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INFLUENCE OF QUAY CONTAINER CRANE PLANNING AND IMPLEMENTATION OF RUBBER TIRED GANTRY CRANE ON PRODUCTIVITY OF STEVEDORING COMPANY IN JAKARTA-INDONESIA

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Abstract

This research aims to demonstrate relationships between quay container crane planning and implementing rubber tyred gantry crane system to container stevedoring productivity in Tanjung Priok Seaport, Indonesia. For this, a descriptive research design was adopted. Research is done by using quantitative method, with questionnaire as the research instruments. Data obtained was analyzed by using simple linear regression, double linear regression, as well as correlation. Results show that quay container crane planning and implementing rubber tyred gantry crane having strong relationship level.

Keywords: Planning, implementation, productivity, linear regression

INTRODUCTION

Stevedoring Company is a company that works in container terminal to serve container loading, unloading, import and export. Their responsibilities mostly are providing loading and unloading services, delivering and ensuring goods from port of origin to port of destination until the goods received by the owner. (Rifni & Rizky Rachman, 2014). In order to support shipping companies performance, stevedoring company shall be able to work professionally.

Nonetheless, company expected to provide sustainable stevedoring facilities such as quay container crane for container movement in dock area, and rubber tyred gantry crane for container lifting activities from container yard to trailer truck or vice versa. However the lack of fleet availability and preparation is still apparent due to lack of equipment maintenance that may deter work. Main factors that contribute slowdown are the limited human resources performance and inadequeacy of loading and unloading as well as trucking facilities. (Badarusman. & Eryana, 2016).

Any disruption or damage found in quay container crane during handling activities or breakage of rubbed tyred gantry crane during receiving/delivery activities will immensely affecting all terminal subsystem including quay operation, field operation, and gate operation, or receipt/delivery activities will be hindered. Hence, an operation procedure of quay container crane and rubber tyred gantry crane is necessary so that the execution is in accordance with the initial planning and increasing company's productivity that aligns with the company's main goal. For service quality improvement, companies are supposed to do evaluation in certain period of time to comply with existing standards and establish new and better standards for company. (Badarusman. & Eryana, 2016).

Planning is a basic process when management decides the goals and how to achieve them (Handoko, 2013). Quay container crane is an equipment to load and unload container from and to container ships. This crane is located above vessel anchor that continuously move along the rail track in quay. (Lasse, 2014). Therefore quay container crane planning is a master plan from quay container crane usage to produce box crane per hour in which box crane per hour is defined as how much containers can be loaded and unloaded by a crane in an hour. Implementation is an activity that utilize tools, facilities and infrastructure designed to help workload. With implementation, work will be faster, more effective, more efficient, and more accurate. (Sugiyono, 2016).

Rubber tyred gantry crane is a crane located in unit terminal container (UTC). This crane moves container from UTC to truck or vice versa. This crane can be found in container yard (CY) which moves along special track and able to relocate where it is required. (Lasse, 2014). The implementation of rubber tyred gantry crane is the act of how much Rubber Tyred Gantry Crane can produce RTGC rate. RTGC rate means How Rubber Tyred Gantry Crane performance in an hour from each crane. Stevedoring productivities is a workforce or equipment ability in doing loading and unloading activities to and from ships, quay, and container terminal. Some factors that could influence stevedoring productivities starting from equipment age until equipment maintenance.

This research aims to show the relationship between quay container crane planning and rubber tyred gantry crane implementation with stevedoring productivities. This research uses quantitative method and collected data are analyzed with inferential statistics while data is tabulated by using SPSS software (Statistic Product and Service Solutions).

LITERATUR REVIEW

Quay Container Crane

According to (Lasse, 2012: 30), Quay Container Crane was first built in 1959 by Paceco with its original construction "A" frame and was called "Portainer". Quay container crane (QCC) stands and runs on rails on the edge of the pier with an electric power source from a power station on land or a diesel engine generating electricity itself (on board power supply). QCC serves ship operations, connecting ships with docks. The working principle of QCC is:

1. The container from the ship's hatch is lifted up, then in a horizontal motion carried by trolley to the dock and stopped between the legs of the crane (legs) to lower the container until it is just above the chassis chassis that is ready to receive it.
2. The next move is to return the empty spreader from the position on the dock carried by the trolley to the ship's hold, and land the spreader on the next unloaded container.

For containers that are loaded, the movements are reversed, lifting the container from the top of the chassis, the trolley carries to the hatch, the container is lowered and released at the location in accordance with the loading plan (bay plan). The horizontal movement of the trolley runs across the width of the hull to reach all the load rows. Troley can also move down the spreader vertically to reach the container at the lowest tier position. Meanwhile, to reach containers in the position of extending ships or moving bays, QCC performs gantry movements on the rails.

QCC construction is not just equal to changes in shipping technology, but the specifications and performance of cranes change to become bigger, faster, and more reliable. Changes have occurred very significantly in the box load and discharging rate at speeds of 40 to 55 boxes per hour, or in other words increasing to twice as fast as before.

Quay Container Crane is a device that is usually the largest dimension in the container port, has arms whose length can be as wide as even exceeding that of a ship, which uses a rail motion (Ardiyanto.id, 2014).

Based on the description above it can be concluded that the definition of Quay Container Crane Planning is the initial planning of the use of quay container cranes to produce box crane per hour, that is the number of containers unloaded or loaded in one hour from each crane.

Productivity

Understanding Productivity

Productivity is the ability of a business to produce products in a specified period of time. The time period is usually calculated quarterly, semester, and yearly. Productivity capacity is also seen from the number of units produced, as well as the quality of products that are in accordance with agreed standards (Fahmi, 2012). Productivity is the relationship between the output or results of the organization with the input needed (Wibowo, 2013).

Loading and unloading productivity is the ability of labor or loading and unloading equipment in carrying out their duties of unloading or loading goods from or to ships and docks (Indriastiwi, 2014).

In improving good service, companies are required to be able to achieve high productivity to meet the standards set by the company, it is necessary to do an evaluation of the company every time period to set new and better standards for the company (Badarusman. & Eryana, 2016).

Based on the description above it can be concluded that the notion of productivity is the ability of a company to produce high output effectively and efficiently.

Loading and Unloading

Loading and Unloading Activities are activities engaged in the loading and unloading of goods to and from ships at the port which include stevedoring, cargodoring, and receiving / delivery (Minister of Transportation, 2013). According to (Lasse, 2014), loading / unloading is:

a. Stevedoring, is lowering and / or raising goods from / to the ship. For unloaded goods, goods are transferred to trucks or railroad cars, or to barges; or
b. Cargodoring, is to the warehouse / field;
c. Receiving, is the activity of receiving goods unloaded from a ship. Receiving can take place on the side of the ship directly to the truck or to the barge, and on the land side of the warehouse / field for goods through the warehouse / field delivered to the consignee or representative; and
d. Delivery, is the delivery of goods by the ship (carrier) to the recipient. Like receiving, delivery can take place on the side of the ship directly to the truck or to the barge, and on the land side of the warehouse / field for goods through the warehouse / field delivered by the carrier to the consignee or representative.

There are several factors that cause the loading and unloading process to experience obstacles. Namely, among others, the performance of human resources is still ineffective, the completeness of loading and unloading equipment, the trucking provided is not effective (Badarusman & Eryana, 2016).

Based on the description above it can be concluded that the definition of loading and unloading is the activity of unloading and loading goods from and to the ship / dock / stacking field which includes stevedoring, cargodoring, receiving / delivery activities.

METHODOLOGY

Study

A descriptive research design was adopted. Research is done by using quantitative method, with questionnaire as the research instruments.

Validity test

Validity test is a tool used to measure the validity of a questionnaire (Sugiyono, 2010). The instrument validity was tested using Product Moment and Pearson correlations. Analysis was carried out on all instrument items from the variable planning quay crane crane. The testing criteria are carried out by comparing the r count with the r table at a level = 0.05. If the calculation result turns out to be r count> r table, then the instrument items are considered valid, conversely if r count <r tables are considered invalid, the instrument cannot be used in research.

1. Variable Validity Test X1

From the results of trials conducted on 30 respondents it can be stated that all items were declared valid.

2. Variable Validity Test X2

From the results of trials conducted on 30 respondents it can be stated that all items were declared valid.

3. Variable Validity Test Y

From the results of trials conducted on 30 respondents it can be stated that all items were declared valid.

Reliability Test

The reliability test is carried out to find out how far the measurement results remain consistent when measuring two or more of the same symptoms using the same measuring device (Sugiyono, 2010). Reliability testing is carried out using Cronbach alpha. Cronbach alpha coefficient> 0.60 indicates the reliability of the instrument.

1. Variable Reliability Test X1

After calculating the valid items, a reliability value of 0.741 is obtained

2. Variable Reliability Test X 2

After calculating the valid items, a reliability value of 0.766 is obtained .

3. Y Variable Reliability Test

After calculating the valid items, a reliability value of 0.725 is obtained

The formulas used in testing research instruments are as follows:

1. Validity Test Formulas:

$$r_{xy} = \frac{N\left(\sum XY\right) - \left(\sum X\right)\left(\sum Y\right)}{\sqrt{\left(N\left(\sum X^2\right) - \left(\sum X\right)^2\left(N\left(\sum Y^2\right) - \left(\sum Y\right)^2\right)\right)}}$$

X = Score chosen by the subject of all items

Y = Total score obtained from all items

ΣX = Number of scores in distribution X

ΣY = Number of scores in the Y distribution

ΣX2 = Number of squares in the score in the distribution X

ΣY2 = Number of squares in the score in the Y distribution

n = Number of respondents

2. Reliability Test Formulas

$$r\overline{11} = \left[\frac{k}{k-1}\right]\left[1 - \frac{\sum S^2}{S1^2}\right]$$

$$s^2 = \sum X^2 - \frac{\frac{(\sum X)^2}{N}}{N}$$

r$\overline{11}$ = Instrument Real...y

k = Number of questions

Σs^2 = Number of questions

$S1^2$ = total variant

Analysis

Data collected analyzed by using simple linear regression, double linear regression, as well as correlation. SPSS V20 software is used.

RESULTS AND DISCUSSION

Relationship between quay container crane planning against container stevedoring productivities

Simple correlation coefficient analysis were used to determine relationship strength between quay container crane planning and container stevedoring productivities.

Results shown the correlation scored 0.639, which means quay container crane have strong and positive correlation with container stevedoring productivities, and concludes the increasing of quay container crane planning will be followed by the increasing of container stevedoring productivities, and vice versa.

Coefficient of determination tested in order to recognize how much quay container crane planning contributes toward container stevedoring productivities. Based on the correlation score 0.639, the value of coefficient of determination is (CoD) = R_{x1y}^2 x 100% = 0.639^2 x 100% = 40.83%. The value indicates quay container crane planning contributes 40.83% of container stevedoring productivity meanwhile 59.17% was influenced by other factors.

Regression coefficient analysis is a method used to analyse the influence of quay container crane to container stevedoring productivity.

According to the calculation, given t_{count} is 6.750, and cross-tabulated with table t in df = n – 2 = 66 and standard deviation 0.05 to do two-party testing resulting t_{table} equals 2.000. Therefore $t_{count} > t_{table}$ (6.750 > 2.000) or H_a accepted, which means quay container crane planning have significant relationship towards container stevedoring productivities.

Regarding equation of linear regression line that implicates relationship between X_1 with Y is: $\hat{Y} = 5.143 + 0.485X_1$, which suggest container stevedoring productivities amount to 5.143 if quay container crane planning equal to zero. Thus, container stevedoring productivity will waning if there is no quay container crane planning. With regression coefficient equals to shown that for every 1% increase in quay container crane, then container stevedoring productivity will also increase 0.485%.

Relationship between rubber tyred gantry crane implementation with container stevedoring productivities

Simple correlation coefficient analysis used in order to understand the relation strength between quay container crane planning independently toward container stevedoring productivity.

Given obtained correlation score is 0.696, which means the implementation of rubber tyred gantry crane have strong and positive correlation towards container stevedoring productivities so it can concludes the increasing of rubbery tyred gantry crane will be followed by container stevedoring productivities or vice versa.

To understand the huge contribution to container stevedoring productivity from rubber tyred gantry crane implementation, a coefficient of determination testing was done. With correlation value 0.696, the value of coefficient of determination (CoD) = $R_{x2y}{}^2$ x 100% = 0.696^2 x 100% = 48.44%. This score implies the participation of rubber tyred gantry crane execution toward container stevedoring productivity. Meanwhile other factors that contribute toward container stevedoring productivities 51.56%.

Subsequently, to analyse the influence of rubber tyred gantry crane execution toward container stevedoring productivities.

From the calculation, given obtained t_{count} 7.880 and cross-tabulated with table t in df = n – 2 = 66 and standard deviation 0.05 for two-parties testing resulting in t_{table} equals to 2.000. Therefore $t_{count} > t_{table}$ (6.750 > 2.000) or H_a accepted, which suggest rubber tyred gantry crane implementation having significant relationship toward container stevedoring productivities. Also given equation of linear regression line that illustrate relation between variable X_1 with Y is: $\hat{Y}$ = 0.747 + $0.606X_2$, which means productivity of container stevedoring equals to 0.747 if rubber tyred gantry crane execution equals to zero, which means productivity of container stevedoring will decrease if there is no implementation of rubber tyred gantry crane. With regression coefficient amount 0.606 indicates when rubber tyred gantry crane implementation improve by 1%, then productivity of container stevedoring will increase around 0.606%.

Relationship between quay container crane planning and implementation of rubber tyred gantry crane against container stevedoring activities

Multiple correlation coefficient analysis used to indicate the strength affiliation between quay container crane planning and implementation of rubber tyred gantry crane simultaneuosly towards container stevedoring productivity.

From given results, obtained correlation score 0.713, which means quay container crane planning and rubber tyred gantry crane implementation having strong and positive correlation toward contrainer stevedoring productivity. Then the value of coefficient of determination (CoD) = $Rx_1x_2y^2$ x 100 % = 0.713^2 x 100% = 50.83%. This indicates quay container crane planning and rubber tyred gantry crane implementation contributes 50.83% of container stevedoring productivity, and 49.17% was contributed by other factors.

Based on the table, obtained F_{count} is 33.595. After cross-tabulated with table F with df numerator (m) 2 and df denominator = n – m - 1 = 65 and standard deviation 0.05 acquired from F_{table} equals to 3.14. So $F_{count} > F_{table}$ (33.595 > 3.14) or H_a approved, which means quay container crane planning and implementation of rubber tyred gantry crane simultaneously having positive significance towards container stevedoring productivity.

As known the equation of linear regression line that describes relationship between variable X_1 and X_2 with Y is: $\hat{Y} = 0.253 + 0.186X_1 + 0.439X_2$. Constant value of container stevedoring productivity is 0.253 if quay container crane planning and implementation of rubber tyred gantry crane equals to zero, which means container stevedoring productivity will decline if there is no quay container crane planning and implementation of rubber tyred gantry crane simultaneously. With regression coefficient X_1 equals to 0.186 and X_2 equals to 0.439 indicates for every 1% increase in quay container crane planning, then container stevedoring productivity will increase 0.186% and for every 1% increase in rubber tyred gantry crane execution then container stevedoring productivity will increase 0.439%.

CONCLUSIONS

Based on the results of the analysis of the data obtained, the conclusions obtained from this study are:

1. There is a significant positive relationship between quay container crane planning and container loading and unloading productivity at PT. Jakarta International Container Terminal with a correlation coefficient of 0.639 and the magnitude of the level of influence of the relationship indicated by a coefficient of determination of 40.83%. Based on the regression equation it is known that an increase in one quay container crane plan will be followed by an increase in container loading and unloading productivity of 0.485 units in the same direction with a constant of 5.143.
2. There is a significant positive relationship between the implementation of rubber tyred gantry cranes to the productivity of container loading and unloading at PT. Jakarta International Container Terminal with a correlation coefficient of 0.696 and the magnitude of the level of influence of the relationship indicated by a coefficient of determination of 48.44%. Based on the regression equation it is known that an increase in the implementation of a rubber tyred gantry crane will be followed by an increase in container loading and unloading productivity of 0.747 units in the same direction as a constant of 5,143.
3. There is a significant positive relationship between the planning of a quay container crane and the implementation of a rubber tire gantry crane on the productivity of container loading and unloading at PT. Jakarta International Container Terminal with a correlation coefficient of 0.713 and the magnitude of the level of influence of the relationship indicated by a coefficient of determination of 50.83%. From the regression equation it is known that each increase of one quay container crane plan will increase 0.186 units of container loading and productivity and at the same time each increase of

one unit of rubber tyred gantry crane will increase 0.439 units of container loading and unloading productivity in the same direction as a constant of 0.253.

RECOMEMENDATIONS

1. Planning a crane quay crane at PT. Jakarta International Container Terminal should be improved again, especially for operators of quay container cranes to be given regular training to improve their ability to operate quay container cranes so as to increase the yield of containers that are unloaded or loaded from ships to docks or vice versa from docks to ships.
2. In this case the implementation of rubber tire gantry cranes at PT. Jakarta International Container Terminal is a very influential factor in container loading and unloading productivity due to regular preventive maintenance (PM) in order to increase equipment readiness, but in this case the company should add a rubber tyred gantry crane to the stacking yard in order to speed up the service process activities in the container stacking field.
3. Container loading and unloading productivity at PT. Jakarta International Container Terminal has been rated as good so it must always be maintained and increase safety in carrying out container loading and unloading activities.

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