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The Impact of Ship Services on The Revenue of PT. Pelabuhan Indonesia (Persero) Regional 1, Dumai Branch

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ABSTRACT

PT. Pelabuhan Indonesia (Persero) Regional 1 Cabang Dumai is one of the port service providers in the Riau Province region that plays a strategic role in supporting the maritime logistics chain. This study aims to analyze the effect of ship services on the revenue of PT. Pelindo Regional 1 Dumai Branch using the simple linear regression method. The independent variable (X) is the number of ship service calls, while the dependent variable (Y) is revenue measured in billions of Rupiah. The study utilizes secondary data from the monthly operational reports of PT. Pelindo Regional 1 Dumai Branch for the 2023 fiscal year, comprising 12 months of observation. The analysis results show a regression equation of $\hat{Y} = -2.0940 + 0.0788X$, with a correlation coefficient (r) of 0.9985 and a coefficient of determination (R^2) of 0.9969, indicating that 99.69% of the variation in revenue can be explained by ship service volume. The t-test yields a t-statistic of 57.0466, far exceeding the t-table value of 2.2281 ($\alpha = 0.05$, $df = 10$), confirming a statistically significant positive relationship. Similarly, the F-test produces an F-statistic of 3,254.31, well above the F-table value of 4.9646. These findings conclude that ship services have a very strong and significant positive effect on the revenue of PT. Pelindo Regional 1 Dumai Branch, where each additional ship call contributes approximately Rp 78.8 million in revenue.

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Keywords:

Ship Services; Revenue; Linear Regression; Port Management; PT. Pelindo

1. INTRODUCTION

The maritime transportation sector constitutes a fundamental pillar of Indonesia's economic infrastructure, given the nation's archipelagic geography spanning over 17,000 islands. Ports serve as critical nodes in the logistics chain, facilitating the movement of goods and commodities both

domestically and internationally. As the primary gateway for maritime trade, ports must continuously optimize their services to maintain competitiveness and ensure sustainable revenue generation [1].

PT. Pelabuhan Indonesia (Persero), commonly known as Pelindo, underwent a significant corporate restructuring in 2021 through the merger of the four previously independent regional port operators (Pelindo I through IV) into a single unified entity. This consolidation aimed to enhance operational efficiency, standardize service quality, and strengthen the company's competitive position in the global maritime industry [2]. Within this new organizational structure, the Regional 1 division oversees port operations across Western Indonesia, including the strategically important Dumai Branch.

Dumai Port, located in Riau Province on the eastern coast of Sumatra, occupies a vital position in Indonesia's maritime logistics network. The port serves as a key export gateway for palm oil products, petroleum derivatives, and various bulk commodities originating from the rich resource base of Sumatra [3]. The operational performance of Dumai Port directly influences the economic vitality of the surrounding region and contributes significantly to national trade volumes.

Ship services represent the core revenue-generating activities for port operators. These services encompass a range of operational functions including pilotage, towage, berthing, mooring, and anchorage services that are provided to vessels calling at the port [4]. The volume and quality of ship services directly impact port revenue, as each vessel call generates fees across multiple service categories. Understanding the quantitative relationship between ship service volume and revenue is essential for strategic planning, resource allocation, and financial forecasting.

Despite the evident operational linkage between ship services and port revenue, empirical studies specifically examining this relationship within the context of Indonesian ports remain limited. Most existing research has focused on broader aspects of port performance measurement, such as throughput efficiency, dwell time analysis, and customer satisfaction metrics [5]. There is a notable gap in the literature regarding the precise quantification of how variations in ship service volume translate into revenue changes for Indonesian port operators.

This study addresses this research gap by applying simple linear regression analysis to investigate the effect of ship services on the revenue of PT. Pelindo Regional 1 Dumai Branch. The research utilizes monthly operational data from the 2023 fiscal year to establish a mathematical model that describes the relationship between ship call volume (independent variable) and port revenue (dependent variable). The findings are intended to provide actionable insights for port management in optimizing service capacity and developing evidence-based revenue projection models.

2. LITERATURE REVIEW

Port Services and Ship Service Operations

Port services encompass the full spectrum of operational activities provided to facilitate the arrival, berthing, cargo handling, and departure of vessels at port facilities. According to Indonesian Government Regulation No. 61 of 2009 concerning Port Activities, port services are categorized into vessel services (jasa kapal), cargo services (jasa barang), and other related services [6]. Ship services specifically refer to the suite of services rendered directly to vessels, including pilotage services that guide vessels through navigational channels, towage services for maneuvering in confined waters, and berthing and mooring services at quay facilities.

Triatmodjo [7] defines port services as all forms of assistance and facilities provided to ships and their cargo during their time at port. The quality and efficiency of these services directly influence a port's attractiveness to shipping lines and, consequently, the volume of vessel traffic. Ports that demonstrate superior service reliability, faster turnaround times, and competitive pricing tend to attract greater vessel traffic, creating a positive feedback loop between service quality and revenue generation.

Port Revenue Structure

Port revenue is derived from multiple sources, with ship-related services typically constituting the largest revenue category for conventional port operators. Sudjatmiko [8] categorizes port revenue into direct revenue from vessel services (harbor dues, anchorage fees, pilotage charges, towage fees, and berth occupancy charges) and indirect revenue from cargo handling, storage, and ancillary services. The revenue structure of a port is influenced by its operational characteristics, traffic composition, and the competitive environment in which it operates.

For PT. Pelindo, revenue from ship services represents a significant proportion of total operational income. Each vessel call generates multiple fee components: harbor dues based on gross tonnage,

pilotage fees calculated on vessel dimensions and movement type, towage charges determined by the number and duration of tug deployments, and berth rental fees based on vessel length and occupancy duration [9]. The cumulative effect of these service fees means that total revenue is closely correlated with the aggregate volume of ship calls.

Simple Linear Regression Analysis

Simple linear regression is a statistical method used to model the relationship between a single independent variable and a dependent variable by fitting a linear equation to observed data. The general form of the simple linear regression model is expressed as $\hat{Y} = a + bX$, where $\hat{Y}$ represents the predicted value of the dependent variable, a is the intercept (constant), b is the regression coefficient (slope), and X is the independent variable [10].

The regression coefficient (b) quantifies the expected change in the dependent variable for each one-unit increase in the independent variable. The strength and direction of the linear relationship are measured by the Pearson correlation coefficient (r), which ranges from -1 to +1. The coefficient of determination (R^2) indicates the proportion of variance in the dependent variable that is predictable from the independent variable [11].

The significance of the regression model is evaluated through hypothesis testing using the t-test for individual coefficient significance and the F-test for overall model significance. The assumptions underlying linear regression include linearity, independence of residuals, homoscedasticity (constant variance of residuals), and normality of residuals [12].

Conceptual Framework

Based on the theoretical review above, the conceptual framework for this study posits a direct positive relationship between ship service volume and port revenue. The hypothesis is formulated as follows:
H0: Ship services have no significant effect on the revenue of PT. Pelindo Regional 1 Dumai Branch.
H1: Ship services have a significant positive effect on the revenue of PT. Pelindo Regional 1 Dumai Branch.
The conceptual framework is illustrated in Figure 1.

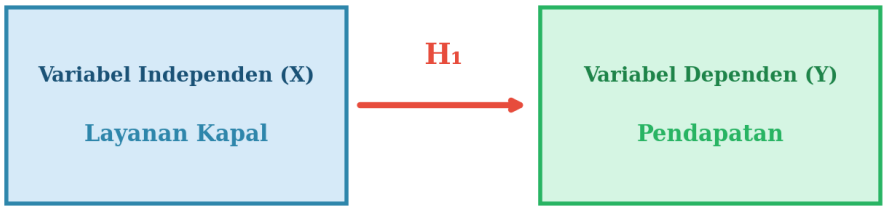

Figure 1. Conceptual Framework

2. RESEARCH METHOD

Research Design

This study employs a quantitative research design with a causal-explanatory approach. The quantitative design is selected because the research seeks to measure the numerical relationship between two variables using statistical analysis. The causal-explanatory approach is appropriate because the study aims to determine whether and to what extent ship service volume (cause) influences port revenue (effect) [13].

The research was conducted at PT. Pelabuhan Indonesia (Persero) Regional 1 Cabang Dumai, located in Dumai City, Riau Province. Dumai Port is strategically positioned along the Strait of Malacca shipping lane and serves as a significant export terminal for petroleum and palm oil products. The study period covers the fiscal year 2023 (January through December), providing 12 monthly data points for analysis.

Population and Sample

The population of this study comprises all operational and financial records of PT. Pelindo Regional 1 Dumai Branch. The sample consists of monthly data on ship service volume and revenue for the 12-month period of January to December 2023. A census sampling technique is applied, as all available monthly data points within the study period are utilized in the analysis. The sample size of n = 12 is

adequate for simple linear regression analysis, meeting the minimum threshold recommended by statistical guidelines [14].

Variables and Instruments

The study involves two variables. The independent variable (X) is the number of ship service calls, measured as the total count of vessels receiving services at Dumai Port each month, expressed in unit calls. The dependent variable (Y) is the revenue generated from port operations, measured in billions of Indonesian Rupiah (Miliar Rp). Data collection instruments include the company's monthly operational performance reports and financial statements, which provide reliable and verified records of both variables.

Data Collection

Data were collected through documentation study, wherein secondary data were obtained from the official monthly reports of PT. Pelindo Regional 1 Dumai Branch. The data sources include monthly vessel traffic reports (Laporan Kunjungan Kapal) and monthly financial performance reports (Laporan Kinerja Keuangan). This secondary data approach ensures objectivity and reliability, as the data have undergone internal verification processes within the company's reporting framework [15].

Data Analysis

Data analysis follows a sequential process consisting of descriptive statistical analysis, assumption testing, regression model estimation, and hypothesis testing. Descriptive statistics are computed to summarize the central tendency and dispersion of both variables. The classical assumption tests include the normality test (using the normal probability plot of residuals), linearity test (using scatter plot visual inspection), and homoscedasticity test (using residual plot analysis). The simple linear regression equation is estimated using the ordinary least squares (OLS) method. Hypothesis testing is conducted using the t-test for coefficient significance and the F-test for overall model significance, both at the $\alpha = 0.05$ significance level. The coefficient of determination (R^2) is calculated to assess the explanatory power of the model [16].

3. RESULTS AND DISCUSSIONS

3.1. Results

3.1.1. Descriptive Statistics

Research Data

The complete monthly data for both variables, along with predicted values and residuals from the regression model, are presented in Table 2.

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Tabel 2. Monthly Ship Services and Revenue Data (2022)

Month	Ship Services (X)	Revenue (Y) Miliar Rp	Predicted ($\hat{Y}$)	Residual ($Y-\hat{Y}$)
January	185	12.40	12.4847	-0.0847
February	192	13.10	13.0364	0.0636
March	178	11.80	11.9331	-0.1331
April	201	13.90	13.7456	0.1544
May	210	14.50	14.4548	0.0452
June	195	13.30	13.2728	0.0272
July	215	14.80	14.8489	-0.0489
August	223	15.40	15.4793	-0.0793
September	198	13.60	13.5092	0.0908
October	230	16.00	16.0309	-0.0309
November	218	15.10	15.0853	0.0147
December	240	16.80	16.8190	-0.0190

Descriptive Statistics

The descriptive statistics for both research variables are presented in Table 1. The data cover 12 months of observation from January to December 2022.

Tabel 1. Descriptive Statistics

Statistic	Ship Services (X) Unit Calls	Revenue (Y) Milliar Rp
N	12	12
Mean	207.08	14.23
Std. Deviation	18.78	1.48
Minimum	178	11.80
Maximum	240	16.80

Table 1 reveals that during 2022, PT. Pelindo Regional 1 Dumai Branch provided an average of 207.08 ship service calls per month, with a minimum of 178 calls in March and a maximum of 240 calls in December. The revenue averaged Rp 14.23 billion per month, ranging from Rp 11.80 billion (March) to Rp 16.80 billion (December). The standard deviations of 18.78 for ship services and 1.48 for revenue indicate moderate variability in both variables across the observation period.

The monthly distribution of ship service calls is illustrated in Figure 2, showing an overall upward trend throughout 2022 with the lowest activity recorded in March and the highest in December.

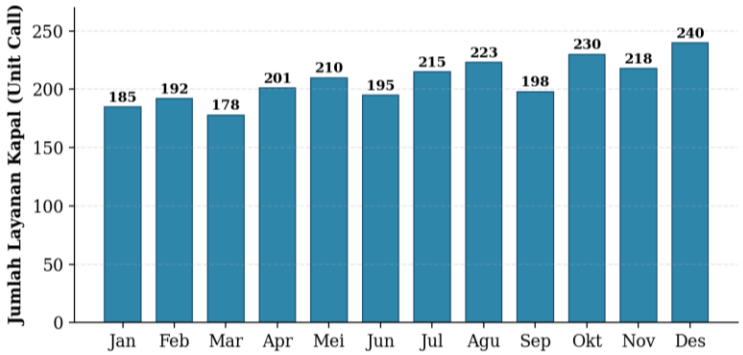

Figure 2. Monthly Ship Service Calls at PT. Pelindo Regional 1 Dumai Branch (2022)

The corresponding monthly revenue pattern is depicted in Figure 3, which demonstrates a revenue trajectory that closely mirrors the ship service volume trend, visually suggesting a strong positive association between the two variables.

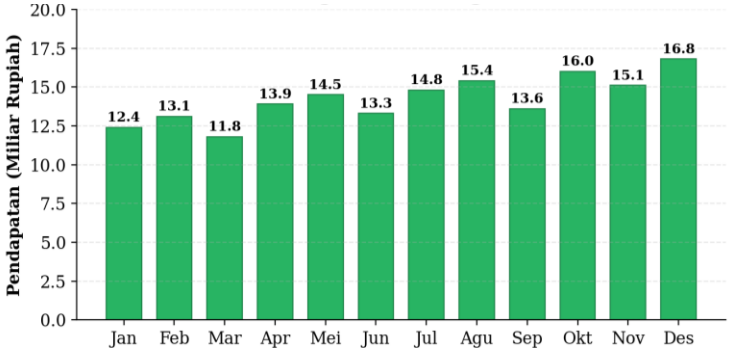

Figure 3. Monthly Revenue of PT. Pelindo Regional 1 Dumai Branch (2022)

3.1.2. Classical Assumption Tests

Normality Test

The normality of residuals is assessed using the Normal Probability Plot (P-P Plot) presented in

Figure 4. The plot shows that the data points closely follow the diagonal reference line, indicating that the residuals are approximately normally distributed. This satisfies the normality assumption required for valid inference in linear regression analysis.

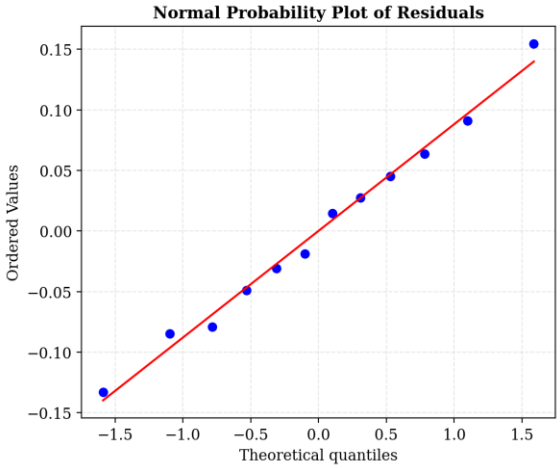

Figure 4. Normal Probability Plot of Regression Residuals

Homoscedasticity Test

The homoscedasticity assumption is evaluated through the residual plot shown in Figure 5. The scatter of residuals appears randomly distributed around the zero line without exhibiting any systematic pattern such as a funnel shape or curvature. This random distribution confirms that the variance of residuals remains approximately constant across all levels of the predicted values, satisfying the homoscedasticity assumption.

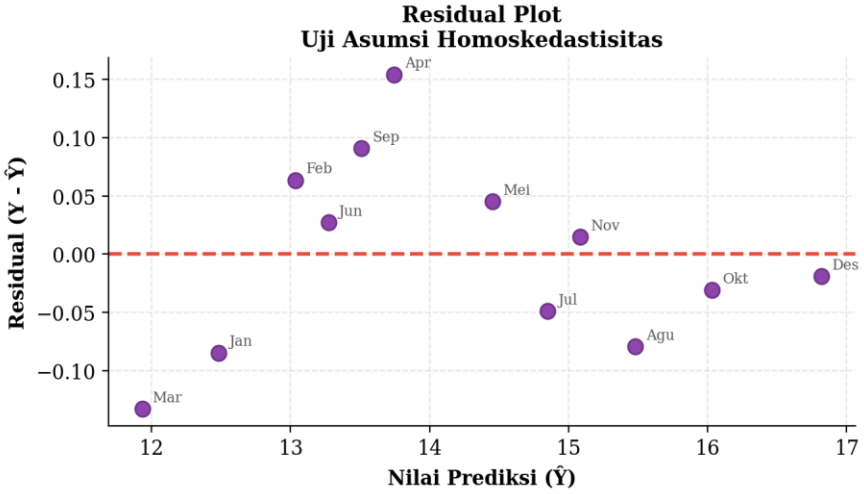

Figure 5. Residual Plot for Homoscedasticity Assessment

Linearity Test

The linearity of the relationship between ship services and revenue is visually assessed through the scatter plot presented in Figure 6. The data points display a clear linear pattern without evidence of curvature or non-linear tendencies. The tight clustering of observations around the fitted regression line further confirms the appropriateness of the linear model specification.

Simple Linear Regression Analysis

The scatter plot with the fitted regression line is presented in Figure 6, illustrating the strong linear relationship between ship service volume and revenue.

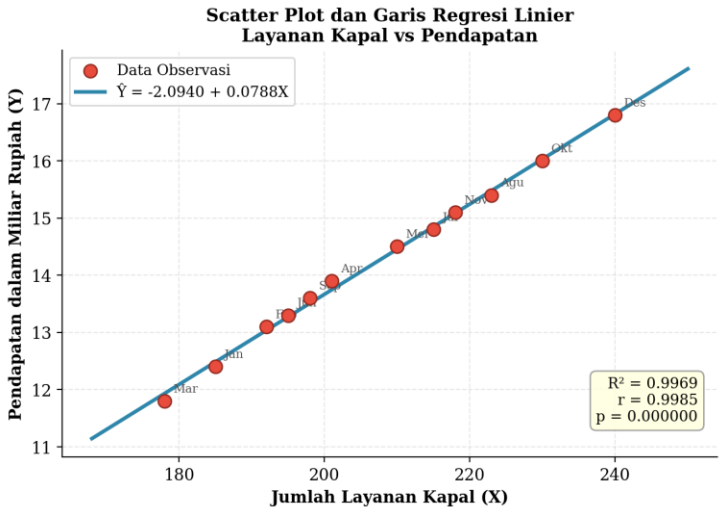

Figure 6. Scatter Plot and Linear Regression Line: Ship Services vs Revenue

The ordinary least squares estimation produces the following regression equation:

$$\hat{Y} = -2.0940 + 0.0788X$$

The regression coefficients are interpreted as follows. The constant value (a) of -2.0940 represents the theoretical revenue value when ship service volume equals zero, which serves as a mathematical anchor for the regression line rather than a practically meaningful value. The regression coefficient (b) of 0.0788 indicates that each additional ship service call is associated with an increase of approximately Rp 0.0788 billion (Rp 78.8 million) in monthly revenue. This positive coefficient confirms the directional hypothesis that increased ship service activity translates into higher revenue for the port operator.

meaningful value. The regression coefficient (b) of 0.0788 indicates that each additional ship service call is associated with an increase of approximately Rp 0.0788 billion (Rp 78.8 million) in monthly revenue. This positive coefficient confirms the directional hypothesis that increased ship service activity translates into higher revenue for the port operator.

Table3. Regression Coefficients

Model	Coefficient	Std. Error	t-statistic	p-value
Constant (a)	-2.0940	0.2867	-7.3052	0.000
Ship Services (b)	0.0788	0.0014	57.0466	0.000

3.1.2. Hypothesis Testing

t-Test (Partial Significance Test)

The t-test is conducted to evaluate the significance of the regression coefficient. The results are summarized in Table 4.

Tabel 4. t-Test Results

Parameter	Value	Decision
t-statistic	57.0466	
t-table (α=0.05, df=10)	2.2281	**t-stat > t-table**
p-value	0.000000	**p < 0.05**
Conclusion	**H_0 Rejected, H_1 Accepted**	

The t-statistic of 57.0466 greatly exceeds the critical t-table value of 2.2281 at the 0.05 significance level with 10 degrees of freedom. Additionally, the p-value of 0.000000 is far below the 0.05 threshold. Therefore, H_0 is rejected and H_1 is accepted, confirming that ship services have a statistically significant positive effect on the revenue of PT. Pelindo Regional 1 Dumai Branch.

F-Test (Simultaneous Significance Test)

The F-test evaluates the overall significance of the regression model. The results are presented in Table 5.

Table 5. ANOVA (F-Test) Results

Source	SS	df	MS	F-stat	F-table
Regression	24.0885	1	24.0885	3,254.31	4.9646
Residual	0.0740	10	0.0074		
Total	**24.1625**	**11**			

The F-statistic of 3,254.31 vastly exceeds the critical F-table value of 4.9646 ($\alpha = 0.05$, $df_1 = 1$, $df_2 = 10$). This result confirms that the regression model as a whole is statistically significant, meaning that ship service volume is a valid predictor of revenue at PT. Pelindo Regional 1 Dumai Branch.

Coefficient of Determination (R^2)

Table 6. Model Summary

R	R^2	Adjusted R^2	Std. Error
0.9985	0.9969	0.9966	0.0860

The correlation coefficient (R) of 0.9985 indicates an extremely strong positive linear relationship between ship service volume and revenue. The coefficient of determination (R^2) of 0.9969 means that 99.69% of the variation in revenue can be explained by the variation in ship service volume. Only 0.31% of revenue variation is attributable to other factors not included in the model. This exceptionally high R^2 value underscores the dominant role of ship services as the primary revenue driver for PT. Pelindo Regional 1 Dumai Branch.

3.2. Discussion

The findings of this study provide robust empirical evidence that ship services exert a very strong and statistically significant positive influence on the revenue of PT. Pelindo Regional 1 Dumai Branch. The regression equation $\hat{Y} = -2.0940 + 0.0788X$ offers a practical tool for revenue forecasting, wherein each additional ship call is expected to contribute approximately Rp 78.8 million to monthly revenue.

The exceptionally high coefficient of determination ($R^2 = 0.9969$) suggests that ship service volume is overwhelmingly the most important factor determining revenue levels at the Dumai Branch. This finding is consistent with the theoretical framework of port economics, which posits that vessel traffic volume serves as the primary driver of port revenue [7]. The result also aligns with the findings of previous studies on port performance, which have demonstrated strong correlations between vessel call frequency and financial performance indicators [4].

The practical implications of these findings are significant for port management. First, the regression model can serve as a reliable forecasting tool, enabling management to project monthly revenue based on anticipated ship call volumes. Second, the strong relationship underscores the strategic importance of marketing efforts aimed at attracting additional vessel traffic to Dumai Port. Investments in service quality improvement, infrastructure expansion, and competitive pricing could yield substantial revenue returns through increased ship call volumes.

Third, the minimal residual variation (0.31% unexplained variance) suggests that other revenue factors, such as cargo handling fees, storage charges, and ancillary services, play relatively minor roles compared to ship services in determining overall

revenue. However, it should be noted that these ancillary revenues may still be partially correlated with ship service volume, as more vessel calls typically generate proportionally more cargo handling and storage activity.

A limitation of this study is the relatively small sample size of 12 monthly observations, which, while adequate for simple linear regression, limits the generalizability of the findings and the power of the statistical tests. Future research could extend the analysis to multiple years of data and incorporate additional variables in a multiple regression framework to capture the effects of vessel size composition, cargo types, seasonal patterns, and macroeconomic conditions on port revenue.

4. CONCLUSION

Based on the results of this study, the following conclusions are drawn. Ship services have a very strong and statistically significant positive effect on the revenue of PT. Pelabuhan Indonesia (Persero) Regional 1 Cabang Dumai. The regression analysis produces the equation $\hat{Y} = -2.0940 + 0.0788X$, indicating that each additional ship service call contributes approximately Rp 78.8 million in revenue. The correlation coefficient (r) of 0.9985 demonstrates an extremely strong positive linear relationship, while the coefficient of determination (R^2) of 0.9969 confirms that 99.69% of revenue variation is explained by ship service volume. Both the t-test (t-statistic = 57.0466 > t-table = 2.2281) and F-test (F-statistic = 3,254.31 > F-table = 4.9646) confirm the statistical significance of this relationship at the 0.05 significance level.

Based on these findings, it is recommended that the management of PT. Pelindo Regional 1 Dumai Branch prioritize strategies to increase ship call volume through enhanced service quality, competitive tariff structures, and targeted marketing to shipping lines. The regression model should be utilized as a financial planning tool for revenue projection and budget preparation. Additionally, continuous monitoring of the ship service-revenue relationship is advised to detect any structural changes in the relationship over time. Future studies should consider expanding the analysis timeframe and incorporating additional explanatory variables to develop more comprehensive revenue prediction models.

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