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Performance of the Semarang Container Terminal

Slamet Hargono , Erhar Augusto

Abstract: ***The number of container boxes handled at the container terminal dynamically fluctuates as a function of a number of parameters. The most prominent variables influencing are the Economics' National Program, the location and trading characteristics of the terminal, and the land use programs of hinterlands. Further, it is one terminal could serve more than one quay simultaneously. This research was conducted in order to determine the optimal performance of container terminals, along with the utilities to the increase in container terminal services Semarang. The results are expected to reveal the existing problems related to the services of a container terminal, especially regarding the following matters: review and develop performance indicators container terminals that is optimized especially for Semarang container terminal (TPKS), knowing the performance level of the container terminal at TPKS utility, and knowing the number of containers optimal service units, ranging from dock to yard container based on the rate of arrival of containers in TPKS. The research methodology used in this study is as follows: conducting a literature study/library, in order to obtain an overview of problems faced by the Semarang container terminal (TPKS), data collection related to the performance of container terminal, processing and analyzing research data to obtain a technical description of the various parameters needed in evaluating the Container Terminal Performance Indicators, Optimal Value of the service unit loading and unloading containers, ships and goods flow forecasting, producing Container Terminal Performance Indicators, formulate conclusions and recommendations from the results obtained in the performance evaluation process and service optimization Container Terminal loading and unloading of containers. The container terminal performance is an important indicator to evaluate the operational continuity and smoothness, in fulfilling its major function in serving the transportation mechanism of goods. One method to evaluate the container terminal performance is to observe the service level and utility of this terminal. From the evaluation's results, a program to improve and to enhance the service levels for the future could be designed. The methodological approach accessed in this research work includes BOR (Berth Occupancy Ratio) data collecting, data processing and analysis using multiple methods, and producing a conclusion. The results are also to typical research topics. The study yielded in a BOR for the period till 2015 based on a BOR mooring of 34 - 45 percent. The benefits of this research can be used to improve container terminal performance.***

Keywords: Container terminal performance, BOR

I. INTRODUCTION

Marine transportation is the backbone of world trade and encourages globalization, as nearly 80% of world trade is seaborne trade (Supriyono, 2010).

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***** Correspondence Author
Slamet Hargono*, Department of Civil Engineering, Diponegoro University, Indonesia Email: hargono@gmail.com
Erhar Augusto , Ministry of Public Works, Indonesia

At the moment, the Government is trying to create the World Maritime Axis, so that the Indonesian marine transportation system must be efficient, Evenly, competitively, safely and sustainably, one of them is by developing container ports or terminals in Indonesia.

Container Terminal is a place of interfacial modes of transportation between the land transport
modes and the container sea freight. it is a limited area (districted area) where the container down from the ship until it is taken out of the terminal door. Containers have become one of the main options in shipping cargo in world trade. Delivery of goods by container has been widely used and the volume is increasing from year to year. Statistics show that more than 90% of international cargo is transported via marine mode with the container terminal as an interfacial transfer, in addition the cargo and shipping from around the world also tends to increase exponentially (Supriyono, 2010).

Indonesia ranks 9th of the largest container volume with the largest port country in the world. the current data mentioned that the world's trade traffic through the sea grew about 4 percent per year and has reached 8.7 billion tons (in 2012) with a proportion of containers of about 1.4 billion tons (151 million Twenty-foot equivalent unit (TEU's)). Twenty-foot equivalent unit is a measure used for capacity in container transportation. Based on figures given, 60 percent of them come from developing countries with the main pattern of European-Asian-American movement (Anwar Iqbal, 2014) In Semarang container
terminal (Terminal Peti Kemas Semarang), the volume of container loading keep increasing on five year period between 2009 until 2013 with the every year average growth is between 5-10 percent, while from 2013 to 2014 the growth reaches 15 percent. According to Manager of Semarang container terminal, the condition related with the higher the volume of shipments from Semarang to a number of countries. Three years ago, the highest volume occurred in May 2014 coincident with the summer in western countries including Australia and United States.

Based on the number of ships, according to the data of Semarang container terminal in 2009, the number of vessels reached 560 ships, 2010 as many as 573 ships, 2011 as
many as 596 ships, 2012 as much as 528 ships, 2013 as many as 566 ships, and in 2014 reached 662 ships. While the loading containers volume in 2009 reached 219,332 boxes or 356,461 teu's, in 2010 reached 236,245 boxes or 384,522 teu's, 2011 reached 265,478 boxes or 427,468 teu's, 2012 reached 286,405 boxes or 457,055 teu's, in 2013 reached 311,525 boxes Or 498,703 teu's, and in 2014 it reached 359,135 boxes with a capacity of 575,670 TEUs. (Aris Wasita W, 2015).

Considering the growth of container loading, Semarang container terminal plans to develop a wharf with an extension of 105 m to 600 m from its 495 m construction beginning in early 2014. Therefore, it is necessary to study the performance of container terminals, whether it is necessary to have an extension.

To evaluate the performance of container terminals in the Semarang container terminal it is necessary to measure the performance of container terminals. Previous research, Oktavera Sulistiana, et al (2011) conducted a study on Operational Performance Analysis of Container Terminals in Eastern Indonesia. Fitra N.B (2010) conducted a study on the Development of Terminal Container Port of Pontianak. Merdekawati, Anastasia N S. (2013). Review of the Performance of Loading and Unloading Facility at Port I. Say Maumere. The weakness of this research is the lack of data to support the calculation of Berth Occupancy Ratio (BOR). One indicator of container terminal performance measures is Berth Occupancy Ratio (BOR). BOR can be calculated using 2 equations, BOR based on mooring and BOR in general.

II. MATERIAL AND METHODOLOGY

In this research the data used are: the number of the loading of containers, the length of the ship (LOA), the mooring time, the length of the dock, the available moorings, the number of available hours, the number of days available, and the productivity of the container crane equipment. The data obtained from the Semarang container terminal office is data from 2012 to 2014.

Next step is to process data using two equations, namely Berth Occupancy Ratio (BOR) based on mooring and BOR in general (B. Triatmodjo, 2010). For BOR based on data mooring processed by equation as follow .

$$BOR = \frac{\sum(LOA + safe\ area)x\ mooring\ time}{length\ of\ dock\ x\ available\ time} x\ 100\%$$

BOR: expressed in%

LOA: The length of the vessel (m)

Safe area: safe distance between boats in moorings, 10 m for small boats and 20 m for large boats (B. Triatmodjo, 2010).

For BOR in general data is processed by equation as follow .

$$BOR = \frac{VsxSt}{effective\ time\ x\ n} x\ 100\%$$

Vs: number of vessels served (unit / year)

St: service time (hour / day)

N: number of moorings

Effective time: the number of days in a year

Service time (St) alone can be calculated using the following equation assuming Not Operation time is taken 20% of effective time (B. Triatmodjo, 2010);

$$St = \frac{ship\ cavacity\ (TEUs/ship)}{Productiviy\ CC\ x\ number\ of\ row} x\ (1 + 0{,}20)$$

Terminal congestion will arise if the terminal capacity is not proportional to the number of ships and goods that will be loaded indicated by terminal performance indicators (BOR). This phenomenon can occur if at a terminal has a sudden need or slowness of loading service in the terminal. Ships and goods forced to wait for days or even weeks outside the terminal to unload their cargo. When this happens, the economy of a country will be greatly affected and the whole voyage will feel the consequences. Therefore, BIMCO (The Baltic and International Maritime Conference), or the association of ship owners in this case representing United Nations Conference on Trade and Development (UNCTAD) makes suggestions to avoid congestion terminal showed in table 1. If number of berths in the group is equal two, so recomended maximum for Berth Occupancy Ratio (BOR) is equal 50%. The more moorings on the warf, the BOR value will increase.

Table 1. Congestion with maximum BOR

Number of berths in the group	Recomended Maximum Berth Occupancy (%)
1	40
2	50
3	55
4	60
5	65
6-10	70
>10	80

(Source : B.Triatmodjo, 2010)

By obtaining the BOR value from equation (1) and equation (2), the density level of a terminal can be measured, besides, the BOR is also an indicator that determines whether a terminal still fills the load to serve vessels and goods or requires developers. Meanwhile, to see the current trend of vessels and containers will be processed using a simple linear regression method on MS. Excel. This trend is used to evaluate the value of BOR for the future, the method shows the relationship of two variables with the form of equation (Supriyono, 2010) as follows:

$$Y = A + B\ X$$

Y = regression value for a certain period

A = the regression constant for a given period

B = average annual regression increase

X = number of annual units calculated from a certain period

III. RESULTS AND DISCUSSION

In general, the Berth Occupancy Ratio (BOR) value is the result of the comparison between the length of mooring and the time available. The calculation of the BOR value in the Semarang container terminal itself is calculated using two equations, namely BOR by mooring and BOR in general. The use of these two equations is due to the number of moorings in 2012-2014 of a number of two moorings, where in the port planning book (B. Triatmodjo, 2010) for BOR values with more than one moorings can be calculated using both equations. The BOR values for both equations are presented in table 2.

Table 2. BOR value for 2 mooring time 2012 -2014

Year	BOR by mooring (%)	BOR in general (%)
2012	41.11	34.39
2013	38.97	35.22
2014	45.14	40.93
∑	125.22	110.54
Average	41.74	36.85

The BOR value in table 2 is still smaller than the UNCTAD recommended BOR value for two moorings of 50%. However, on average BOR value in table 2 there is a difference between BOR by mooring and BOR in general at 4.89%.

This can happen because of the different parameters. In BOR based on the mooring, the main parameters used are the length of the vessel added with the safe area (safe distance between ships) and the available dock length. If the BOR value exceeds that of the

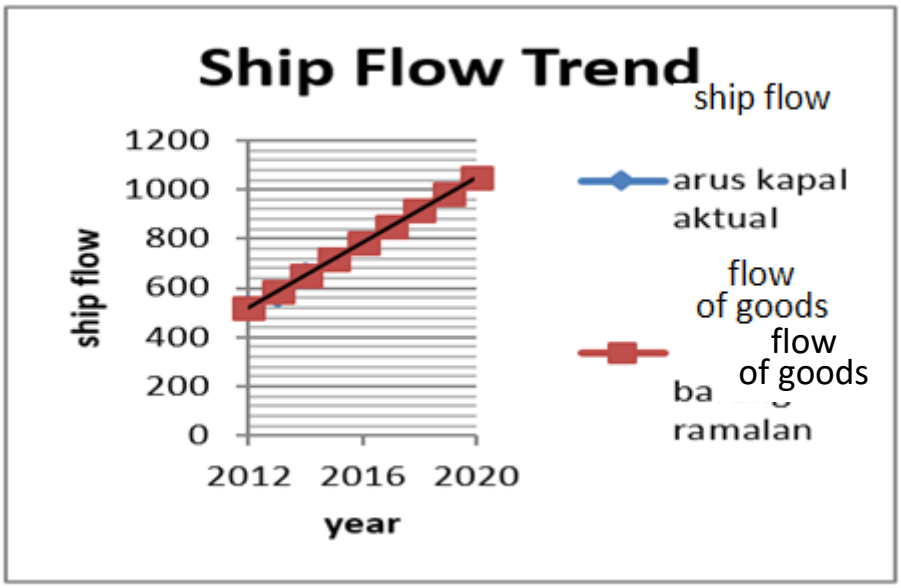

Fig. 1. Trend of Ship Flow (Linear Regression).

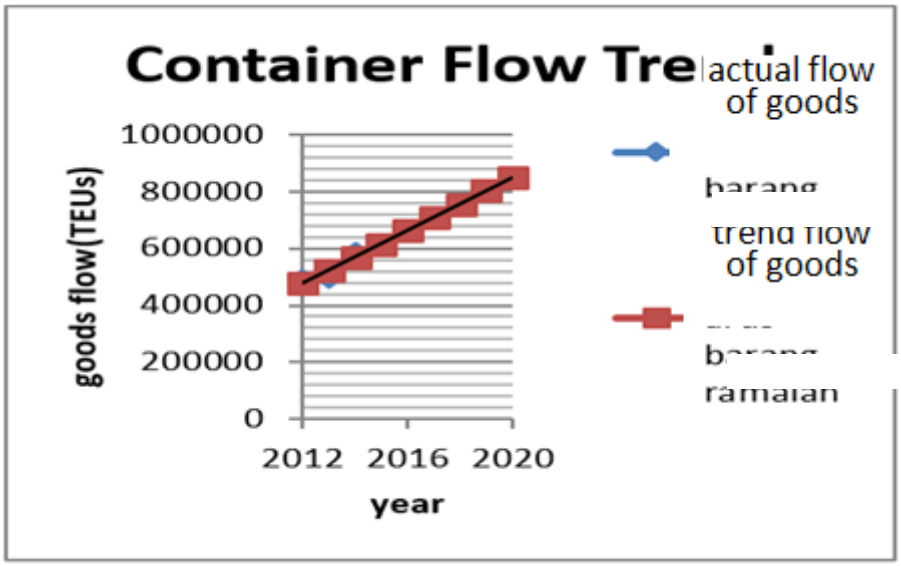

Fig. 2. Trend of Container (Linear Regression).

UNCTAD provisions, the thing to be increased is the addition of the dock length. While in BOR in general, the main parameters used more to the service time of the total ship. So if the BOR value exceeds UNCTAD terms, then the dock time of each ship must be limited.

Pointed at the picture 1, trend of ship and container flows is shown to predict the performance capability of port services up to 2020 based on actual data processing from 2012-2014. The trends are calculated based on simple linear regression with the Ms. program Excel. In figure 1

is show the current trend of the ship where by the end of 2020 the flow of ships reaches 1,050 ships. The tendency of ship flow and the flow of goods is the same.

In figure 2, it is aimed at the container trends which by the end of 2020 container flows reach 848,313 Twenty-foot equivalent unit (TEU's). The trend of the actual flow of goods with the flow of forecasts is the same.

From the calculation of the current trend of vessels and containers in Figures 1 and 2, BOR values in future TPKS can be predicted. Where in 2018 the value of BOR in TPKS reached 53.20% with ship flow of 917 vessels and container flows of 755,408 TEUs. This indicates that terminal performance especially in warf service has been densely packed because the value of BOR has exceeded UNCTAD requirements, so there is an need for an increase in the warf to optimize service.

IV. CONCLUSIONS

From Berth Occupancy Ratio (BOR) results based on data from 2012-2014, BOR value was obtained at end of 2014 for BOR based on mooring of 45.14% and for BOR in general amounted to 40.93%. Both BOR values are still below the United Nations Conference on Trade and Development (UNCTAD) requirements that indicate the performance of the terminal especially the dock service is still optimal.

There is a difference between BOR based on moorings and BOR in general, this is because the use of parameters contained in each of the equations is different. In BOR based on the mooring, the main parameters used are the length of the vessel added with the safe area (safe distance between ships) and the available warf length. While in BOR in general, the main parameters used more to the service time of the total ship.

Based on the calculation of ship and container flow trends with simple linear regression method, dock service in 2018 is not able to properly serve the ship flow of 917 ships and container flows of 755,408 TEUs. This is indicated by the BOR value reaching 53.20% where this value has exceeded the UNCTAD requirements.

Based on the calculation of BOR in 2012 - 2014 the extension of the warf has not been required.

However, in anticipation of a container and vessel flow surge by 2018, which is based on trends, the extension of the pier can be done from now so that the BOR value in 2018 does not exceed the UNCTAD requirements.

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