, M. A., Athyah, N., Amanda, P. D., Sulaiman, S. D., & Citra, Z. (2023). Ratifikasi Paris Agreement dan pengaplikasian Nationally Determined Contribution (NDC) Indonesia. *JISIP-UNJA*, 7(1).
- Nur, N. K., Rangan, P. R., Mahyuddin, H., Halim, H., Tumpu, M., Sugiyanto, G., Radjawane, L. E., Ahmad, S. N., & Rosyida, E. E. (2021). *Sistem transportasi*. Yayasan Kita Menulis.
- Palapa, A. (2023). Examining academic self-efficacy to achieve student academic performance: Evidence from computer-based training. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran*, 9(1), 80–91. <https://doi.org/10.33394/jk.v9i1.7074>
- Palapa, A., Saifudin, I., Jamaan, A., & Kalmareuro, V. U. (2024). Pengaruh fungsi manajemen terhadap kompetensi peserta didik dimediasi sistem informasi terintegrasi pada diklat kemaritiman. *Saintara: Jurnal Ilmiah Ilmu-Ilmu Maritim*, 8(2).
- Reusser, C. A., & Pérez Osses, J. R. (2021). Challenges for zero-emissions ship. *Journal of Marine Science and Engineering*, 9(10). <https://doi.org/10.3390/jmse9101042>
- Ridwan, & Kuncoro, E. A. (2018). *Metode penelitian kuantitatif*. Alfabeta.
- Sekaran, U., & Bougie, R. (2020). *Research methods for business: A skill-building approach* (8th ed.). Wiley.
- Selasdini, V., Barasa, L., & Wartono. (2018). Pengaruh ketersediaan utilisasi alat bongkar muat pelabuhan terhadap kinerja produktifitas di Pelabuhan Batu Ampar Batam. *METEOR STIP Marunda*, 11(2).
- Simanjuntak, M. B., Winarno, W., Purnama, C., Simanjuntak, M., Wibowo, T. A., Palapa, A., & Simanjuntak, P. D. (2025). *Professional perspectives on smart port cities: Integration of urban agriculture and maritime energy networks for sustainable coastal development (Transformative maritime education paradigms)*. BIO Web of Conferences, 199, 03009. <https://doi.org/10.1051/bioconf/202519903009>
- Simanjuntak, M., Herawati, S., & Pangestu Gusti, A. (2024). The analysis of interpersonal communication and basic safety training with organizational policy as an intervening variable. *International Journal of Maritime Studies*, 5(1), 45–53. <https://ejurnal.pip-semarang.ac.id/jdb/article/view/574>
- Siregar, V. Selasdini., Haryati, S., & Rizq, M. D. (2021). Pengaruh kebijakan perusahaan mengenai penempatan pelaut berijazah kompetensi kelas III sebagai juru mudi dan juru minyak terhadap pengembangan karir pelaut di atas kapal milik PT Tanto Intim Line. *Jurnal Ilmu Pelayaran*, 3(1), 25-32.
- Sugiyono. (2019). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.
- Sugiyono. (2024). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.
- Timple, R., & Shanmughapriya, P. (2025). A study on customer satisfaction in maritime industry. *International Journal of Research Publication and Reviews*, 6(3), 3997–4000.
- Tjendana, Y., & Pranitasari, D. (2024). Determinants of SERVQUAL dimensions on customer satisfaction and loyalty in maritime transportation and logistics services. *Ecoment Global Journal*, 9(3), 227–240. https://doi.org/10.2991/978-94-6463-628-4_13
- Winanti, W. S., Sudinda, T. W., Oktivia, R., Ihsan, I. M., Ikhwanuddin, M., Amru, K., Anjani, R., & Aryantie, M. H. (2023). Barrier analysis to leverage climate change mitigation-adaptation implementation. *IOP Conference Series: Earth and Environmental Science*, 1201(1). <https://doi.org/10.1088/1755-1315/1201/1/012062>
- Yu, H., Zhang, M., Cui, C., Xu, L., Lin, S., & Xu, J. (2024). Evaluating competitiveness of container shipping operators in the sustainability and digitalization era. *Sustainability*, 16(10), 4228. <https://doi.org/10.3390/su16104228>