Analysis of Ship Scheduling at the Kariangau-Penajam Ferries Route in Response to a Decline in Transport Productivity

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Kariangau Crossing Port is a port that connects Balikpapan Regency and Penajam Regency. Based on the data obtained, there was a decrease in productivity data at Kariangau Port from 2020 to 2024 and the ideal load factor was not achieved in March 2025. This study aims to analyze the number of ship needs and the ideal ship scheduling on the Kariangau-Penajam crossing in response to the predicted results of a decrease in productivity data in 2025. The research method used is descriptive-quantitative to obtain the value of the ship's load factor, prediction of transportation productivity data in 2025-2029, the ideal number of ships and the planning of the ship's operational schedule. The results of the calculation of the average load factor value of vehicle departures in March 2025 were obtained at 51%, the result did not reach the ideal condition of 65%. Predicting vehicle departure data from Kariangau Port for 2025-2029 using linear regression analysis processed in SPSS found that there will still be a decrease in productivity data. Therefore, planning for the operational schedule and the number of new ships needs to be done to overcome the decrease in the load factor value at Kariangau Port. This schedule adjustment is expected to improve port operational performance and support the integration of transportation networks in East Kalimantan.

Keyword: *Ship Scheduling, Load Factor, Kariangau Port, Operating Pattern*

1. INTRODUCTION

Transportation modernization has a good impact on the acceleration of human movement, the mobility of production factors and the movement of processed products on the market. Better mobilization means better transportation and equipment in smooth distribution as well as shortening the time it takes to process materials and move them from one location to another [1]. One of the factors that support the mobilization is the transportation network, one of which is the Kariangau Crossing Port.

According to Adisasmita [2] , transportation design is needed to overcome the rate of population growth, traffic volume, and urban and regional development to overcome the problems that arise, serve needs effectively, prevent problems that arise, prepare businesses to overcome problems in the future However, the results of the observations

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carried out found that there is a decrease in transportation productivity data from 2020 to 2024 which affects the value of the load factor on the ship. The productivity data is also predicted to continue to decline in the future due to the access to the transportation network in the form of the Balang Island Bridge which can also connect Balikpapan Regency with Penajam Regency [3].

The decrease in transportation productivity data at the Kariangau Crossing Port causes the need for an analysis of the needs of operating ships and the scheduling of ships at the Port to increase the value of load factor ships to remain in ideal condition in accordance with the Regulation of the Minister of Transportation Number 35 of 2019, which is 65% [4]. Because of these problems, the author published a Mandatory Working Paper (KKW) with the title "Analysis of Ship Scheduling Across the Kariangau-Penajam Crossing Adjustments to the Decline in Transportation Productivity".

2. METHODOLOGY

This The method used by the researcher is a descriptive quantitative method that is carried out by processing statistical data and explaining a problem with data systematically [5]. The method is used to obtain a load factor ships operating in ports, predict the productivity of transportation departures for 2025 to 2029 using the linear regression method, as well as determine the number of ship needs and the ideal ship scheduling for 2026. This research uses research instruments in the form of Mobile, software SPSS and Ms. Excel, with data collection techniques by means of documentation and observation.

3. DISCUSSION

This analysis is a calculation of the existing condition of *the* load factor *value* on all ships operating at Kariangau Port. The data used to make the calculation is data on the productivity of transportation departures for 30 days, precisely in March 2025.

Based on the results of the calculation *of the load factor* value in March 2025 by comparing the amount of available capacity with the capacity used, it was found that the *load factor value* for transportation departures in March 2025 was 51%, this value was below the ideal conditions in accordance with regulations, which was 65%

This analysis is a calculation to predict transportation departures from 2025 to 2029 using a simple linear regression analysis method, where the data processing is calculated using SPSS software. The data used is data on linear trends in transportation

productivity from 2020 to 2024 which has decreased significantly based on the following graph:

Figure 1. Kariangau Port Transportation Departure Productivity Chart for 2020-2024

The variables used to obtain the value of a simple linear regression equation in

predicting the productivity of transportation departures from 2025 to 2029 are the time variable as variable t and the amount of transportation productivity as variable y. So that the equation that will be obtained is [8], The results of data processing using the SPSS program obtained the following results:

Table 1. Test Results

Model Summary and Parameter Estimates

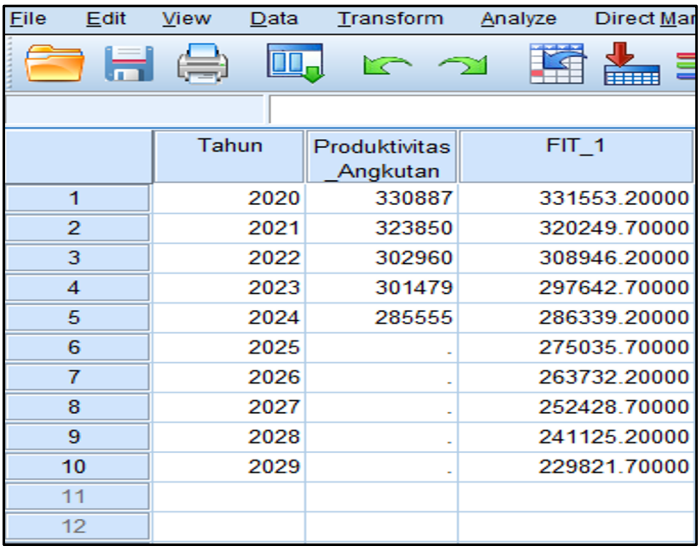
Dependent Variable: Produktivitas_Pelabuhan

Equation	*Model Summary*					*Parameter Estimates*	
	R Square	*F*	*df 1*	*df 2*	*Itself.*	*Constant*	*b1*
Linear	.952	59.361	1	3	.005	342856.700	-11303.500

The results of the table above interpret the data on vehicle departure productivity for the previous 5 years, where the *R Square* value (R2) interprets the determination coefficient value of 0.965 which means that there is an influence of 95.2% of the independent variable (time/year) on the bound variable (port productivity) and the other 4.8% is influenced by other factors. The table also interprets the values of a and b for the regression equation used in predicting the number of freight departures from 2025 to 2029, namely

$$Y = 342.856{,}7 + (-11.303{,}5)t$$

from the results of the equation, using SPSS, namely, click *Analyze* *Regression* *Curve Estimation* *Save* *checklist Predict Values* *Predict Through* : (t = 10, because (2029-2020) +1)) Ok, so that the results are obtained in the data view as follows:



	Tahun	Produktivitas_Angkutan	FIT_1
1	2020	330887	331553.20000
2	2021	323850	320249.70000
3	2022	302960	308946.20000
4	2023	301479	297642.70000
5	2024	285555	286339.20000
6	2025	.	275035.70000
7	2026	.	263732.20000
8	2027	.	252428.70000
9	2028	.	241125.20000
10	2029	.	229821.70000
11			
12			

Figure 2. Transportation Departure Prediction Results in 2025-2029

The results of the prediction of vehicle departure productivity from data processing using SPSS in figure 2 were obtained data in 2025 or in the 6th period, namely 275,036 units of vehicles and will continue to decline until 2029 to 229,822 units of vehicles that will cross through Kariangau Port to Penajam.

The calculation of the planning of the number of ship needs at Kariangau Port in response to the prediction of a decrease in the number of transportation productivity in 2026 is carried out by calculating the prediction of the frequency of ship departures in accordance with the productivity data in 2026 and the components of ship scheduling as follows:

In the analysis of the planning needs of the number of ships operating at Kariangau Port for 2026, it has been known that the number of ships that meet transportation needs in that year is 8 ships with a total of 9 trips/ship. To determine the ship's departure schedule and the ship's arrival time at the port, the calculation of the departure time (*headway* time) between ships is carried out as follows:

$$Headway\ Time = \frac{waktu\ operasional\ pelabuhan}{Fk}$$

$$Headway\ Time = \frac{1440\ menit}{72\ trip/hari}$$

$$Headway\ Time = 20\ menit/trip$$

After all the scheduling components are calculated, the preparation of the schedule of departure and arrival schedules of ships at the port at the Kariangau-Penajam crossing is obtained as follows:

Round Trip Time = 160 minutes
Lay Over Time = 30 minutes
Port Time = 1440 minutes
Sailing Time = 50 minutes
Headway Time = 20 minutes/trip

In this ship scheduling planning, the operating time of the ship's departure on the first trip starts from 06.50 WITA., then

Arrival Time = 2 x *Running time* + *Lay Over Time*
= (2 x 50) minutes + 30 minutes
= 100 minutes + 30 minutes
= 130 minutes
= 2 hours 10 minutes
Arrival Time = 06:50 AM local time + 2 hours 10 minutes
= 09:00 AM local time

To get the next departure time, a calculation is made by adding the previous departure time with *the headway time* as follows:

Next Departure = 06.50 + 20 minutes
= 07.10 WITA.

The schedule planning table for the pattern of 8 ships in operation and 10 ships in service on the first day of 2026 can be seen as follows:

4. CONCLUSION

Based on the results of the analysis, the average value of ship load factor on the Kariangau-Penajam route in March 2025 is 51%. This value is still below the ideal load factor standard of 65% in accordance with PM regulation Number 35 of 2019. The prediction of the number of departure productivity for vehicles from 2025 to 2029, the departure results in 2025 are predicted to amount to 275,036 vehicles, in 2026 there will be 263,732 units of vehicles, in 2027 there will be 252,429 units of vehicles, in 2028 there will be 241,125 units of vehicles, and in 2029 there will be 229,822 units of vehicles. The prediction of the number of ship needs to meet the needs of service users in 2026 is as many as 8 ships/day with the ability of ship trips of 8 trips/ships, as well as the total frequency of ship departures of 72 trips/day, layover time of 30 minutes, round trip time of 160 minutes, with a departure and arrival interval between ships (headway time) of 18 minutes.

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