# THE INFLUENCE OF CONTAINER CRANE PRODUCTIVITY AND THE SHIP CALL FREQUENCY ON THE CARGO HANDLING PERFORMANCE

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## ABSTRACT

*The purpose of this research are to analyze the influence of container crane productivity (X1) and ship call frequency (X2) on the number of containers handled (Y) at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. The tool of analysis which was used was Multiple Regression with Classic Assumption Test. This research used secondary data obtained from TPKS such as monthly report the achievement of performance, monthly report of ship call and monthly report of stevedoring production within period of 6.5 years (January 2009 – June 2015).The Result of the Multiple Regression Analysis was* ***Log Y = 4.923991 + 0.525387 log XI + 0.423276 log X2 + e.*** *This equation showed that all regression coefficients were positive. It means that if container crane productivity and ship call frequency was increased, the number of the containers handled would increase too.*$\beta_1$ *= 0.525, it means that if there is increase in container crane productivity by 10%, it will increase the cargo handling performance by 5.25%. Next,* $\beta_2$ *= 0.423, it explains that if there is an increase in ship call frequency by 10%, it will increase the cargo handling performance by 4.23%. The result of Coefficient of Determination of Test shows that container crane productivity and ship call frequency give the proportion or percentage of the total variation in the number of containers handled for about 94,8%. While, F-Test shows that container crane productivity and ship call frequency influenced simultaneously on the number of containers handled. Furthermore, container crane productivity influenced positively on the number of containers handled. Then the other X variable, ship call frequency influenced positively on the number of containers handled.*

***Key words****: Container Crane, Ship Call, Cargo Handling and Port.*

## INTRODUCTION

### Background of the Study

In the economic globalization era, international trade barriers among countries have become disappeared because there are not tariff barrier and non-tariff barrier any longer. Reducing tariff can increase international trade which involves developed and developing countries to trade their competitive product. Furthermore, ASEAN Economic Community (AEC) will be implemented in December 2015, there will be an increase of international trade among ASEAN countries.

Consequently, those condition will be the same as ships follow the trade where ships deliver products from one of ASEAN's port to others. Ships are very important in international trade because freight cost of ship is relatively cheaper and have bigger capacity loading cargo than land transportation and air transportation.

In ASEAN Region, container traffic increase significantly from 2009 to 2013. In 2013, container traffic in the ASEAN is 14% of container traffic in the world. The number of container traffic in Indonesia which is 12.3% of container traffic in the ASEAN rose by about 12%.

To support increase in container port traffic, Indonesia must improve competitiveness of ports. Indonesia must prepare competitive port in order to compete with other ASEAN members in giving services for containers flow entering or exiting at the regional and global trade area.

Semarang Container Terminal (TPKS) is one of Container Terminal in Indonesia which

holds stevedoring activities. The existence of TPKS plays significant role in advancing and improving the flow of export – import as well as having a great influence in supporting the smooth process of loading and loading of goods at the port.

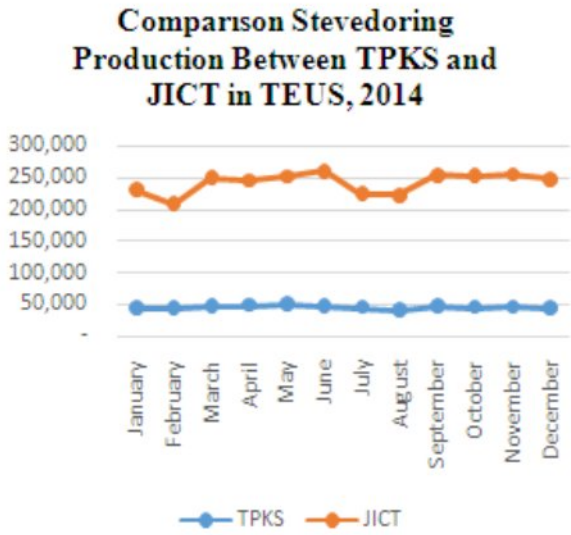
**Table 1**
**Stevedoring Production of TPKS**

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| BOX | 219,332 | 236,245 | 265,478 | 286,269 | 302,904 | 341,736 |
| TEUS | 356,461 | 384,522 | 427,468 | 456,896 | 488,292 | 551,655 |

Sorce: Terminal Petikemas Semarang, 2015

In general, there was a significant increase of stevedoring production of TPKS in boxes also teus from 2009 to 2014. However, it was still lower than stevedoring production of Jakarta International Container Terminal (JICT) in 2014 based on the Figure 1.

**Figure 1**




Source: Terminal Petikemas Semarang, 2015; Jakarta International Container Terminal, 2015

Port performance in term of stevedoring production at TPKS was not competitive compared with JICT. Next, stevedoring production of TPKS on TEUS is 23.42% of JICT, it means that stevedoring production of TPKS is under one fourth of stevedoring production of JICT.

Accordingly, TPKS is expected to provide the optimal service in term of speed of stevedoring, effectiveness and readiness tool of cargo handling which includes container crane (CC). Container Crane is the primary equipment of containers cargo handling from the quay to the ship or otherwise.

Based on previous research that conducted by Lee (2005), the article uses two outputs and six inputs to measure of port performance for the year 1996 - 2005 for which the data on port throughputs are available. The dependent variable is cargo handled and the independent variables which are used are Y1 = TEUs handled, Y2 = Ship rate, X1 = No. of

Cranes, X2 = No. of Container berths, X3 = No. of tugs, X4 = Terminal area (m2), X5 = Delay time (h) and X6 = Labor (units). Next, Liu (2010) evaluated the influence of infrastructure equipment on containers handled. Huang (1997) examined number of berth and crane affect port performance.

Of the various things that have seen mentioned the writer are interested specifically to hold and take the object of research at at TPK Swith the title **"The Influence of Container Crane Productivity and the Ship Call Frequency on the Cargo Handling Performance at Semarang Container Terminal (TPKS) Branch PT Pelabuhan Indonesia III (Persero)"**

**Objectives Of The Study**

This study was carried out to achieve the followings:

a. To analyze the influence of container crane productivity on cargo handling performance at Terminal Petikemas Semarang branch PT Pelabuhan Indonesia III.
b. To examine the influence of ship call frequency on cargo handling performance at Terminal Petikemas Semarang branch PT Pelabuhan Indonesia III.

**LITERATURE REVIEW**

According to Government Regulation RI No. 69 year 2001 about port that is: *Pelabuhan adalah Tempat yang terdiri dari daratan dan perairan disekitarnya dengan batas-batas tertentu sebagai tempat kegiatan pemerintahan dan kegiatan ekonomi yang dipergunakan sebagai tempat kapal bersandar, berlabuh, naik turun penumpang dan / atau bongkar muat barang yang dilengkapi dengan fasilitas keselamatan pelayaran dan kegiatan penunjang pelabuhan serta sebagai tempat perpindahan intra dan antar moda transportasi*

It means that Port is place which consists of the land and water with certainly limitation as the government regulation and economic activity used as a place for berthing, passenger services and loading - discharging activity with shipping safety facilities and supporting activity of port as a transport chain.

**Container Terminal**

Under the provisions of Article 1 d of the Decision of the Board of Directors Pelabuhan Indonesia II No. HK.56 / 2/25 / PIII-2002, the container terminal is a terminal which is equipped at least with facilities such as moorings, quay, container yard, as well proper equipment to serve the activities of loading and unloading of containers. (Suryono, 2003:186)

**The Definition of Cargo Handling**

Cargo handling is the activity of the good movement from sea transport mode to the land transport mode or otherwise, includes the following activities:

a. Stevedoring
   Stevedoring is the activity of discharging goods from the hold to the quay/barge/rail truck or vice versa, loading goods from the quay/barge/rail truck to the hold using a vessel crane or other equipment.
b. Cargodoring
   Cargodoring is the activity of releasing or removing goods from sling (ex.tackle) on the quay side of the hull, haulage from the quay and then stacking in warehouse or the first line of the field, or activities otherwise.
c. Receiving/Delivery
   Receiving/delivery is activity taking goods from vehicle in the warehouse/ container yard.

**The Equipment of Cargo Handling**

According in the book "Peralatan Pelabuhan" published by PT. Pelabuhan Indonesia (2008, 11-18), the equipment of cargo handling (especially in the container terminal) below:

a. Ship to Shore (STS) Crane/ Container Crane

Ship to Shore (STS) Crane / Container Crane is placed permanently in the quay and functioned as the primary equipment of containers cargo handling from the quay to the ship or otherwise. The speed of cargo handling is determined by the specification of the CC, the number of units, the long path/ track of cargo handling activities (throughput) in the terminal.

b. Rubber Tyred Gantry (RTG)
Rubber Tyred Gantry (RTG) Crane is one of cargo handling equipment for stacking in the container yard. RTG has 4 (four), eight (8) or sixteen (16) wheels which is made of rubber, has a width/ span generally as wide as 6 rows of container and able to stacking 4 tiers up to 7 tiers container.

c. Rail Mounted Gantry Crane (RMGC)
Rail Mounted Gantry Crane (RMGC) functions as RTG, but moving on the rails. Stretch his legs are in several rows, the distance of the stretch his legs is more than 36 meters which fortify the 12-13 rows of containers. This equipment can stack containers more than 4 tiers with a lift capacity about 35-40 tons or more.

d. Reach Stacker
Reach Stacker is cargo handling equipment which is used for stacking container up to height of 5 tiers.
This equipment is a combination of forklifts and mobile cranes, so that it can be operated freely such as lifting, carrying and stacking from chassis to container yard.

e. Head Truck and Chassis
Head truck plus chassis or called trailer is used in container terminal to carry container from quay to container yard and then to warehouse (CFS) or otherwise.
Another function is for receiving/delivering activity, beside that it is also used as container carrier to and from roro ship. This equipment can be operated on the local road.

f. Top Loader (Lift Truck)
Top loader is used for loading and unloading of containers in the yard. Another kind of top loader can be call front-end-loader and side-end-loader. Front-end-loader and side-end-loader have different way to operate, the container is handled from the front side and beside the equipment. It can be used on "direct" system when container crane or a gantry crane does container loading, top loader can stand on crane's foot. Besides on relay system, top loader works to transfer the container in a quay. Top loader can be used to handle and stack an empty/ a full container, also it can be used as inter transport transfer especially for cargo to or from railway.

g. Forklift
Forklift is a support equipment in container terminal, it can be used to load-unload in small tonnage, it is usually used in CFS for stripping and stuffing and another activity that related with delivering or interchanging. Forklift can used for handling loose cargo or empty container. It has various capacities between 2 – 7.5 tones.

h. Side Container Loader
This equipment is a kind of forklift with capacity between 7.5 tones till 10 tones as basic construction with replacement fork device to be spreader to lift up empty container.

**A Productivity Theory**

Nicholson (2002) states that production function is a mathematical function that shows the relationship between the inputs used to obtain a certain output level (Rachman, 2014). Production function can be expressed in the following equation:

Output = $f$ (input) ……...…. (1)

Q = f (X1, X2, X3, …, Xi)

Q : output

Xi : inputs used in the production process; i = 1,2,3, ..., n

Number of container handled in box (Q) requires inputs, container crane (X1), labor (X2), cargo handling equipment (X3), Truck (X4), breadth of CY(X5), length of quay (X6), and number of ship call. All variables which are stated before are endogenous variables. Meanwhile, indirectly international trade also influence container handled. Ships will follow the increasing of international trade. So, ship call is also used as independent variable which influence container handled in port. In this research, ship call as exogenous variable in affecting container handled. Cargo handling service production function is expressed in the form:

Q= f(X1, X2, X3, X4, X5, X6) + Ship calls…(2)

The author uses container crane productivity and ship call frequency as independent variables. Then, the output notation above will be transformed into regression model is as follow:

$$\mathbf{Q = a + b_1X_1 + b_2X_2 + \varepsilon}\text{……..……...(3)}$$

X1 : Container Crane Productivity
X2 : Ship Call Frequency

## HYPOTHESIS OF RESEARCH

Hypothesis is a temporary answer to the problems of research, until proven through the data collected (Arikunto, 1998:67). This research based on a hypothesis of influence between container crane productivity and the ship call frequency on cargo handling performance.

### Simultaneous Hypothesis

$Ho_1$ : Container crane productivity and ship call frequency do not affect the amount of number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. ($Ho_1$: $\beta_1 = \beta_2 = 0$)

$Ha_1$ : Container crane productivity and ship call frequency affect the amount of number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. ($Ho_1$: $\beta_1 = \beta_2 \neq 0$)

### Partial Hypothesis

Container crane productivity on cargo handling performance

$Ho_1$ : Container crane productivity does not affect the amount of number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. ($Ho_1$: $\beta_1 = 0$)

$Ha_1$ : Container crane productivity affects positively the amount of number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. ($Ho_1$: $\beta_1 \neq 0$)

Ship call frequency on cargo handling performance

$Ho_2$ : Ship call frequency does not affect the amount of number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. ($Ho_2$: $\beta_2 = 0$)

$Ha_2$ : Ship call frequency affectspositivelythe amount of number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. ($Ho_2$: $\beta_2 \neq 0$)

## RESEARCH VARIABLE AND DEFINITION OF OPERATIONAL VARIABLE

Arikunto (1998:101) states that variable is the object of research, or what the focal point of a study is. The relationship between one variable with another variable can be generally classified into two types:

a. Independent Variable, also often referred to as the stimulus, predictors, and antecedent. This variable is a variable that affects or causes of the change in dependent variable that is commonly

denoted by "X". In this research the independent variables are $X_1$ = container crane productivity, $X_2$= ship call frequency.

b. Dependent Variable, often also referred to as output, criteria, and consequently. This variable is a variable that is affected or caused because of the independent variables, commonly denoted by "Y". In this research the dependent variables is Y = number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III.

**Definition of Variable Operational**

Here is the definition of variables operational in this study at Table 2.

**Table 2**
**Definition of Variable Operational**

| No. | Variable | Definition | Measurement scale |
|---|---|---|---|
| 1. | Container Crane Productivity | Total operational hours of container crane that is used in loading/ unloading of containers each month. | Ratio |
| 2. | Ship Call Frequency | Number of international vessel that berths at Terminal Petikemas Semarang branch PT Pelabuhan Indonesia III each month | Ratio |
| 3. | Number of containers handled | Number of containers handled is the number of containers handled by Terminal Petikemas Semarang PT Pelabuhan Indonesia III in boxes. | Ratio |

## RESEARCH METHOD

The tool of analysis which was used was Multiple Regression with Classic Assumption Test. This research used secondary data obtained from TPKS such as monthly report the achievement of performance, monthly report of ship call and monthly report of stevedoring production within period of 6.5 years (January 2009 – June 2015).

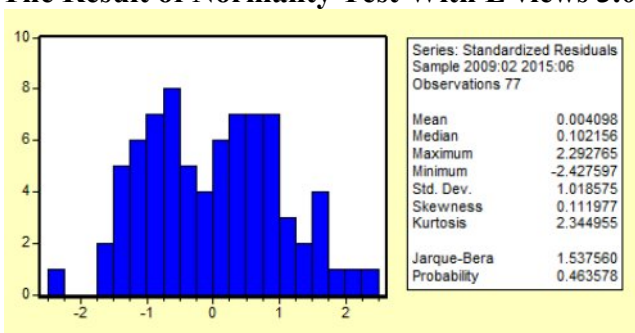
## FINDING AND DISCUSSION

### The Result of Classic Assumption Test

### Normality Test

Residual normality test is used to test the residual value resulting from the regression whether the normal distribution or not. The good regression models is residual value which is normally distributed.

**Figure 2**
**The Result of Normality Test With E views 3.0**




Source: Proceeded secondary data, 2015

From the histogram at Figure 2, JB value amounted to 1.538, while the Chi Square (k = 3, degrees of freedom or df = 78-3 = 75 at α = 5%) was 96.21667, it means JB value is

smaller than Chi Square value (1.538 < 96.21667). It can be concluded that the data in this research were normally distributed.

**Autocorrelation Test**

Autocorrelation means that adjacent observations are correlated. The Durbin-Watson test is a widely used method of testing for autocorrelation. After it was done with Eviews 3.0, the result would be described in the Table 3.

**Table 3**
**The Eviews Result of Durbin-Watson Statistic**

| Dependent Variable | Durbin - Watson |
|---|---|
| Container Handled | 2.226145 |

Source: Proceeded secondary data, 2015

From Table 3 it is known the value of DW was 2.226145.From the Durbin-Watson statistic table, when n = 78 and k = 2 at 5% level (α=0.05), it is known that DL = 1.5801 and DU = 1.6851. So that, DW is located between DU and 4-DU; DU (1.6851) < DW (2.226145) < 4-DU (2.3149), it can be concluded that the regression model was not autocorrelation.

**Heteroscedasticity Test**

Heteroscedasticity is the residual variance which is not the same in all of observations in the regression model (Priyatno, 2014:166). The good regression is if there is no heterocedasticity.

The result that was done with Eviews 3.0 can be seen in the Table 4.

**Table 4**
**The E views Result of Heteroskedasticity Test**

| White Heterokedasticity Test | P Value |
|---|---|
| Obs*R-squared | 0.514472 |

Source: Proceeded secondary data, 2015

Ho: there is not a hetererocedasticity

$H_1$: there is a hetererocedasticity

If the p-value obs * -Square < α, then Ho is rejected. Since the p value-obs*-Square = 0.514472 > 0.05, Ho is accepted. It can be said that with the 95% confidence level there is no heteroscedasticity in this regression model.

**Multicollinearity Test**

Multicollinearity test is purposed to find out whether the influence between independent variable has multicollinearity problem or not. Multicollinearity is when the correlation is very high or very low in the influence between independent variables. The good regression is if there is no multicollinerarity.

**Table 5**
**The Result of Multicollineraity Test with Eviews 3.0**

| Variable | CCOP | SHIPC |
|---|---|---|
| CCOP | 1.000000 | -0.011179 |
| SHIPC | -0.011179 | 1.000000 |

Source: Proceeded secondary data, 2015

Based on the Table 5, it can be seen that there was no variable that has a value of more than 0.8, so it can be concluded that there is no multicollinearity in this regression model.

**Multiple Regression Analysis**

The analysis that is used in this research is a multiple regression analysis. This analysis is used to determine the influence of container crane productivity and ship call frequency on cargo handling performance at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. Below are the result of this analysis with Eviews 3.0

**Table 6**
**The Multiple Regression Analysis Result**

| Variables | Coefficient | Probability |
|---|---|---|
| C | 4.923991 | 0.0000 |
| X1 (Container Crane Productivity) | 0.525387 | 0.0000 |
| X2 (Ship Call Frequency) | 0.423276 | 0.0000 |

Source: Proceeded secondary data, 2015

From the Table 6, can be arranged the regression equation as follows:

**Log Y = 4.923991 + 0.525387 log XI + 0.423276X log X2**

It means that all of dependent variables influence the independent variable positively. If X1 and X2 were zero so Y was 4.923991. The coefficient regression of Container Crane Productivity variable (X1) was 0.525387, it shows that if there is increase in Container Crane Productivity by 1%, it will increase the Cargo Handling Performance by 0.525387%. Next, the coefficient regression of Ship Call Frequency (X2) was 0.423276, it shows that if there is an increase in Ship Call Frequency by 1%, it will increase the Cargo Handling Performance by 0.423276%. Then, the significance of X1 and X2 were 0.000, as the sig < 0.05 it can be concluded that X1 variable and X2 variable influence on Y variable significantly.

**Coefficient of Determination**

R Square (R2) or coefficient of determination is used to know how the contribution of X Variables to Y variable which can be seen in the Table 7.

**Table 7**
**The Eviews Result of R-square Test**

| Dependent Variable | R - Squared |
|---|---|
| Container Handled | 0.948028 |

Source: Proceeded secondary data, 2015

From the Table 7, it is found that the value of R-square was 0.948, it shows that independent variables (Container Crane Productivity and Ship Call Frequency) give the proportion or percentage of the total variation in the dependent variable (Container Handled) for about 94,8% and 5,2% were influenced by other variables or factors which are not discussed in this research.

**The Result of Hypothesis Test**

The hypotheses test consists of two tests, they are F-Test (Simultaneous Test) and T-Test (Partial Test)

**a. F – Test**

Simultaneous Test is used to test model collectively and to find out the relation of independent variables in giving influence to dependent variable collectively.

**Table 8**
**The Result of F – Test**

| Dependent Variable | F – Statistic (F – Count) | F Table | P Value |
|---|---|---|---|
| Container Handled | 212.8125 | 3.12 | 0.000 |

Source: Proceeded secondary data, 2015

Before analyzing the result of this test as shown in the Table 8, below are the procedures of hypothesis using F Test.

1) $H_0$: there is no influence simultaneously between independent variables and dependent variable.
   Ha: there is influence simultaneusly between independent variables and dependent variable.
2) Level of significance α = 0.05, df = n-k-1
3) In concluding hypothesis testing using F Test, it can be found by comparing between $F_{count}$and $F_{table}$
   a) If $F_{count}<F_{table}$ , $H_0$ is accepted, it means that there is no influence between X variables collectively on Y variable.
   b) If $F_{count}>F_{table}$ , $H_0$ is rejected, it means that there is influence between X variables collectively on Y variable.

From the Table 8 above, it can be seen in F column that $F_{count}$ was 212.8125 with P Value of 0.000. $F_{table}$ was obtained from the F Distribution Table with the probability of 0.05, as seen in the appendix. In that table there is df (degree of freedom) for denominator which is accounted for the number of data (78) – the number of variables (3) = 75 and the df for numerator accounted for the number variables (3) – 1 = 2, so can be seen $F_{table}$ was 3.12.

The next step is comparing $F_{count}$and $F_{table.}$ As $F_{count}>F_{table}$ (212.8125 > 3.12), so the $H_0$ (Null Hypothesis) was rejected and the Ha (Alternative Hypothesis) was accepted. It can be concluded that there was influence between container crane productivity and ship call frequency collectively on cargo handled.

**T – Test**

T test (testing coefficient partially) is used to find out whether each dependent variable influence to dependent variable. The result of this test would be described in the Table 9.

**Table 9**
**The Result of T – Test**

| Independent Variable | $t_{count}$ | $t_{table}$ | Significance | Note |
|---|---|---|---|---|
| X1 (Container Crane Productivity) | 9.082337 | 1.99167 | 0.0000 | Significant |
| X2 (Ship Call Frequency) | 5.338265 | 1.99167 | 0.0000 | Significant |

Source: Proceeded secondary data, 2015

The $t_{table}$ was gotten from t distribution table with significance level 5% (α=0.025) and df = n-k-1 (n = number of samples,
k = number of independent variables) that was 1.99167.
Each independent variable has a $H_0$ (Null Hypothesis) and a $H_a$ (Alternative Hypothesis). To know which one of them is accepted, it is determined by comparing $t_{count}$and $t_{table}$ also using the significance value with the requirements are:

1. If $t_{count}<t_{table}$ , $H_0$ is accepted
2. If $t_{count}>t_{table}$ , $H_0$ is rejected
3. If the significance < 0.05, an independent variable influences dependent variable significantly and positively.
4. If the significance is > 0.05, an independent variable does not influence dependent variable significantly and positively.

The hypothesis of Partial Test are explained in each independent variable as follows:

$Ho_1$: Container crane productivity does not influence positively on the number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. ($Ho_1$: $\beta_1 = 0$)

$Ha_1$: Container crane productivity influences positively on number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. ($Ho_1$: $\beta_1 \neq 0$)

It can be seen in the Table 9 that container crane productivity (X1) variable had the $t_{coun\ t}$accounted for9.082337 and $t_{table}$ was 1.99167 also the significance was 0.000. As $t_{count}>t_{table}$ (9.082337 >1.99167) and the significance < 0.05. So it can be determined that $Ho_1$ was rejected and Ha was accepted. It means that container crane productivity gave influence positively on the number of containers handled significantly and individually.

$Ho_2$: Ship call frequency does not influence positively on the number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. ($Ho_2$: $\beta_2 = 0$)

$Ha_2$: Ship call frequency influences positively on the number of containers handled at Terminal Petikemas Semarang branch PT. Pelabuhan Indonesia III. ($Ho_2$: $\beta_2 \neq 0$)

As shown in the Table 9, it can be seen that ship call frequency (X2) variable had the $t_{count}$ accounted for5.338265and $t_{table}$ was 1.99167 also the significance was 0.000. As $t_{count}>t_{table}$ (5.338265 >1.99167) and the significance < 0.05. So it can be determined that $Ho_2$ was rejected and $Ha_2$ was accepted. It means that ship call frequency influences on the number of containers handled significantly and individually.

## CONCLUSION

Based on the result of analysis of the influence of container crane productivity and ship call frequency on cargo handling performance, some points can be concluded as follows:

a. According to the hypothesis test, in partial Container Crane Productivity variable (X1) had 0.000 as the significance and $t_{count}$ (9.082337) > $t_{table}$ (1.99167) so this predictor variable influenced the number of containers handled. Next, Ship Call Frequency variable (X2) had 0.000 as the significance and $t_{count}$ (5.338265) > $t_{table}$(1.99167), it means that ship call frequency influence on number of containers handled significantly and individually. Then, the predictor variable (X1 and X2) influenced the number of containers handled as a criterion variable (Y) because $F_{count}$ (110.137) > $F_{table}$ (3.12).
b. The result of multiple regression analysis can be arranged to the equation, that is Log Y = 4.923991 + 0.525387 log XI + 0.423276 log X2 + e. Container Crane

Productivity (X1) had the coefficient in 0.525387 and Ship Call Frequency was 0.525387. In order to enhance cargo handling performance, the variable that must be increased is Ship Call Frequency.

## RECOMMENDATION

The data from internal Terminal Petikemas Semarang were obtained and after being analyzed, some recommendations could be considered:

1. To improve the Container Crane Productivity, it is suggested to invest Container Crane.
2. To enhance Ship Call Frequency:
   2.1. Today, only two vessels that can berth at Terminal Petikemas Semarang at the same time. So that, lengthening the quay can increase the ship call frequency.
   2.2. Expand the port by dredging the bay to allow the larger vessels to enter the port.

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