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Vessel Seaworthiness, Service Quality, Information Technology, And Financial Performance: The Role Mediation of Operational Performance in Passenger Shipping Companies in Indonesia

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ABSTRACT

The strategic role of passenger vessels ensures accessibility in Indonesia's regions. However, the number of ships each year has not shown significant improvement. The company's financial condition has become an issue, delaying fleet renewal due to the high cost of vessels. Economic performance is linked to operational performance, where the port conditions are not fully standardized, affecting service quality. Additionally, ship accidents each year highlight the need to address vessel seaworthiness, crew competence, and maintenance. The use of information technology for operations and revenue improvement has not been optimal. This study aims to analyze the impact of vessel seaworthiness, service quality, and information technology on financial performance through the mediation of passenger vessel operational performance. Data were collected through a questionnaire with a sample of 181 out of 328 populations. This study uses descriptive and quantitative data analysis techniques using Structural Equation Modelling (SEM)-Partial Least Square (PLS). The results of this study contribute to the development of a passenger shipping management model, where the financial performance of passenger shipping companies is influenced by operational performance, which is determined indirectly by vessel seaworthiness and directly and indirectly by service quality and information technology.

1. Introduction.

Indonesia has a total area of 1,904,569 km^2 consisting of 17,504 islands. As an archipelagic country, the islands are connected by seas, making Indonesia's maritime area more significant than its land area, accounting for approximately 74% of the total territory (Saha, 2016). Farhadi (2015) and Agbelie (2014) stated that as an archipelagic country, regional or inter-island interactions must be encouraged by improving transportation infrastructure development to enhance productivity and production, especially in the economic sector. Sea or maritime transport is essential for driving Indonesia's economy, particularly in the 3TP regions (frontier, outermost, underdeveloped, and border areas). As one of the transportation facilities, transportation has two widely known concepts: trade follows the ship and ship follows the trade, both of which are influenced by the community's ability to pay and willingness to pay (Rahmanita et al., 2023). This is expected to grow in line with increasing trade, meaning that trade will follow the development of transportation in a region. This forms the pioneering areas where the state is present, and transportation (ship) follows trade development, marking a more commercial area.

As an archipelagic country with an uneven level of economic development, Indonesia still requires maritime transportation under the concept of trade following the ship, with the expectation that maritime transportation facilities will help improve the economies of the areas they serve, both in terms of passengers and cargo (Rizaldy et al., 2024). In this regard, the government, specifically the Ministry of Transportation through

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the Directorate General of Sea Transportation, has implemented a policy of pioneering sea transportation to support the trade following the ship concept. According to the Regulation of the Minister of Transportation of the Republic of Indonesia Number PM 6 of 2016, a Pioneering Vessel is defined as a ship assigned to connect remote regions or islands lacking adequate sea transportation facilities by utilizing state-owned sea transportation that carries both passengers and cargo, subsidized by the government. To operate these pioneering vessels, the government allocates substantial subsidy funds, managed either by national shipping operators, State-Owned Enterprises (SOEs), or private companies through a tender mechanism for the operation of state-owned passenger ships. One of the largest state-owned shipping companies operating passenger ships is PT. (Persero) Pelayaran Nasional Indonesia, commonly known as PT. PELNI's mission includes ensuring community accessibility, particularly in serving the 3TP regions (frontier, outermost, underdeveloped, and border areas). For this mission, the company receives funding from the government through Public Service Obligation (PSO), which has increased over the past five years, from 2019 to 2023. This is due to the economic-class ticket prices not aligning with the operational costs of passenger ships. At the same time, revenue from non-assignment activities remains relatively small compared to the revenue generated from assignments.

The rejuvenation of PT. PELNI's passenger ships are currently necessary, considering the average age of its passengers exceeds 30 years, while their economic lifespan is 30 years. Presently, PT. PELNI has submitted a request to the government for State Capital Injection (PMN) for the 2024 fiscal year. Based on this, the company's financial capacity to rejuvenate passenger ships with the same type as those being replaced is relatively inadequate when using its funds, thus requiring capital assistance from the government, particularly for assignment operations (Ricardianto et al., 2023a).

Syriopoulos et al. (2022) revealed that the number of passengers has a significant positive relationship with net operating profit, operating revenue, return on total assets and equity, and earnings per share of shipping companies. These indicators will increase or decrease in line with the increase or decrease in ship passengers. The smooth operation of passenger ships will achieve on-time performance (OTP) targets for departures and arrivals, ensuring ships arrive on time according to the established schedules. Customer trust increases as a result of improvements in ship operational performance, including commission days (operating time), load factor (occupancy), round trip days (voyage), and safety (Agusinta et al., 2024).

In addition to financial and operational performance, attention must also be given to ship conditions before sailing. Ensuring ship safety is crucial in shipping. Ship safety refers to fulfilling requirements that affect ships' condition and reliability, including aspects such as stability, construction, materials, machinery and electrical systems, layout and equipment, lifesaving appliances, radio equipment, and ship electronics. Compliance is proven by certificates issued after inspections, audits, and testing. When discussing shipping safety, apart from ship conditions, another crucial factor is the competence and skills of those operating the ship (crew). A reliable ship would be futile if operated by crew members who lack the necessary skills, knowledge, or functions. Therefore, crew competence becomes a key factor in ensuring the seaworthiness of a ship (Farisyi et al., 2024). According to maritime safety research, 80% of accidents at sea are caused by human error (Ishak et al., 2019). Majid et al. (2024) show that seaworthiness has a robust relationship with shipping safety, which makes it a critical concern for shipping companies. Based on this, ensuring the seaworthiness of passenger ships before sailing is a key point to minimize or even eliminate ship accidents and, at the very least, reduce their occurrence.

In general, passenger ship services are divided into three phases: pre-onboard (services before boarding), onboard (services while on the ship), and post-onboard (services after disembarking). These services are closely related to passenger terminals at ports. Ports play a critical role as part of the transportation infrastructure that drives economic activity in a region. They are integral to the transportation and logistics chain (Marina et al., 2023; Nofrisel et al., 2024). The primary roles of seaports include moving cargo, both passengers and goods and serving industrial functions by providing facilities for ship-related activities at ports. Port management has not yet been carried out effectively, efficiently, or economically in Indonesia. This hinders the port's ability to serve as a trigger and driver for national economic competitiveness (Parola et al., 2017).

Two factors influence service quality: expected and perceived service (Ricardianto et al., 2023b). If the services received or experienced meet customer expectations, the service quality is considered good and satisfactory, potentially exceeding customer expectations. Service quality, therefore, represents an ideal competitive advantage (Adi et al., 2024). The quality of a service, whether good or bad, depends on the ability of the service provider or company to consistently meet customer expectations (Ricardianto et al., 2022).

The use of information technology on passenger ships is critical and is one of the mandatory requirements that must be fulfilled onboard (Kim et al., 2020). Information technology's benefits include operational improvements, shipping safety, cost efficiency, and revenue growth. Utilizing information technology tools at ports equipped with data exchange capabilities for seamless coordination ensures the smooth flow of ships and goods at the port. The development and implementation of information technology at ports must align with the service mechanisms of various relevant agencies operating in port areas while adhering to the highest regulatory framework, Law of the Republic of Indonesia No. 17 of 2008, to ensure that port services achieve their intended goals effectively.

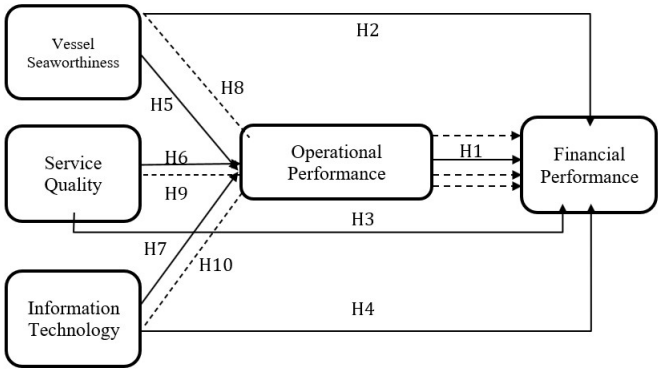
Based on the background and problem identification, the scope of this study focuses on the seaworthiness of passenger ships, including RoPax ships or Roro Passenger ships, which transport passengers and vehicles. This is particularly relevant given the ongoing occurrences of ship accidents. The study will also address service quality in ship operations, particularly at ports and passenger terminals, to increase the number of passengers, achieve on-time arrivals and departures, and improve commission days as part of achieving ship operational

performance, ultimately improving financial performance. The mandatory use of information technology, in compliance with SOLAS regulations, is expected to enhance the effectiveness and efficiency of each operational process. Additionally, the use of information technology for ticket sales is anticipated to improve financial performance further.

2. Methodology.

This quantitative research focuses on developing relationships between research variables and answering the hypotheses based on real-world phenomena. The population in this study consists of passenger shipping companies registered with the Ministry of Transportation of the Republic of Indonesia, totaling 328 companies, with a sample size of 181 companies. Probability Sampling is applied using the Proportionate Stratified Random Sampling method. In this research, the types of data used include primary data, collected through questionnaires and observations, and secondary data, obtained by gathering relevant information about the phenomena from passenger shipping companies, journals, and articles. This study employs two data analysis techniques, namely Descriptive Data Analysis and Quantitative Data Analysis using Structural Equation Modeling (SEM). The conceptual framework can be seen in Figure 1.

Figure 1: Research Framework.



Source: Authors.

3. Results and Discussions.

3.1. Vessel Seaworthiness.

The vessel's seaworthiness has an average score of 3.89 or 77.76% of the ideal (highest) value, categorized as good. The indicator with the highest influence on the vessel seaworthiness variable is the statement regarding the stability condition of the vessel meeting the standards, with an average score of 3.97 or 79.45%, which falls into the good category. This indicates that the reliability of passenger vessels currently owned and operated by passenger shipping companies is still good and must be maintained to ensure they remain according to the specifications or the ship's particulars. On the other hand, the statement regarding the functionality of all safety equipment on the vessel has the lowest average score, at 3.81 or 76.24%, which is still within the good category.

Therefore, the implementation of passenger vessel maintenance, particularly the fulfillment of safety equipment requirements, must be improved. This includes ensuring that the quantity of safety equipment available exceeds the passenger capacity and that its quality is maintained through regular testing to ensure proper functionality. Although this has been done well, attention must be given to improving further improving this aspect so it does not remain the lowest score and can rise to the outstanding category. This is particularly crucial as safety equipment must be ready for use in emergencies during voyages.

3.2. Service Quality.

The service quality has an average score of 3.81 or 76.07% of the ideal (highest) value, categorized as good. The indicator with the highest influence on the service quality variable is the statement regarding the certainty of berth allocation for passenger vessels, with an average score of 3.96 or 79.12%, categorized as good. This indicates that the certainty of berth allocation remains a priority for port operators, which is satisfying for passenger shipping companies and must be maintained. On the other hand, the statement regarding the speed of the fuel (BBM) logistics supply process for vessels has the lowest average score, at 3.62 or 72.49%, still falling into the good category. This aspect requires the operational division's attention to improve the speed of fuel supply services for passenger vessels. Continuous coordination with port operators and fuel logistics suppliers is necessary to ensure the logistics service process can be carried out immediately when the vessel docks.

3.3. Information Technology.

The information technology variable has an average score of 3.95 or 79.01% of the ideal (highest) value, categorized as good. The indicator with the highest influence on the information technology variable is the statement regarding the implementation of digitalization for ticket sales, with an average score of 4.07 or 81.33%, categorized as very good. The shift in the ticket sales model from manual counter transactions to online sales, mobile ticketing applications, and e-ticketing has provided convenience for passengers in purchasing tickets. For passenger shipping companies, this is highly beneficial as it contributes to increased revenue by expanding the accessibility for passengers to purchase tickets more easily. This achievement must be maintained and further expanded in its implementation to ensure sustained progress.

On the other hand, the indicator with the lowest score is the statement regarding implementing digitalization in every business process within each unit, with an average score of 3.72 or 74.36%, still categorized as good. This condition indicates that the acceleration of digitalization in business processes across all units must be continuously pursued within passenger shipping companies further to enhance the speed and efficiency of business activities.

3.4. Passenger Ship Operational Performance.

The passenger ship operational performance variable has an average score of 4.05 or 80.97% of the ideal (highest) value, categorized as very good. The indicator with the most decisive influence on the operational performance variable is the statement regarding the achievement of On-Time Performance (OTP) (arrival and departure) of ships according to the scheduled targets, with an average score of 4.24 or 84.75%, categorized as very good. This indicates that the quality of operations, specifically the achievement of On-Time Performance (OTP) for passenger ship voyages, is currently perceived by company management as excellent. On the other hand, the indicator with the lowest score is the achievement of the realization of the number of passengers by the target, with an average score of 3.90 or 77.90%, still categorized as good. This indicates the need for further improvements in production achievements, particularly the realization of the number of passengers meeting or exceeding the target.

This requires greater attention to ensure further improvements. One strategy is to maximize ticket sales through online ticketing and move toward full e-ticketing systems. This strategy will facilitate passengers' obtaining and purchasing tickets while maintaining on-time ship schedules, which is a key focus for passenger shipping companies.

3.5. Financial Performance.

The financial performance variable has an average score of 4.11 or 82.87% of the ideal (highest) value, categorized as very good. The indicator with the highest influence on the financial performance variable is the statement regarding monthly positive cash flow, with an average score of 4.28 or 85.64%, categorized as very good. This signifies that the current monthly cash flow position for passenger ships, as perceived by company management, is already excellent and critical. On the other hand, the indicator with the lowest score is the statement regarding sales growth of the company, with an average score of 4.03 or 80.55%, still categorized as very good. This condition aligns with the production achievement-namely, the realization of the number of passengers-which still requires improvement and directly impacts sales growth.

This calls for further attention to achieve better results by maximizing ticket sales or considering ticket price adjustments on commercial routes with high passenger demand. Further evaluation of specific routes at ports visited by passenger ships—by categorizing them into commercial and pioneer routes—is necessary. This updated evaluation will allow for the implementation of sensitivity tariff policies, thereby maximizing sales growth.

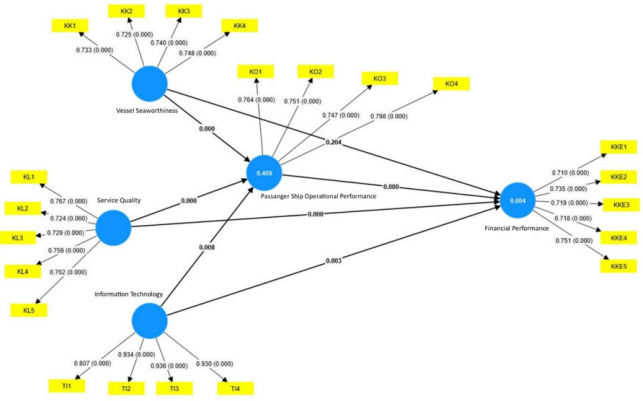
3.6. Hypothesis Testing and Discussion.

In hypothesis testing or path coefficient testing, the hypothesis will be accepted if the t-statistic value is above 1.96 (at a 5% significance level) and the p-value is ≤ 0.05. Testing is conducted using the bootstrapping method to determine the t-statistic and p-value. In this study, hypothesis testing examines the presence or absence of a significant direct effect of exogenous variables on endogenous variables and a significant indirect effect of exogenous variables on endogenous variables through mediation.

3.6.1. Direct Effect.

Based on the data processing using SmartPLS version 4 with bootstrapping, the t-statistic values and p-values are obtained, as illustrated in Figure 2 and Table 1.

Figure 2: Hypothesis Testing With Bootstrapping.



Source: Authors.

Table 1: Direct Effect Hypothesis Testing using the Bootstrapping Method.

Variable	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	t-statistics	p-values	Explanation
Passenger Ship Operational Performance -> Financial Performance	0,529	0,531	0,061	8,671	0,000	Significant
Vessel Seaworthiness ->Financial Performance	0,090	0,087	0,071	1,271	0,204	Not Significant
Service Quality -> Financial Performance	0,231	0,230	0,062	3,703	0,000	Significant
Information Technology ->Financial Performance	0,148	0,155	0,049	3,010	0,003	Significant
Vessel Seaworthiness ->Passanger Ship Operational Performance	0,382	0,380	0,070	5,429	0,000	Significant
Service Quality-> Passenger Ship Operational Performance	0,303	0,303	0,073	4,179	0,000	Significant
Information Technology -> Passenger Ship Operational Performance	0,133	0,138	0,050	2,682	0,008	Significant

Source: Authors.

3.6.2. Indirect Effect.

The testing criteria for the mediation variable is that if the p-value is less than 0.05, the independent or exogenous variable affects the dependent or endogenous variable through the mediation variable. Below are the results of the data processing as shown in Table 2, the output results of the indirect effects from this study:

Table 2: Indirect Effect Hypothesis Testing using the Bootstrapping Method.

Variable	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics	P values	Explanation.
Vessel Seaworthiness -> Passenger Ship Operational -> Financial Performance	0,070	0,073	0,027	2,592	0,010	Significant
Service Quality -> Vessel Seaworthiness -> Financial Performance	0,202	0,202	0,045	4,506	0,000	Significant
Service Quality -> Passenger Ship Operational Performance -> Financial Performance	0,160	0,161	0,043	3,705	0,000	Significant

Source: Authors.

3.6.3. *Effect of Passenger Ship Operational Performance on Financial Performance.*

Based on the data processing results shown in Figure 2 and Table 1, the t-statistics value obtained is 8.671, and the p-value is 0.000, with a t-table value of 1.96 at a 5% significance level. Since the t-statistics > t-table (8.671 > 1.96) and p-values ≤ 0.05 (0.000 < 0.05), H0 is rejected, and H1 is accepted, indicating that there is a significant effect of passenger ship operational performance on financial performance. Additionally, according to Table 3, the F-Square value obtained is 0.416, above 0.34, meaning the effect of passenger ship operational performance on financial performance is significant.

Table 3: *Q-Square* (Q^2) Test or *Predictive Relevance*.

	Q^2 predict	Prediction
Financial Performance	0,415	Strong
Passenger Ship Operational Performance	0,385	Strong

Source: Authors.

3.6.4. *Effect of Vessel Seaworthiness on Financial Performance.*

Based on the data processing results shown in Figure 2 and Table 1, the t-statistics value is 1.271, and the p-value is 0.204, with a t-table value of 1.96 at a 5% significance level. Since the t-statistics < t-table (1.271 < 1.96) and p-value > 0.05 (0.204 > 0.05), H2 is rejected, and H0 is accepted, indicating no significant effect of vessel seaworthiness on financial performance. Additionally, according to Table 3, the F-Square value is 0.010, below 0.02, meaning the effect of vessel seaworthiness on financial performance is weak.

3.6.5. *Effect of Service Quality on Financial Performance.*

Based on the data processing results shown in Figure 2 and Table 1, the t-statistics value is 3.703, and the p-value is 0.000, with a t-table value of 1.96 at a 5% significance level. Since the t-statistics > t-table (3.703 > 1.96) and p-value ≤ 0.05 (0.000 < 0.05), H3 is accepted, indicating a significant effect of service quality on financial performance. Additionally, according to Table 3, the F-Square value is 0.067, which is above 0.02, meaning the effect of service quality on financial performance is moderate.

3.6.6. *Effect of Information Technology on Financial Performance.*

Based on the data processing results shown in Figure 2 and Table 1, the t-statistics value is 3.010, and the p-value is 0.003, with a t-table value of 1.96 at a 5% significance level. Since the t-statistics > t-table (3.010 > 1.96) and p-value ≤ 0.05 (0.003 < 0.05), H4 is accepted, indicating a significant effect of information technology on financial performance. Additionally, according to Table 3, the F-Square value is 0.053, which is above 0.02, meaning the effect of information technology on financial performance is moderate.

3.6.7. *Effect of Vessel Seaworthiness on Passenger Ship Operational Performance.*

Based on the data processing results shown in Figure 2 and Table 1, the t-statistics value is 5.429, and the p-value is 0.000, with a t-table value of 1.96 at a 5% significance level. Since the t-statistics > t-table (5.429 > 1.96) and p-value ≤ 0.05 (0.000 < 0.05), H5 is accepted, indicating a significant effect of vessel seaworthiness on passenger ship operational performance. Additionally, according to Table 3, the F-Square value is 0.131, which is above 0.02, meaning the effect of vessel seaworthiness on passenger ship operational performance is moderate.

3.6.8. *Effect of Service Quality on Passenger Ship Operational Performance.*

Based on the data processing results shown in Figure 2 and Table 1, the t-statistics value is 4.179, and the p-value is 0.000, with a t-table value of 1.96 at a 5% significance level. Since the t-statistics > t-table (4.179 > 1.96) and p-value ≤ 0.05 (0.000 < 0.05), H6 is accepted, indicating a significant effect of service quality on passenger ship operational performance. Additionally, according to Table 3, the F-Square value is 0.083, which is above 0.02, meaning the effect of service quality on passenger ship operational performance is moderate.

3.6.9. *Effect of Information Technology on Passenger Ship Operational Performance.*

Based on the data processing results shown in Figure 2 and Table 1, the t-statistics value is 2.682, and the p-value is 0.000, with a t-table value of 1.96 at a 5% significance level. Since the t-statistics > t-table (2.682 > 1.96) and p-value ≤ 0.05 (0.000 < 0.05), H7 is accepted, indicating a significant effect of information technology on passenger ship operational performance. Additionally, according to Table 3, the F-Square value is 0.030, which is above 0.02, meaning the effect of information technology on passenger ship operational performance is moderate.

3.6.10. *Indirect Effect of Vessel Seaworthiness on Financial Performance through Passenger Ship Operational Performance.*

Based on the data processing results shown in Table 2, the t-statistics value is 2.592, and the p-value is 0.010, with a t-table value of 1.96 at a 5% significance level. Since the t-statistics > t-table (2.592 > 1.96) and p-value ≤ 0.05 (0.010 < 0.05), H8 is accepted, indicating a significant indirect effect of vessel

seaworthiness on financial performance through passenger ship operational performance. Additionally, according to Table 5, the R-Square value is 0.409, indicating a moderate effect. Furthermore, Table 4 shows a Q-Square value of 0.415, meaning that the variable of vessel seaworthiness, through the mediation of passenger ship operational performance, can predict changes in financial performance quite strongly.

Table 4: *Goodness of Fit Index (GFI).*

	Mean Communality	Mean R square	GoF Index	Category
Model Value	0,603	0,507	0,553	High

Source: Authors.

Table 5: *Test of F-Square (F^2) atau Effect Size.*

Variable	F-Squared	Explanation
Passenger Ship Operational Performance -> Financial Performance	0,416	Strong
Vessel Seaworthiness -> Financial Performance	0,010	Weak
Service Quality -> Financial Performance	0,067	Moderate
Information Technology -> Financial Performance	0,053	Moderate
Vessel Seaworthiness-> Passenger Ship Operational Performance	0,131	Moderate
Service Quality -> Passenger Ship Operational Performance	0,083	Moderate
Information Technology -> Passenger Ship Operational Performance	0,030	Moderate

Source: Authors.

3.6.11. Indirect Effect of Service Quality on Financial Performance through Passenger Ship Operational Performance.

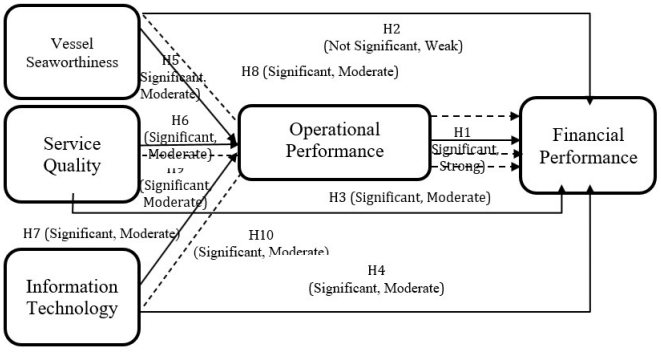
Based on the data processing results shown in Table 2, the t-statistics value is 4.506, and the p-value is 0.000, with a t-table value of 1.96 at a 5% significance level. Since the t-statistics > t-table (4.506 > 1.96) and p-value ≤ 0.05 (0.000 < 0.05), H9 is accepted, indicating a significant indirect effect of service quality on financial performance through passenger ship operational performance. Additionally, according to Table 5, the R-Square value is 0.409, indicating a moderate effect. Furthermore, Table 4 shows a Q-Square value of 0.415, meaning that the service quality variable, through the mediation of passenger ship operational performance, can strongly predict changes in financial performance.

3.6.12. Indirect Effect of Information Technology on Financial Performance through Passenger Ship Operational Performance.

Based on the data processing results shown in Table 2, the t-statistics value is 3.705, and the p-value is 0.000, with a t-table value of 1.96 at a 5% significance level. Since the t-statistics > t-table (3.705 > 1.96) and p-value ≤ 0.05 (0.000 < 0.05), H10 is accepted, indicating a significant indirect effect of information technology on financial performance through passenger ship operational performance. Additionally, according to Table 5, the R-Square value is 0.409, indicating a moderate effect. Furthermore, Table 4 shows a Q-Square value of 0.415, meaning that the information technology variable, through the mediation of passenger ship operational performance, can strongly predict changes in financial performance

Figure 3 depicts the relationships between the exogenous and endogenous variables in this study, both direct and indirect, based on the model evaluation results, hypothesis testing, and the conceptual framework shown in Figure 1.

Figure 3: Reflective Indicator Model and Intervariable Influence.



Source: Authors.

Conclusions.

Based on the research findings and discussion, the financial performance of the passenger shipping company, as an endogenous variable, is influenced by the service quality and information technology variables both directly and indirectly through the mediating variable of passenger vessel operational performance. Meanwhile, the vessel seaworthiness variable does not directly affect financial performance. However, indirectly, the mediating variable of passenger vessel operational performance does affect financial performance.

The mediating variable in this study, which is the operational performance of the passenger vessel, has a strong influence on the endogenous variable, which is the financial performance of the passenger shipping company. This indicates that the mediating variable, passenger vessel operational performance, is significant for the passenger shipping company to improve its financial performance. As a passenger shipping company, the primary long-term and short-term goal is financial performance, which is strongly influenced by passenger vessel operational performance. Therefore, as the operational performance of the passenger vessel improves, the financial performance will also increase.

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