Effect of Berthing Time and Berth Output on Conventional Donation Utilization at PT Pelindo II Palembang Branch

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ABSTRACT

Boombaru Port which is managed by PT Pelindo II Palembang Branch is a marine transportation infrastructure that plays an important role and function in the transportation wheel in the South Sumatra area. This is because this port is located in the city of Palembang as a center of government, trade and activitiestourism in South Sumatra. Based on data in 2017, the problem at this port is the high berthing time of ships at conventional docks, the realization of berth output is lower than the potential amount of cargo unloaded and loaded at conventional docks, and not achieving the target of conventional dock utilization. The purpose of this study is to find out and analyze how much influence berthing time, berth output together on the utilization of conventional docks. This research was conducted by collecting and processing data on ship and goods service performance and facilities and equipment utilization format reports in 2017. In this study it was found the average loading and unloading speed based on berthing time at conventional docks does not meet the loading discharge rate that has been determined based on the service level agreement. There is a difference in value between loading discharging rate with time and the loading discharging rate with working time. To optimize the utilization of conventional docks to match the predetermined RKA, streamlining the berthing time faster so that the output berth will also be optimized properly. To streamline berthing time and optimize berth output by accelerating loading and unloading activities at conventional docks by increasing the number of loading and unloading equipment at conventional docks such as jib cranes and head trucks. For the use of one jib crane/hour unit requires three head truck units. So for the addition of one jib crane unit also requires three head truck units. In order to support the loading and unloading activities at conventional docks and to avoid the high idle time at berthing time of the ship, care and maintenance of the loading and unloading equipment is needed so that the loading and unloading equipment can always be used.

Keywords: Berthing Time, Berth Output, Berth Occupancy Ratio, Dock Utilization
JEL Classifications: L62, R41, R42

1. INTRODUCTION

Port Performance Indicators (Chang, 2013), namely:
1. Service
   Port performance indicators on the service side of the ship are waiting time, approach time, postpone time, not operation time, idle time, effective time, berthing time, working time, and turn around time.
2. Output
   Performance indicators show how many items are loading and unloading in tons/cubic meters, and also boxes.

3. Utilization
   Utilization performance indicator shows the comparison between the time of use of the dock, warehouse buildup, and also the buildup in the field.

According to (Berthon et al., 2012) berth time (BT) or mooring time is the amount of time during the ship is at mooring, since the ship tied to a rope off the mooring rope.

According to (Knapp and Van De Velden, 2011) time of ship berthed is the amount of time during mooring both working and

not working for all ships during moorings divided by the number of ships (can be interpreted the same as service time).

According to (Habib et al., 2013) berthing time is the time taken during mooring at the pier to carry out loading and unloading activities which are calculated from the first rope tied to the dock until the release of the last mooring rope from the dock.

According to (Chang, 2013) berth output or berth troughput is the amount of cargo and unloading through the pier divided by the length of the pier in ton/m³ units in a reporting period.

According to (Crowley, 2008) berth throughput or berth output is the number of goods unloaded at mooring.

Utilization of conventional piers is used to measure the extent to which conventional pier facilities are used intensively. The level of use of the pier or so-called berth occupancy ratio (BOR).

According to (Ghemawat, 2017) the berth occupancy ratio (BOR) is a comparison between the amount of time of use of each available pier divided by the amount of time available during one period (month/year) stated in the percentage.

According to (Chang, 2013) port performance is shown by the BOR or dock usage level, which is a comparison between the amount of dock time used and the amount of time available during one period expressed in percent. Port performance indicators are used to measure the extent to which dock facilities and supporting facilities are used intensively.

Problems that are often experienced at the Palembang branch of PT Pelindo II are one of the high berthing time of ships at the conventional dock, the realization of output berth is lower than the potential amount of cargo unloaded and loaded at the conventional dock of the Palembang branch of PT Pelindo II and not achieving targets on dock utilization.

1.1. Objectives and Research Benefits
1. Research purposes
   a. To find out and analyze how much the influence of berthing time on conventional dock utilization.
   b. To find out and analyze how much the influence of berth ouput on conventional dock utilization.
   c. To find out and analyze how much influence berthing time, berth output together to the utilization of conventional docks.
2. Benefits of research
   a. Can be useful theoretically and contribute to the development of science in the port sector. And as a material consideration to better know about the factors that can cause high berthing time and the amount of realization of output berth exceeds the budget work plan that has been at the port.
   b. Can be input to the port of a scientific nature in order to evaluate whether the performance and service commitment At ABC nan as well as preparations were made to minimize the berthing time and berth ouput

so as to me nReach target at a predetermined dock utilization.

2. METHODOLOGY

2.1. Data Description
2.1.1. Berthing time
This is the time the ship is used during mooring at the dock to carry out loading and unloading activities which are calculated from the first rope tied to the dock until the last mooring rope is released from the dock.

The following is a recapitulation regarding ship berthing time (X_1) starting from January 2017 to December 2017, including Table 1:

2.2. Berth Output
This is the number of goods unloaded through each meter of the pier length available.

The following is a recapitulation regarding berth output (X_2) from January 2017 to December 2017, including Table 2:

2.3. Conventional Dock Utilization
This is the level of use of conventional wharves used to measure the extent to which conventional wharf facilities are used incentives. The level of use of the pier or so-called BOR is the ratio between the amount of time used for each available pier divided by the amount of time available during 1 period.

The following is a recapitulation regarding the utilization of conventional docks (Y) from January 2017 to December 2017, including Tables 3 and 4:

2.4. Research Time
This research was conducted at the time the authors conducted a Land Practice at PT Pelindo II Palembang Branch starting from August 8, 2017 to November 3, 2017.

2.5. Research Sites
This research was conducted by the authors at the Palembang branch of PT Pelindo II, namely at the Boom Baru Conventional Port of Palembang.

Table 1: Ship berthing time for 2017 (Hours)

Month	Berthing time (X_1)
January 2017	1,821,55
February 2017	2,713.80
March 2017	2,419,35
April 2017	2,301.73
May 2017	2,379.43
June 2017	2,422.37
July 2017	2,404.75
August 2017	2,701.10
September 2017	2,522.60
October 2017	2,060.67
November 2017	2,984.87
December 2017	3,280.62
Total	3012,84
Average	2,501.07

Table 2: Berth output for 2017 (Ton/M)

Month	Utilization of conventional derma (y)
January 2017	53.18
February 2017	69.96
March 2017	71.93
April 2017	60.25
May 2017	60.86
June 2017	57.61
July 2017	63.46
August 2017	68.17
September 2017	59.48
October 2017	52.95
November 2017	71.89
December 2017	69.35
Total	759.09
Average	63,2575

Table 3: Conventional dock utilization (BOR) in 2017 (%)

Month	Berth Output (X_2)
January 2017	291.76
February 2017	418,15
March 2017	321.64
April 2017	295.28
May 2017	295,32
June 2017	312.44
July 2017	296.48
August 2017	358.82
September 2017	349.96
October 2017	271,33
November 2017	395.90
December 2017	445.87
Total	4052.95
Average	337,7458

Table 4: Data on the number of loading and unloading at conventional wharfs in 2017

Month	Unloading (ton)	Load (ton)	Number of unloading (tons)
1	44,090	94,060	138,150
2	55301	132,040	187,341
3	57,645	86,040	143,685
4	42,432	89,331	131,763
5	64,191	67,810	132,001
6	53,667	85,574	139,241
7	52,280	80,041	132,321
8	68,720	91,599	160,319
9	77,846	87,263	165,109
10	53,774	67,457	121,231
11	78,000	99,013	177,013
12	87,699	111,709	199,408
Total	735,645	1,091,937	1,827,582

2.6. Approach Method

In this study using a quantitative data approach method. In this study the data obtained and analyzed in the form of secondary data, that is data that has been obtained from reading scientific literature that has a close relationship with the object of research that is the operation of the ship during the port. For example, the authors get data on the performance reports of ships and goods in 2017, the report on the 2017 utilization format and definitions of understanding from the reference books in the library, etc.

2.7. Data Collection Techniques

In completing this research the writer collected data and information needed to complete this thesis material by using "Field Research." Field research is research to obtain the data needed through direct observation and interviews and taking secondary data about the company PT Pelindo II Palembang Branch. In this field research using the following techniques.

a. Observation

Observation is a method of collecting data where the research records information as they witnessed it during the study. Witnessing these events can be seen, heard, felt and then recorded subjectively (Sofiati and Limakrisna, 2017).

In this technique, the author uses research directly by visiting the place under study. In this observation researchers looked directly and observed work activities in the planning and control of ship operations at PT Pelindo II Palembang Branch. Where in the observation section, the authors observe the results of unloading and loading activities on conventional docks in order to get information and factual events from the field regarding Berthing Time and Berth Output and their effects on Conventional Dock Utilization.

b. Documentation

According to (Arikunto, 2019), documentation originates from the origin of said documents which means written goods. In carrying out the method of documentation, researchers investigate written objects such as books, magazines, documents, regulations, minutes of meetings, diaries and so on. From the study of this document the authors obtain data in the form of a recapitulation of unloading activities in 2017, which consists of the amount of unloading and loading of goods, loading and unloading time and records of the use of tools during the unloading and loading activities.

c. Literature review

Namely the collection of data by way of reading, viewing, researching, quotes from books or references presented, input or consideration and comparison menegenai what can be seen from existing theories.

This literature study aims to obtain the basics of theory by reading books including regulations and other documents relating to the problem to be discussed.

In taking data by means of literature study taken from books and references, among others:
1. Shipping (Capt. RP Suyono)
2. Port Planning (Bambang Triatmodjo)
3. Management of Sea and Port Transportation Operations (Suranto, SE)
4. Port Business Management (Raja Oloan Saut Gurning, ST., M.Sc., And Dr. Eko Hariyadi Budiyanto, Ak.MM.M.Sc.)

2.8. Research Subjects

The population consists of a group of objects that are the center of attention, which contain information that wants to be known (Blinch et al., 2011).

The sample is a subset of a population, the sample provides a true picture of the population. Taking a sample from a population is

called sampling. The population that is sampled when planning a study is called the target population, while the population studied when conducting research is called the sampling population (Nur'ainy et al., 2013).

In this case, the population taken by the author in the preparation of this thesis is the data of all the activities of loading and unloading of goods during the last 6 months at the conventional pier, and calculated in the period of months in the period January 2017–December 2017 at the Conventional Pier of the Boom Baru Palembang Port.

3. RESULTS AND DISCUSSION

The following is a recapitulation of ship berthing time (X_1), berth output (X_2) and recapitulation of conventional dock utilization (Y) from January 2017 to December 2017, including Table 5:

3.1. Correlation of Relationships between Ship Berthing Time (X_1) Against Conventional Dock Utilization (Y)

Table 6, calculation of the correlation between the variables X_1 and Y variables. Based on the table above, the numbers can be obtained through statistics as follows:

a. Validity test

Validity test is done to determine the level keandalah and validity of variables berthing time of the ship (X_1) of the utilization of conventional dock (Y) the validity of the formula used together with a correlation coefficient formula as follows.

$$r_{x1y} = \frac{n.\sum X_1 Y. - \sum X_1.\sum Y}{\sqrt{n.\sum X_1{}^2 - (\sum X_1)^2}\sqrt{n.\sum Y^2 - (\sum Y)^2.}}$$

$$r_{x1y} = \frac{(12)(1.921.784,85) - (30.012,84)(759,09)}{\sqrt{(12)76.724.085,68 - (30.012,84)^2}.}$$
$$\sqrt{(12)48.542,84 - (759,09)^2}$$

$$r_{x1y} = \frac{23.061.418,18 - 22.782.446,72}{\sqrt{920.689.028,19 - 900.770.564,87}.}$$
$$\sqrt{582.514,09 - 576.217,63}$$

$$r_{x1y} = \frac{278.971,46}{\sqrt{19.918.463,32}.\sqrt{6.296,47}}$$

$$r_{x1y} = \frac{278.971,46}{(4.463,01)(79,35)}$$

$$r_{x1y} = \frac{278.971,46}{354.139,84}$$

$$r_{x1y} = 0.79$$

To test the validity of membukitkan variable berthing time ship (X_1) of the utilization of conventional dock (Y) according to the calculations

Table 5: Ship berthing time (X_1), berth output (X_2) and conventional dock utilization (Y)

Month	X_1	X_2	Y
1	1,821,55	291.76	53.18
2	2,713.80	418,15	69.96
3	2,419,35	321.64	71.93
4	2,301.73	295.28	60.25
5	2,379.43	295,32	60.86
6	2,422.37	312.44	57.61
7	2,404.75	296.48	63.46
8	2,701.10	358.82	68.17
9	2,522.60	349.96	59.48
10	2,060.67	271,33	52.95
11	2,984.87	395.90	71.89
12	3,280.62	445.87	69.35
Total	3012,84	4052.95	759.09

Table 6: Correlation of variables

X_1	Y	$X_1 Y$	$(X_1)^2$	Y^2
1,821,55	53.18	96,870.03	3,318,044.40	2,828.11
2,713.80	69.96	189,857.45	7,364,710.44	4,894.40
2,419,35	71.93	174,023.85	5,853,254.42	5/173.92
2,301.73	60.25	138,679.23	5,297,960.99	3,630.06
2,379.43	60.86	144,812.11	5,661,687.12	3,703.94
2,422.37	57.61	139,552.74	5,867,876.42	3,318.91
2,404.75	63.46	152,605.44	5,782,822,56	4027.17
2,701.10	68.17	184,133.99	7,295,941.21	4,647,15
2,522.60	59.48	150,044.25	6,363,510.76	3,537.87
2,060.67	52.95	109,112.48	4,246,360.85	2,803.70
2,984.87	71.89	214,582.30	8,909,448.92	5,168.17
3,280.62	69.35	227,511.00	10,762,467,58	4,809.42
3012,84	759.09	1,921,784.85	76,724,085.68	48,542.84

are obtained in figure correlation coefficient of (0.79), so that the figure validity of (0.79) then do is to look for r_{count} is based on the criteria of the provisions df (degree of freedom) premises the value of n (number of samples) note 12, df = $n - 2$ then becomes df = 12 − 2 i.e. 10 later than r_{table} at α = 0.05; then it is 0.576 (from r_{table}).

Then, the results obtained are $r_1 = r_{arithmetic} = 0,79$, because $r_{arithmetic} > r_{table}$ (0.79 > 0.576). So it can be concluded that the variable berthing time of the ship (X_1) against the conventional dock utilization (Y) is declared valid.

b. Regression Correlation Coefficient Analysis

To find out the strength or weakness of the relationship between variable X_1 and Y, then this analysis will find out the value of r (correlation coefficient), namely by the formula:

Regression correlation coefficient formula = Validity test formula

$$r_{x1y} = \frac{n.\sum X_1 Y. - \sum X_1.\sum Y}{\sqrt{n.\sum X_1{}^2 - (\sum X_1)^2}\sqrt{n.\sum Y^2 - (\sum Y)^2.}}$$

$$r_{x1y} = 0.79$$

From the above calculation, the correlation coefficient figure of (0.79) is obtained, which means that there is a strong influence between the berthing time of the ship on the utilization of conventional docks. If the correlation results are positive, it can

be interpreted if the berthing time of the ship increases, it will also increase the utilization of conventional docks. Vice versa, if there is a decrease in the ship berthing time it will reduce the utilization of conventional docks.

c. Analysis The coefficient of determination (KD = R²)
Analysis of the coefficient of determination is to find out how much the contribution of the berthing time variable of the ship (X_1) to the conventional dock utilization (Y) is used the formula of the coefficient of determination as follows:

$KD = r^2 \times 100\%$
$KD = (0.79)^2 \times 100\%$
$KD = 0,63 \times 100\%$
$KD = 63\%$

With the regression line value ($r^2 = 0,63$) close to 1, it is said to be feasible to use. Then the coefficient of determination is 63% indicating that the value is worth continuing to predict by using a regression formula in which 63% of the berthing time of a ship affects conventional dock utilization and 37% by other factors.

d. Hypothesis testing
Hypothesis testing about the correlation coefficient. Judging from the calculation of the correlation coefficient, determination and regression line, then the hypothesis test can be done to determine the influence of the berthing time of the ship on the conventional dock utilization at PT Pelindo II Palembang Branch.

1) Partial Correlation Coefficient Test (T Test)
Hypothesis tests used by the authors are as follows:
To prove that H_1 is accepted or rejected, then what is done is to look for $t_{arithmetic}$ by step in entering the value (r) into the formula, the value of n (number of samples) is known to be 12, then compared to t_{table} at $\alpha = 0.05$; df = nk where k is the number of variables (free + bound) and n is the number of observations/samples forming the regression. So df = 12 − 2 = 10 is 1,812 (from t_{table}).

$t_1 = t$ count

$$t_1 = \frac{r\sqrt{n-2}}{\sqrt{1-(r)^2}} = \frac{(0.79)\sqrt{12-2}}{\sqrt{1-(0,79^2)}} = \frac{(0.79)\sqrt{10}}{\sqrt{1-0,63}}$$

$$= \frac{(0,79) \cdot 3,16}{\sqrt{0,37}} = \frac{2.50}{0.61} = 4,10$$

Then, the results obtained are $t_1 = t_{arithmetic} = 4,10$, because $t_{arithmetic} > t_{table}$ (4.10 > 1,812). So H_0 is rejected and H_1 is accepted, meaning that there is a significant relationship between X_1 and Y. So there is a significant relationship between ship berthing time and conventional dock utilization at PT Pelindo II Palembang Branch.

2) Simultaneous Correlation Coefficient Test (Test F)
Hypothesis tests used by the authors are as follows:
To prove that H_1 is accepted or rejected, what is done is to find $f_{arithmetic}$ by step in entering the value (r) into the formula, the value of n (number of samples), the degree of freedom (df) for the numerator or known as df$_1$ with the symbol $N1$, degree of freedom (df) for the denominator, or known as df$_1$ with the symbol

$N2$ then compare the f_{table} at $\alpha = 0.05$; df$_1 = k − 1$; df$_2 = nk$ where k is the number of variables (free + bound) and n is the number of observations/samples forming the regression. Can be calculated:
df$_1 = k − 1$
$= 2 − 1 = 1$
df$_2 = n − k$
$= 12 − 2 = 10$
So that $N1 = 1$ and $N2 = 10$ then f$_{table} = 4,96$.

$f_1 = f_{hitung}$

$$f_{hitung} = \frac{r^2/k}{1-r^2/(n-k-1)} = \frac{(0,79)^2/2}{1-(0,79)^2/(12-2-1)}$$

$$= \frac{0,63/2}{1-0,63/9} = \frac{0,315}{0,04}$$

$$= 7,88$$

Then, the results obtained are $f_1 = f_{arithmetic} = 7,88$, because $f_{arithmetic} > f_{table}$ (7.88 > 4.96). So H_0 is rejected and H_1 is accepted, meaning that there is a significant relationship between X_1 and Y. So there is a significant relationship between ship berthing time and conventional dock utilization at PT Pelindo II Palembang Branch.

3.2. Correlation of Relationships between Berth Output (X_2) and Conventional Dock Utilization (Y)
Table 7, calculation of the correlation between the variables X_2 and Y variables. Based on the table above, the numbers can be obtained through statistics as follows:

a. Validity test
Validity test is done to determine the level keandalah and validity of variables berth output (X_2) of the utilization of conventional dock (Y) used the same formula to the validity of the correlation coefficient formula as follows:

$$r_{x2y} = \frac{n.\sum X_2Y - \sum X_2.\sum Y}{\sqrt{n.\sum X_2^2 - (\sum X_2)^2}\sqrt{n.\sum Y^2 - (\sum Y)^2}}.$$

$$r_{x2y} = \frac{(12)(259.508,86) - (4.052,95)(759,09)}{\sqrt{(12)1.403.729,56 - (4.052,95)^2}.\sqrt{(12)48.542,84 - (759,09)^2}}$$

$$r_{x2y} = \frac{3.114.106,32 - 3.076.553,82}{\sqrt{16.844.754,77 - 16.426.403,70}.\sqrt{582.514,09 - 576.217,63}}$$

$$r_{x2y} = \frac{37.552,50}{\sqrt{418.351,07}.\sqrt{6.296,47}}$$

$$r_{x2y} = \frac{37.552,50}{(646,80)(79,35)}$$

Table 7: Results of analysis of berth output (X_2) on conventional dock utilization (Y)

X_2	Y	X_2Y	$(X_2)^2$	Y^2
291.76	53.18	15515.80	85,123.90	2,828.11
418,15	69.96	29,253.77	174,849.42	4,894.40
321.64	71.93	23,135,57	103,452.29	5,173.92
295.28	60.25	1790.92	87,190.28	3,630.06
295,32	60.86	17,973.18	87,213.90	3,703.94
312.44	57.61	17,999.67	97,618.75	3,318.91
296.48	63.46	18,814.62	87,900.34	4027.17
358.82	68.17	24,460.76	128,751.79	4,647,15
349.96	59.48	20,815.62	122,472.00	3,537.87
271,33	52.95	14,366.92	73,619.97	2,803.70
395.90	71.89	28,461.25	156,736.81	5,168.17
445.87	69.35	30,921.08	198,800.06	4,809.42
4052.95	759.09	259,508.86	1,403,729,56	48,542.84

$$r_{x2y} = \frac{37.552,50}{51.323,58}$$

$$r_{x2y} = 0.73$$

To test the validity of membukitkan variable berth output (X_2) of the utilization of conventional dock (Y) according to the calculations are obtained in figure correlation coefficient of (0.73), so that the figure validity of (0.73) then do is to find r_{count} that is based on the criteria with the provisions of df (degree of freedom) with the value of n (number of samples) known 12, df = $n − 2$ then it becomes df = 12 − 2 which is 10 then compared to r_{table} at $\alpha = 0.05$; then it is 0.576 (from r_{table}).

Then, the results obtained are $r_1 = r_{arithmetic} = 0.73$, because $r_{arithmetic} > r_{table}$ (0.73 > 0.576). So it can be concluded that the variable berth output (X_2) against the conventional dock utilization (Y) is declared valid.

3.3. Regression Correlation Coefficient Analysis

To find out the strength or weakness of the relationship between the variables X_2 and Y, then this analysis will find the value of r (correlation coefficient), namely by the formula:

Regression Correlation Coefficient Formula = Validity Test Formula

$$r_{x2y} = \frac{n.\sum X_2Y - \sum X_2.\sum Y}{\sqrt{n.\sum X_2{}^2 - (\sum X_2)^2}\sqrt{n.\sum Y^2 - (\sum Y)^2}.}$$

$$r_{x2y} = 0.73$$

From the above calculation, the correlation coefficient figure of (0.73) is obtained, which means that there is a strong influence between the berth output on the utilization of conventional docks. If the correlation results are positive, it can be interpreted if the berth output increases, it will also increase the utilization of conventional docks. Vice versa, if there is a decrease in output berth it will reduce the utilization of conventional docks.

a. Analysis The coefficient of determination (KD = R^2)
Analysis of the coefficient of determination is to determine how big contribution of variable berth output (X_2) of the utilization of conventional dock (Y) used formula coefficient of determination as follows:

$KD = r^2 \times 100\%$
$KD = (0.73)^2 \times 100\%$
$KD = 0.53 \times 100\%$
$KD = 53\%$

With a regression line value ($r^2 = 0.53$) close to 1, it is said to be feasible to use. Then the coefficient of determination is 53% indicating that the value is worth continuing to predict by using a regression formula where 53% of berth output affects the utilization of the dock and 47% by other factors.

b. Hypothesis testing
Hypothesis testing about the correlation coefficient. Judging from the calculation of the correlation coefficient, determination and regression lines, the hypothesis test can be done to determine the effect of the berth output on the utilization of conventional docks at PT Pelindo II Palembang Branch.

1. Partial correlation coefficient test (t test)
Hypothesis tests used by the authors are as follows:
To prove that H$_2$ is accepted or rejected, then what is done is to look for $t_{arithmetic}$ by step in entering the value (r) into the formula, the value of n (number of samples) is known to be 12, then compared to t_{table} at $\alpha = 0.05$; df = nk where k is the number of variables (free + bound) and n is the number of observations/samples forming the regression. So df = 12 − 2 = 10 is 1,812 (from t_{table}).

$t_2 = t$ count

$$t_2 = \frac{r\sqrt{n-2}}{\sqrt{1-(r)^2}} = \frac{(0.73)\sqrt{12-2}}{\sqrt{1-(0,73^2)}} = \frac{(0.73)\sqrt{10}}{\sqrt{1-0,53}}$$

$$= \frac{(0,73).3,16}{\sqrt{0,47}} = \frac{2.31}{0.69} = 3,35$$

Then, the results obtained are $t_2 = t_{arithmetic} = 3,35$, because $t_{arithmetic} > t_{table}$ (3.35 > 1,812). So H$_0$ is rejected and H$_2$ is accepted, meaning that there is a significant relationship between X_2 and Y. So there is a significant relationship between berth output and conventional dock utilization at PT Pelindo II Palembang Branch.

2. Simultaneous correlation coefficient test (test f)
Hypothesis tests used by the authors are as follows:
To prove that H$_2$ is accepted or rejected, what is done is by finding $f_{arithmetic}$ by step in entering the value (r) into the formula, the value of n (number of samples), the degree of freedom (df) for the numerator or known as df$_1$ with the symbol N1, degree of freedom (df) for the denominator, or known as df$_1$ with the symbol N2 then compare the f_{table} at $\alpha = 0.05$; df$_1 = k − 1$; df$_2 = nk$ where k is the number of variables (free + bound) and n is the number of observations/samples forming the regression. Can be calculated:

$\text{df}_1 = k - 1$
$= 2 - 1 = 1$
$\text{df}_2 = n - k$
$= 12 - 2 = 10$

So that $N1 = 1$ and $N2 = 10$ then $f_{table} = 4,96$.

$f_2 = f_{arithmetic}$

$f_2 = f_{hitung}$

$$f_{hitung} = \frac{r^2 / k}{1 - r^2 / (n - k - 1)}$$

$$\frac{(0,73)^2 / 2}{1 - (0,73)^2 / (12 - 2 - 1)} = \frac{0,53 / 2}{1 - 0,53 / 9}$$

$$= \frac{0,27}{0,05} = 5,4$$

Then, the results obtained are $f_2 = f_{arithmetic} = 5,4$, because $f_{arithmetic} > f_{table}$ (5.4 > 4.96). So H_0 is rejected and H_2 is accepted, meaning that there is a significant relationship between X_2 and Y. So there is a significant relationship between berth output and conventional dock utilization at PT Pelindo II Palembang Branch.

3.4. Correlation Relationship between Berthing Time (X_1) and Berth Output (X_2)

Table 8, calculation of the correlation of the relationship between variable X_1 and variable X_2. Based on the table above, the numbers can be obtained through the following statistics:

a. Validity test

Validity test is done to determine the level of reliability and validity of a variable berthing time (X_{-1}) to berth output (X_2) used the same formula to the validity of the correlation coefficient formula as follows.

$$r_{x1x2} = \frac{n. \sum X_1 X_2 - \sum X_1 . \sum X_2}{\sqrt{n . \sum X_1^2 - (\sum X_1)^2} \sqrt{n . \sum X_2^2 - (\sum X_2)^2}}.$$

$$r_{x1x2} = \frac{(12)(10.352.123,76) - (30.012,84)(4.052,95)}{\sqrt{(12)76.724.085,68 - (30.012,84)^2}.}$$
$$\sqrt{(12)1.403.729,56 - (4.052,95)^2}$$

$$r_{x1x2} = \frac{124.225.485,10 - 121.640539,88}{\sqrt{920.689.028,19 - 900.770.564,87}.}$$
$$\sqrt{16.844.754,77 - 16.426.403,7}$$

$$r_{x1x2} = \frac{2.584.945,22}{\sqrt{19.918.463,32} . \sqrt{418.351,07}}$$

$$r_{x1x2} = \frac{2.584.945,22}{(4.463,01)(646.80)}$$

$$r_{x1x2} = \frac{2.584.945,22}{2.886.674,87}$$

$$r_{x1x2} = 0.90$$

Table 8: Results of ship berthing time analysis (X_1) against berth output (X_2)

X_1	X_2	$X_1 X_2$	$(X_1)^2$	$(X_2)^2$
1,821,55	291.76	531,455.43	3,318,044.40	85,123.90
2,713.80	418,15	1,134,775.47	7,364,710.44	174,849.42
2,419,35	321.64	778,159.73	5,853,254.42	103,452.29
2,301.73	295.28	679,654.83	5,297,960.99	87,190.28
2,379.43	295,32	702,693.27	5,661,687.12	87,213.90
2,422.37	312.44	756,845.28	5,867,876.42	97,618.75
2,404.75	296.48	712,960.28	5,782,822,56	87,900.39
2,701.10	358.82	969,208.70	7,295,941.21	128,751.79
2,522.60	349.96	882,809.10	6,363,510.76	122,472.00
2,060.67	271,33	559,121,59	4,246,360.85	73,619.97
2,984.87	395.90	1,181,710.03	8,909,448.92	156,736.81
3,280.62	445.87	1,462,730.04	10,762,467,58	198,800.06
3012,84	4052.95	10,352,123.76	76,724,085.68	1,403,729,56

To prove the validity test of the berthing time variable (X_1) to the berth output (X_2) according to the calculations obtained in the correlation coefficient of (0.90), so that the validity number of (0.90) then it is done by finding r_{count} that is based the criterion with the provisions of df (degree of freedom) with the value of n (number of samples) is known to be 12, df $= n - 2$ then it becomes df $= 12 - 2$ which is 10 then compared to r_{table} at $\alpha = 0.05$; then it is 0.576 (from r_{table}).

Then, the results obtained are $r_1 = r_{arithmetic} = 0,90$, because $r_{arithmetic} > r_{table}$ (0.90 > 0.576). So it can be concluded that the variable berthing time (X_1) to the berth output (X_2) is declared valid.

b. Regression correlation coefficient analysis

To find out the strength or weakness of the relationship between variable X_1 and variable X_2, then this analysis will find out the value of r (correlation coefficient), namely by the formula:

Regression correlation coefficient formula = Validity test formula

$$r_{x1x2} = \frac{n. \sum X_1 X_2 - \sum X_1 . \sum X_2}{\sqrt{n . \sum X_1^2 - (\sum X_1)^2} \sqrt{n . \sum X_2^2 - (\sum X_2)^2}}.$$

$$r_{x1x2} = 0.90$$

From the above calculation, the correlation coefficient figure of (0.90) is obtained, it means that there is a very strong influence between berthing time on berth output. If the correlation results are positive, it can be interpreted if the berthing time increases, it will also increase the berth output. Vice versa, if there is a decrease in berthing time it will reduce the berth output.

c. Analysis The coefficient of determination (KD = R²)

Analysis of the coefficient of determination is to determine how big contribution of variable berth output (X_2) of the utilization of conventional dock (Y) used formula coefficient of determination as follows:

KD $= r^2 \times 100\%$
KD $= (0.90)^2 \times 100\%$
KD $= 0,81 \times 100\%$
KD $= 81\%$

With the regression line value ($r^2 = 0,81$) close to 1, it is said to be feasible to use. Then the coefficient of determination is 81% indicating that the value is worth continuing to predict by using a regression formula where 81% of berthing time affects the berth output and 19% by other factors.

d. Hypothesis testing

Hypothesis testing about the correlation coefficient. Judging from the calculation of the correlation coefficient, determination and regression lines, then the hypothesis test can be done to determine the effect of berthing time on berth output at PT Pelindo II Palembang Branch.

1. Partial correlation coefficient test (t test)

Hypothesis tests used by the authors are as follows:

If $t_{arithmetic} > T_{table}$ then H_0 is rejected and H_3 is accepted, meaning that there is a significant relationship between berthing time and berth output at PT Pelindo II Palembang Branch. To prove that H_3 is accepted or rejected, it is done by finding t_{count} is by step enter a value (r) into the formula, the value of n (number of samples) note 12, then compared t_{table} at $\alpha = 0.05$; df = nk where k is the number of variables (free + bound) and n is the number of observations/ samples forming the regression. So df = 12 − 2 = 10 is 1,812 (from t_{table}).

$t_3 = t$ count

$$t_3 = \frac{r\sqrt{n-2}}{\sqrt{1-(r)^2}} = \frac{(0.90)\sqrt{12-2}}{\sqrt{1-(0.90^2)}} = \frac{(0.90)\sqrt{10}}{\sqrt{1-0,81}}$$

$$= \frac{(0,90)\cdot 3,16}{\sqrt{0,19}} = \frac{2.85}{0.44} = 6,48$$

Then, the results obtained are $t_3 = t_{arithmetic} = 6,48$, because $t_{arithmetic} > t_{table}$ (6.48 > 1,812). So H_0 is rejected and H_3 is accepted, meaning that there is a significant relationship between X_1 and X_2. So there is a significant relationship between berthing time and berth output at PT Pelindo II Palembang Branch.

2. Simultaneous correlation coefficient test (test f)

Hypothesis tests used by the authors are as follows:

To prove that H_3 is accepted or rejected, it is by looking f_{count} is by step enter a value (r) into the formula, the value of n (number of samples), degrees of freedom/degree of freedom (df) for the numerator or known df_1 with the symbol $N1$, degree of freedom (df) for the denominator, or known as df_1 with the symbol $N2$ then compare the f_{table} at $\alpha = 0.05$; $df_1 = k − 1$; $df_2 = nk$ where k is the number of variables (free + bound) and n is the number of observations/samples forming the regression. Can be calculated:

$df_1 = k − 1$
$= 2 − 1 = 1$
$df_2 = n − k$
$= 12 − 2 = 10$

So that $N1 = 1$ and $N2 = 10$ then $f_{table} = 4,96$.

$f_3 = f_{arithmetic}$

$$f_{hitung} = \frac{r^2/k}{1-r^2/(n-k-1)}$$

$$= \frac{(0,90)^2/2}{1-(0,90)^2/(12-2-1)}$$

$$= \frac{0,81/2}{1-0,81/9} = \frac{0,41}{0,02} = 20,5$$

Then, the results obtained are $f_3 = f_{arithmetic} = 20,5$, because $f_{arithmetic} > f_{table}$ (20.5 > 4.96). So H_0 is rejected and H_3 is accepted, meaning that there is a significant relationship between X_1 and X_2. So there is a significant relationship between berthing time and berth output at PT Pelindo II Palembang Branch.

3.5. Correlation of Relationships between Ship Berthing Time (X_1) and Berth Output (X_2) and Conventional Dock Utilization (Y)

a. Validity test

Validity test is done to determine the level keandalah and validity of variables berthing time of the ship (X_1) of the utilization of conventional dock (Y) the validity of the formula used together with a correlation coefficient formula as follows.

$$r_{x1y} = 0,79 \; ; \; r_{x2y} = 0,73 \; ; \; r_{x1x2} = 0,90$$

$$r_{yx1x2} = \sqrt{\frac{r^2 x_1 y + r^2 x_2 y - 2\, rx_1 y\, rx_2 y\, rx_1 x_2}{1-r^2 x_1 x_2}}$$

$$r_{yx1x2} = \sqrt{\frac{(0,79)^2 + (0,73)^2 - 2(0,79)(0,73)(0,90)}{1-(0,90)^2}}$$

$$r_{yx1x2} = \sqrt{\frac{(0,63)+(0,53)-1,04}{1-(0,81)}}$$

$$r_{yx1x2} = \sqrt{\frac{1,16-1,04}{0,19}}$$

$$r_{yx1x2} = \sqrt{\frac{0,12}{0,19}}$$

$$r_{yx1x2} = \sqrt{0,63}$$

$$r_{yx1x2} = 0,80$$

To test the validity of membukitkan variable berthing time ship (X_1) and berth output (X_2) of the utilization of conventional dock (Y) according to the estimates obtained in point correlation coefficient of (0.80), so that the figure validity of (0.80) then done is to find r_{count} that is based on the criteria with the provisions of df (degree of freedom) with the value of n (number of samples) known 12, df = $n − 2$ then it becomes df = 12 − 2 i.e. 10 then compared to r_{table} on $\alpha = 0.05$; then it is 0.576 (from r_{table}).

Then, the results obtained are $r_1 = r_{arithmetic} = 0,80$, because $r_{arithmetic} > r_{table}$ (0.80 > 0.576). So it can be concluded that the variable berthing

time of the ship (X_1) and berth output (X_2) to the conventional dock utilization (Y) is declared valid.

b. Equation of Multiple Linear Regression

Table 9 and 10, to find out how big the correlation between the berthing of ship time (X_{-1}) and a berth output (X_2) of the conventional dock utilization (Y) is by using Equation Regression. Where in general, the data observed by Y are influenced by variables X_1 and X_2, so the formula of multiple linear regression is:

$Y = a + b_1 X_1 + b_2 X_2$

$\sum X_1^2 = \sum X_1^2 -$
   $= 76,724,085.68 -$
   $= 76,724,085.68 -$
   $= 76,724,085, 68 - 75,064,213.74$
   $= 1,659,871, 94$

$\sum X_2^2 = \sum X_2^2 -$
   $= 1,403,729,56 -$
   $= 1,403,729,56 -$
   $= 1,403,729, 56 - 1,368,866.98$
   $= 34,862.58$

$\sum Y^2 = \sum Y^2 -$
   $= 48,542.84 -$
   $= 48,542.84 -$
   $= 48,542.84 - 48,018.14$
   $= 524,70$

$\sum X_1 Y = \sum X_1 Y -$
   $= 1,921,784,85 -$
   $= 1,921,784, 85 - 1,898,537.23$
   $= 23,247.62$

$\sum X_2 Y = \sum X_2 Y -$
   $= 259,508, 86 -$
   $= 259,508.86 - 256,379.48$
   $= 3,129.38$

$\sum X_1 X_2 = \sum X_1 X_2 -$
   $= 10,352.123, 76 -$
   $= 10,352.123, 76 - 10,136,711.66$
   $= 215,412.10$

So, the values of b_1, b_2 and a are as follows:

$$b_1 = \frac{\left[\left(\sum X_2^2 . \sum X_1 Y\right) - \left(\sum X_2 Y . \sum X_1 X_2\right)\right]}{\left[\left(\sum X_1^2 . \sum X_2^2\right) - \left(\sum X_1 X_2\right)^2\right]}$$

$$= \frac{\left[(34.862,58)(23.247,62) - (3.129,38)(215.412,10)\right]}{\left[(1.659.871,94)(34.862,58) - (215.412,10)^2\right]}$$

$$= \frac{\left[(810.472.012,06) - (674.106.317,50)\right]}{\left[(57.867.418.298,01) - (46.402.372.826,41)\right]}$$

$$= \frac{\left[136.365.694,56\right]}{\left[11.465.045.471,60\right]}$$

$= 0,01$

$$b_2 = \frac{\left[\left(\sum X_1^2 . \sum X_2 Y\right) - \left(\sum X_1 Y . \sum X_1 X_2\right)\right]}{\left[\left(\sum X_1^2 . \sum X_2^2\right) - \left(\sum X_1 X_2\right)^2\right]}$$

$$= \frac{\left[(1.659.871,94)(3.129,38) - (23.247,62)(215.412,10)\right]}{\left[(1.659.871,94)(34.862,58) - (215.412,10)^2\right]}$$

$$= \frac{\left[(5.194.370.051,60) - (5.007.818.644,20)\right]}{\left[(57.867.418.298,01) - (46.402.372.826,41)\right]}$$

$$= \frac{\left[(186.551.407,40)\right]}{\left[11.465.045.471,60\right]}$$

$= 0,02$

$$a = \frac{\sum Y - \left(b_1 \sum X_1\right) - \left(b_2 \sum X_2\right)}{n}$$

$$= \frac{759,09 - (0,01 \times 30.012,84) - (0,02 \times 4.052,95)}{12}$$

$$= \frac{759,09 - (356,97) - (65,95)}{12}$$

$$= \frac{336,17}{12}$$

$= 28,01$

So, the multiple linear regression equation is

$Y = a + b_1 X_1 + b_2 X_2$

Table 9: Results of ship berthing time analysis (X_1), berth output (X_2) and conventional dock utilization (Y)

Month	X_1	X_2	Y	$(X_1)^2$	$(X_2)^2$	Y^2
1	1,821,55	291.76	53.18	3,318,044.40	85,123.90	2,828.11
2	2,713.80	418,15	69.96	7,364,710.44	174,849.42	4,894.40
3	2,419.35	321.64	71.93	5,853,254.42	103,452.29	5,173.92
4	2,301.73	295.28	60.25	5,297,960.99	87,190.28	3,630.06
5	2,379.43	295,32	60.86	5,661,687.12	87,213.90	3,703.94
6	2,422.37	312.44	57.61	5,867,876.42	97,618.75	3,318.91
7	2,404.75	296.48	63.46	5,782,822,56	87,900.39	4027.17
8	2,701.10	358.82	68.17	7,295,941.21	128,751.79	4,647,15
9	2,522.60	349.96	59.48	6,363,510.76	122,472.00	3,537.87
10	2,060.67	271,33	52.95	4,246,360.85	73,619.97	2,803.70
11	2,984.87	395.90	71.89	8,909,448.92	156,736.81	5,168.17
12	3,280.62	445.87	69.35	10,762,467,58	198,800.06	4,809.42
$\sum$	3012,84	4052.95	759.09	76,724,085.68	1,403,729,56	48,542.84

Table 10: Continued analysis of ship berthing time (X_1) and berth output (X_2) conventional dock utilization (Y)

Month	X_1X_2	X_1Y	X_2Y
1	531,455.43	96,870.03	15515.80
2	1,134,775.47	189,857.45	29,253.77
3	778,159.73	174,023.85	23,135,57
4	679,654.83	138,679.23	1790.92
5	702,693.27	144,812.11	17,973.18
6	756,845.28	139,552.74	17,999.67
7	712,960.28	152,605.44	18,814.62
8	969,208.70	184,133.99	24,460.76
9	882,809.10	150,044.25	20,815.62
10	559,121,59	109,112.48	14,366.92
11	1,181,710.03	214,582.30	28,461.25
12	1,462,730.04	227,511.00	30,921.08
Σ	10,352,123.76	1,921,784.85	259,508.86

$Y = 28.01 + 0.01\,X_1 + 0.02\,X_2$

c. Interpretation of correlation coefficients
1) Value of $a = 28.01$; This means that if the berthing time of the ship (X_1) and the berth output (X_2) value is 0, then the utilization of conventional docks (Y) the value is 28.01%.
2) Value of $b_1 = 0.01$; meaning that if the berth output is considered fixed and the berthing time of the ship increases by one percent, the utilization of conventional docks will increase by 0.01 unit. Positive coefficient means that there is a positive relationship between berthing time and conventional dock utilization, the more berthing time rises, the more conventional dock utilization increases.
3) Value of $b_2 = 0.02$; meaning that if the berthing time is considered fixed and the berth output increases by one percent, the utilization of conventional docks will increase by 0.02 units. Positive coefficient means that there is a positive relationship between berth output and conventional berth utilization, the more berth output rises, the more the utilization of conventional berth increases.

d. Calculate the multiple regression correlation coefficient
To find out the strength or weakness of the relationship between variable X_1 and variable X_2 to variable Y then this analysis will find out the value of r (correlation coefficient), namely by the formula:

Regression correlation coefficient formula = Validity test formula

$r_{x1y} = 0,79$; $r_{x2y} = 0,73$; $r_{x1x2} = 090$

$r_{yx1x2} = \sqrt{\dfrac{r^2\,x_1 y + r^2\,x_2 y - 2\,rx_1 y\,rx_2 y\,rx_1 x_2}{1 - r^2 x1x2}}$

$r_{yx1x2} = 0,80$

From the above calculation, the correlation coefficient figure of (0.80) is obtained, which means that there is a very strong influence between berthing time (X_1) and berth output (X_2) on conventional dock utilization (Y).

If the correlation results are positive, it can be interpreted if the berthing time of the ship and the berth output increases will also increase the utilization of conventional docks. Vice versa, if there is a decrease in the berthing time of the ship and the output berth it will reduce the utilization of conventional docks.

e. Calculate the coefficient of determination
Analysis of the coefficient of determination is to find out how much the contribution of the variable berthing time (X_1) and berth output (X_2) to the conventional dock utilization (Y) used the coefficient of determination formula as follows:

$r^2 = \dfrac{(b_1\sum X_1 Y) + (b_2 \sum X_2 Y)}{\sum Y^2}$

$r^2 = \dfrac{(0,01\,.\,23.247,62) + (0,02\,.\,3.129,38)}{524,70}$

$r^2 = \dfrac{(232,45) + (62,59)}{524,70}$

$r^2 = \dfrac{295,04}{524,70}$

$r^2 = 0,56$

$KD = r^2 \times 100\%$
$KD = (0.56) \times 100\%$
$KD = 56\%$

By getting the KD value $= 56\%$ shows that the magnitude of the coefficient of determination between berthing time and berth output to conventional dock utilization is 56%. This means that around 56% between berthing time (X_1) and berth output (X_2) can explain the utilization of conventional docks (Y).

f. Hypothesis testing
Hypothesis testing about the correlation coefficient. Judging from the calculation of the correlation coefficient, determination and regression line, the hypothesis test can be performed to determine the effect of berthing time and berth output on the utilization of conventional docks at PT Pelindo II Palembang Branch.

Hypothesis testing used in multiple linear regression by the author is by calculating $t_{arithmetic}$ and $f_{arithmetic}$ is as follows.

1. Partial correlation coefficient test (t test)
To prove that H_4 is accepted or rejected, it is done by finding t_{count} is by step enter a value (r) into the formula, the value of n (number of samples) note 12, then compared t_{table} at $\alpha = 0.05$; df $= nk$ where k is the number of variables (free + bound) and n is the number of observations/samples forming the regression. So df $= 12 - 3 = 9$ is 1,833 (from t_{table}).

$t_4 = t$ count

$t_4 = \dfrac{r\sqrt{n-2}}{\sqrt{1-(r)^2}} = \dfrac{(0.80)\sqrt{12-2}}{\sqrt{1-\left(0,80^2\right)}} = \dfrac{(0.80)\sqrt{10}}{\sqrt{1-0,64}}$

$= \dfrac{(0,80)\,.\,3,16}{\sqrt{0,36}} = \dfrac{2.53}{0.60} = 4,21$

Then, the results obtained are $t_4 = t_{arithmetic} = 4,21$, because $t_{arithmetic}$ $> t_{table}$ (4.21 > 1,833). So H_0 is rejected and H_4 is accepted, meaning that there is a significant relationship between X_1, X_2 and Y. So that there is a significant relationship between berthing time and berth output to conventional dock utilization at PT Pelindo II Palembang Branch.

2. Simultaneous correlation coefficient test (test F)

To prove that H_4 is accepted or rejected, it is by looking f_{count} is by step enter a value (r) into the formula, the value of n (number of samples), degrees of freedom/degree of freedom (df) for the numerator or known df_1 with the symbol $N1$, degree of freedom (df) for the denominator, or known as df_1 with the symbol $N2$ then compare the f_{table} at $\alpha = 0.05$; $df_1 = k - 1$; $df_2 = nk$ where k is the number of variables (free + bound) and n is the number of observations/samples forming the regression. Can be calculated:

$df_1 = k - 1$
$= 3 - 1 = 2$
$df_2 = n - k$
$= 12 - 3 = 9$

So $N1 = 2$ and $N2 = 9$ then $f_{table} = 4,26$.

$f_4 = f_{hitung}$

$$f_{hitung} = \frac{r^2/k}{1-r^2/(n-k-1)} = \frac{(0,80)^2/2}{1-(0,80)^2/(12-3-1)}$$

$$= \frac{0,64/2}{1-0,64/8} = \frac{0,32}{0,045}$$

$$= 7,11$$

Then, the results obtained are $f_4 = f_{arithmetic} = 7,11$, because $f_{arithmetic}$ $> f_{table}$ (7.11 > 4.26). So H_0 is rejected and H_4 is accepted, meaning that there is a significant relationship between X_1, X_2 and Y. So that there is a significant relationship between berthing time and berth output to conventional dock utilization at PT Pelindo II Palembang Branch.

Based on the results of data analysis above, it can be detailed as follows:

The amount of berthing time = 30,012.84 h
Total berth output = 4,052.95 tons/m
Total loading and unloading = 1,827,582 tons
Loading discharge rate based on all commodities = 107 TGH.

The loading discharging rate for each commodity is based on the Service Level Agreement as follows in Table 11.

The realization of the Loading Discharging Rate based on the Berth Working Time in the 2017 domestic period is as follows Table 12.

Average loading and unloading speed based on berthing time is

$$= \frac{\text{Number of loading and unloading}}{\text{The amount of berthing time}} = \frac{1.827.582}{30.012,84} = 61 \text{ TGH}$$

Table 11: Loading discharging rate based on service level agreement

Description	Performance	
	Unit	Domestic
General Cargo	TGH	80
Cargo Bag	TGH	40
Liquid Bulk	TGH	200

Table 12: Actual loading discharging rate based on domestic berth working time in 2017

Month	Cargo bag	Liquid bulk	General cargo	Unit
1	40.90	220.85	135.87	TGH
2	46.97	218.73	154.36	TGH
3	42.23	198.18	139.22	TGH
4	44.58	220.49	81.65	TGH
5	45.57	229.78	76.37	TGH
6	43.95	186.20	125.91	TGH
7	39.75	197.98	109.18	TGH
8	39.09	208.00	117.83	TGH
9	45.35	219.21	141.37	TGH
10	38.80	197.83	112.57	TGH
11	39.43	233.25	154.78	TGH
12	39.86	200.03	102.46	TGH
Average	42.21	210.88	120.97	TGH
Average		124.68		TGH

So that the average loading and unloading speed based on berthing time at conventional docks does not meet the loading discharge rate that has been determined based on the service level agreement.

There is a difference in value between loading discharging rate with a time time and loading discharging rate with a working time of 63.68 TGH which is caused by the idle time in the berthing time element. Idle time is caused by weather factors such as rain, loading and unloading equipment damage, lack of readiness of ship crane equipment, waiting trucks, and draining tanks for types of liquid bulk loads.

Ideal Berthing time based on the realization of the amount of unloaded and loaded loads, namely:

$$\frac{\text{Number of loading and unloading}}{\text{The amount of berthing time}} = \frac{1.827.582}{107} = 17,080 \text{ h}$$

So for the amount of cargo unloaded and loaded as much as 1,827,582 tons, it should take 17,080 h for the time to dock or berthing time with a loading discharge rate of 107 TGH but the realization is 30,012.84 h with a loading discharge rate of 61 TGH.

4. CONCLUSION

Based on the results of research and discussion of regression analysis and correlation coefficient, coefficient of determination, validity test, and hypothesis testing between berthing time and berth output on the utilization of conventional docks at PT Pelindo II Palembang Branch in the period January 2017–December 2017, then it can be taken The conclusion is:

1. To meet the conventional dock utility standard of 70%, it can be done by shortening the berth or berthing time of the ship. Shorten mooring time or berthing time can be done by speeding up loading and unloading activities at conventional docks by increasing the number of jib cranes used for loading and unloading activities and increasing the number of head trucks used to transport cargo. For the use of one jib crane/hour unit requires three head truck units. So for the addition of one jib crane unit also requires three head truck units. In order to support the loading and unloading activities at conventional docks and to avoid the high idle time at berthing time of the ship, care and maintenance of the loading and unloading equipment is needed so that the loading and unloading equipment can always be used. TGH standards (tons of gangs per hour) and SOP (ship output per day) were improved so as to reduce berthing time when the ship was planned.

2. To optimize the berth output at conventional docks can be done by speeding up the time of loading and unloading activities in order to achieve loading discharging rate based on all commodities of 107 TGH. The realization of loading discharging rate based on existing berthing time only reached a figure of 61 TGH so that additional loading and unloading equipment is needed to speed up loading and unloading activities time by increasing the number of jib cranes and increasing the number of head trucks used to support loading and unloading activities at conventional docks. For the use of one jib crane/hour unit requires three head truck units. So for the addition of one jib crane unit also requires three head truck units. In order to support the loading and unloading activities at conventional docks and to avoid the high idle time at berthing time of the ship, care and maintenance of the loading and unloading equipment is needed so that the loading and unloading equipment can always be used.

3. If the berthing time value of the ship is low, the speed of the berth ship will increase faster so that the value of the output berth will be well optimized. With the number of loading and unloading at the conventional dock in 2017 amounting to 1,827,582 tons, it should take 17,080 h for the berth or berthing time. But its realization is 30012.84 h, should be able to produce the number of loading and unloading larger with an average speed of 107 TGH unloading so that the value berth output also will increase. Alternatives that can be done to overcome the above effects are by increasing the loading and unloading performance of conventional ships at the dock by taking into account the effective time, TGH (tons of gangs per hour), and SOP (ship output per day) which refers to the standardization of performance and the addition of the number of cranes or head truck used for loading and unloading activities itself For the use of one jib crane/hour unit requires three head truck units. So for the addition of one jib crane unit also requires three head truck units. In order to support the loading and unloading activities at conventional docks and to avoid the high idle time at berthing time of the ship, care and maintenance of the loading and unloading equipment is needed so that the loading and unloading equipment can always be used.

4. In order to optimize the utilization of conventional dock to fit the predetermined RKA, then from the PT Pelindo II Palembang Branch itself should be able to handle the efficiency of berthing time faster so berth output also will be optimized.

To streamline berthing time and optimize berth output by accelerating loading and unloading activities at conventional docks with the number of loading and unloading at conventional docks of 1,827,582 tons and the average loading and unloading speed at conventional docks of 107 TGH will result in a mooring time of 17,080 h. But its realization is 30012.84 h, should be able to produce the number of loading and unloading larger with an average speed of loading and unloading of 107 TGH so that the value berth output also will increase. Based on the above, if all is well realized it can increase the productivity of loading and unloading activities at PT Pelindo II Palembang Branch. In order to speed up loading and unloading activities, an alternative can be done is to increase the number of loading and unloading equipment at conventional docks such as jib cranes and head trucks. For the use of one jib crane/hour unit requires three head truck units. So for the addition of one jib crane unit also requires three head truck units. In order to support the loading and unloading activities at conventional docks and to avoid the high idle time at berthing time of the ship, care and maintenance of the loading and unloading equipment is needed so that the loading and unloading equipment can always be used.

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