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Performance Analysis of Quay Container Cranes in Loading and Unloading Operations at Koja Terminal

Lis Lesmini[1*], Daeng Rifqi Fadhlurrahman[2]

[1,2]*Trisakti Institute of Transportation and Logistics, Jakarta, Indonesia*

***Corresponding author:** lies.1969@yahoo.com |

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Abstract

Purpose: This study aimed to determine the effect of Quay Container Crane performance on the smoothness of container loading and unloading activities at the Koja Container Terminal, North Jakarta.

Research Methodology: Data were collected through interviews and questionnaires. This study used a quantitative descriptive approach with primary and secondary data sources. The data analysis techniques included simple linear regression analysis, correlation coefficients, coefficients of determination, hypothesis testing, validity testing, and reliability testing. The study population comprised 37 QCC operators, and the research sample comprised 37 individuals. Technique sampling using a saturated sample.

Results: The results of the analysis show the influence of the performance of the Quay Container Crane and smooth loading and unloading activities, as shown by the simple linear regression line equation: Y = 9.679 + 0.696X. This means that if there is a performance change in the QCC (variable X), the smoothness of the loading and unloading activity will increase by 0.696 with a constant (a) of 9.679. The Correlation Coefficient Analysis (r) = 0.610 means that the performance of the QCC (variable X) with smooth running of loading and unloading activities has a strong relationship influence and is positive. Analysis Coefficient Determinant (KP) of 37.2%.

Conclusions: Based on the results of the hypothesis test, t count > t table or 5.746 > 2.030, so H0 is rejected and Ha is accepted, meaning that there is an influence of QCC performance on the smoothness of loading and unloading activities.

Limitations: This study is limited to the operational performance of Quay Container Cranes (QCC) at the Koja Container Terminal KSO, North Jakarta, using data collected from 37 operators during the 2018 operational period.

Contributions: This study contributes to the understanding of the relationship between Quay Container Crane performance and the smoothness of container loading and unloading activities at container terminals.

Keywords: *Container Loading and Unloading, Operational Productivity, Port Operations, Quay Container Crane, Terminal Performance*

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1. Introduction

Tanjung Priok Port is the largest port in Indonesia with the busiest activity, both by ship traffic entering or leaving the port and (land) vehicles transporting containers (Anggraini, 2021; Selasdini & Almuzani, 2022). The container terminal in Tanjung Priok is the KSO (Joint Operation) Terminal Koja Container Terminal, commonly known as KSO TPK Koja. Shipping lines typically favor container terminals with fast loading and unloading times. This is because faster loading and unloading means less time spent at the port, thus lowering the vessel costs (Aprillita & Perkasa, 2021; Prakoso et al., 2017; Pranogyo et al., 2021).

Indonesia's growth in the early 1990s led to an increase in export and import activities through the Tanjung Priok Port (Abdullah, 2021; Febriansyah et al., 2019). To meet the sharply increasing demand for container handling services, the state-owned company PT Pelabuhan Indonesia II (Persero), in partnership with the private company PT Hutchison Ports Indonesia, jointly developed a completely new terminal, the Koja Container Terminal (TPK KOJA). The two companies also established a Joint Operation to handle the terminal's daily operations. Through several optimization programs, its capacity has increased from 680,000 to over 1 million TEUs of containers per year, and is ready to serve large fourth-generation container ships (Moeis et al., 2020; Satria, 2021).

The KSO Koja Container Terminal is the first container terminal in Indonesia, operated jointly by the government and a private company that aims to contribute to the country's growth. Located at Jl. Digul No. 1 Tanjung Priok, North Jakarta 14310, Indonesia. Currently, the KSO TPK Koja implements a system operation called next Generation (nGen), which was changed in 2003. Previously, Koja TPK KSO used an operating system called NAVIS. This system was designed to link with the customer system, allowing quick online communication (Kierzkowski & Kisiel, 2017; Solihin, 2021). This allows customers to track the position of containers, plan shipments, and track their shipments. stacking and the vessels used. For better growth, KSO TPK Koja currently has a stacking area of 21.80 Ha, Import Stacking Capacity of 7,560 TEUs, Export Stacking Capacity of 7,696 TEUs, and Reefer Stacking Capacity of 310 plugs. Meanwhile, the length of KSO TPK Koja's cadmeter is 650 cad meters, with a Pier Width of 40 m and a pool depth of -14 MLWS.

As a container terminal with busy activities, it must have loading and unloading equipment that is in good and prime condition to facilitate all existing loading and unloading activities. at container terminals. However, the loading and unloading processes do not always run as smoothly as expected (Fathihani, 2021; Fathihani & Nasution, 2021). Occasionally, numerous obstacles seriously disrupt the process, causing delays in loading and discharge from or to the ship. To carry out terminal operations so that activities at the terminal run smoothly, a good communication system is also needed between field members and members in the control tower (Ikhsani et al., 2021). Currently, the Koja Container Terminal KSO uses the N-Gen system, which is used at the Koja Container Terminal KSO location, where N-Gen is a new system implemented by the Koja Container Terminal KSO. Previously, when N-Gen had not been implemented, the Koja Container Terminal KSO used a system called NAVIS. N-Gen was made by the company Hutchinson Port, which is the parent company of the Koja Container Terminal Joint Operation (KSO) that collaborates with PT. Pelindo (Pelabuhan Indonesia). The new system will minimize misunderstandings between the two companies. party One with Which other. While performing the operation activity unloading and loading container, the number of personnel who will carry out container loading and unloading activities is determined. The Koja Container Terminal Joint Operation (KSO) currently has several teams (Ricardianto et al., 2021). Each team consisted of 12 stevedoring workers (TKBM). These TKBMs are booked based on the ship capacity or number of quay container cranes used during operating hours (Rizqi & Sakinah, 2021; Wardhani & Ully, 2021).

In carrying out loading and unloading operations, KSO TPK Koja has equipment, namely seven units of

Quay Container Crane (QCC), which are used to carry out container loading or unloading operations at the edge of the dock, 25 units of Rubber Tyred Gantry Crane (RTGC), which are used to stack containers when the containers are already in the Container Yard (CY) (Setyawati et al., 2021), 48 units of Head Trucks, which are used to transport containers from the dock to the stacking yard or from the stacking yard to the dock, and three units of Reach Staker. KSO Terminal Container Koja has several customers who use the terminal for container stacking, including China Shipping Container Line, Gold Star Line LTD, Hapag-Lloyd, Hanjin, Heung-A Shipping, HMM, KMTC Line, K-Line, MOL, SINOKOR, TEMAS Line, Wan Hai Lines LTD, BEN LINE AGENCIES, SPIL, ANL, Regional Container Lines (RCL), and MSC (Susanto & Parmenas, 2021).

This study focuses regarding QCC (quay container Crane), which often experience problems in carrying out loading and unloading activities. Quay container cranes must always be in prime condition when used (Abou Kasm & Diabat, 2020; Ayuningtyas & Ilman, 2021). To indicate how many containers are unloaded and loaded, a calculation called the Gross Crane Rate (GCR), formerly known as the Box Crane per Hour), and Vessel Operation Rate (VOR), formerly known as the Box Ship per Hour), is used (Prijono et al., 2021). The GCR indicates the number of containers that are unloaded and loaded. The number of containers that can be unloaded and loaded on each Quay Container Crane in one hour (Karam et al., 2020; Wahyuningsih et al., 2021). Meanwhile, VOR shows how many containers can be unloaded and loaded on one ship in one hour. time One clock.GCR And VOR in Joint Operation Koja Container Terminal Alone have a target 26 box per o'clock for GCR and 65 boxes per hour for VOR, respectively. The loading and unloading speeds are unstable and fluctuate. If we look at the average speed per month, sometimes there are those that exceed the target, sometimes according to the target, and even some are below the specified target (Kizilay & Eliiyi, 2021; Syahrial & Sudono, 2021). According to the data obtained by the author, the average GCR in 2018 was 24 boxes per hour, and the VOR was 63 boxes per hour. This shows that the average speed of loading and unloading containers did not reach the target set by the KSO Koja Container Terminal. In reality, the GCR at TPK Koja is only 24 boxes per hour; therefore, there is a difference of 2 numbers below the target, which should be 26 boxes per hour. In the VOR, which should be 65 boxes per hour, in reality, it is only 63 boxes per hour, there is a difference of 2 numbers below the specified target (Berlian Rms & Wahyuningsih, 2021; Huang et al., 2021).

According to the results of interviews with the Manning Operation, the gate-out sections at the Koja Container Terminal QCC number 2 (Panamax), number 4 (Post Panamax), and number 5 (Post Panamax) experienced breakdown problems/damage in their cabins, causing the QCC to be unable to operate for one month. Therefore, with the damage to three QCCs (numbers 2, 4, and 5), only four QCCs can operate (numbers 1, 3, 6, and 7) (Saputra & Kusnadi, 2021; Sumaryadi & Kusnadi, 2021; Suyanto et al., 2021). This damage significantly affects the performance of the QCC in smoothing loading and unloading operations. If a large ship arrives with a stack of containers/tiers on a tall ship, only QCC 6 and 7 can operate. QCC 4 and 5 should also be able to operate for ships with high container stacks/tiers because QCC 4 and 5 experienced breakdowns/damages; therefore, only QCC 6 and 7 can operate, which have a higher height for unloading. The container (Nunuh & Wulandari, 2021). QCCs 1 and 3 were unable to operate because of height restrictions for unloading containers on board. This was quite disruptive and hampered the loading and unloading processes. Another problem was that the lock and unlock on the spreader broke while lifting the container, hampering loading and unloading activities because the spreader had to be repaired immediately by a technician. Repairing the lock and unlocking it usually takes 15 min. If the Quay Container Crane is always ready and in prime condition, loading and unloading can run smoothly and optimally (Saputro & Soleha, 2021).

Therefore, it can be concluded that the performance of the Quay Container crane affects the smoothness of loading and unloading. If the Quay Container Crane is in prime condition at the time of operation, then the loading and unloading activities can run well, and the performance is optimal. However, if there

are several obstacles (damage or jammed equipment) on the Quay Container Crane, the smoothness of the loading and unloading activities will not be optimal, and the results will not be in accordance with the predetermined targets.

2. Literature Review

According to Lumi and Yosef (2022) and Wahono (2015), performance is a person's overall result during a certain period in carrying out tasks, such as work result standards, targets, or criteria targets that have been determined in advance and agreed upon together. Meanwhile, according to Lesmini and Purwanto (2016) and Parmenas (2021), performance is the work results in terms of quality and quantity achieved by an employee in carrying out his duties in accordance with the responsibilities given to him. From the several definitions above, the author can conclude that performance is work achievement or work results (output) in both quality and quantity achieved by human resources per unit of time period in carrying out their work duties in accordance with the roles and responsibilities given to them in the company (Kuncoro & Harahap, 2021; Nuraeni et al., 2022; Setyawati & Aristiyanto, 2021).

One of the determining factors of loading and unloading performance is the availability of adequate loading and unloading equipment (**hernawan'**; Heriyanto, 2021). Loading and unloading activities at the port consist of stevedoring, which is the activity of unloading cargo from the ship to the dock or from the dock to the ship using ship cranes, dock cranes, and other supporting equipment; cargodoring, which is the activity of moving cargo that has been unloaded from the ship from the dock to the warehouse/stack yard (Abidin et al., 2022; Lesmini et al., 2022; Saputra et al., 2022), then arranged/stacked in the warehouse or stacking yard; and receiving/delivery, which is the activity of receiving and handing over cargo from the warehouse/stack yard in the line 1 area and arranging it on land transportation vehicles to be delivered to the consignee (Agusinta et al., 2021; Keke et al., 2021; Wijayanti & Santoso, 2022).

In the process of loading and unloading containers, a tool is needed to lift and lower containers, which is called a Quay Container Crane. The equipment is operated by an operator and assisted by TKBM (Standing and Unloading Workers) to carry out these activities. One gang/team consists of 12 TKBM persons. A Quay Container Crane (QCC) is a tool (crane) used for unloading or loading containers from a ship onto a head truck chassis or vice versa and transferring them from a head truck chassis onto a ship. This loading and unloading equipment is the most important because it is located at the edge of the dock where container ships dock, and the QCC performance is assessed by its loading and unloading speed.

Indicators that support activities to run smoothly are as follows: QCC in prime condition, certified and expert operators, use of tools according to Standard Operating Procedures, availability of spare parts in case of damage, mechanics that are always in a ready condition, and equipment maintenance (Kurniawan & Hariadi, 2022; Ricardianto et al., 2021). This Quay Container Crane extends the QCC's reach further out to sea to reach containers on ships. If a crane ship moves down (Boom Down) to carry out loading or unloading operations, whereas when not in operation, the crane moves up (Boom Up) (Harywibowo & Hariadi, 2022). Apart from cranes, there are also cabins that function to move forward and backward with the trolley so that the operator inside can see the position of the spreader when lifting the container (Achir et al., 2022; Ardhianti et al., 2022; Fadhilah et al., 2022). Another tool, the Gantry, is useful for moving the QCC right and left during operation. The motor Hoist is useful for moving the spreader to raise or lower the container when it is being lifted. The spreader is a loading and unloading tool installed in the QCC, which has four corners, each with a twistlock that is used to lift containers onto or from a ship. This tool greatly assists the QCC operators in lifting the containers. Spreaders are available in two types: TwinLift and SingleLift.

In carrying out its activities, the QCC has three movements: Hoist Up & Hoist Lower, which is useful for moving the spreader up and down; Trolley Cabin & Spreader to move forward and backward; and gantry,

which is useful for shifting from right to left. Sometimes, one of the three movements is problematic because each QCC has its own constraints and is always different. Currently, the QCC is divided into three types: Panamax (QCC numbers 1, 2, and 3), Post Panamax (QCC numbers 4 and 5), and Super Post Panamax (QCC numbers 6 and 7) (Pekih et al., 2021).

Quay Container Crane Operators are individuals with specialized skills in QCC operation. Currently, there are 37 QCC operators in the Koja TPK Joint Operation (KSO) divided into four shift groups (A, B, C, and D). These crane operators are trained at the Pelindo 2 Education and Training Center (BPL) to obtain a certificate of expertise. Each crane operator must have specialized skills in the training they receive to avoid untoward incidents. Every terminal wants loading and unloading equipment that is always in prime condition to launch operations smoothly without any technical disruptions from loading and unloading equipment (Bharadwaj, 2020; Emde et al., 2020). The continuous use of loading and unloading equipment will certainly reduce the equipment's performance to its original level. Therefore, regular maintenance is necessary to ensure that the loading and unloading equipment remains in optimal condition.

For maintenance at KSO TPK Koja (source: Engineering Division/Workshop). Maintenance was carried out on the QCC machine, checking the gantry machine, gantry machine cable, oil on the gantry machine, air filter, carbon bras on the gantry motor, sliding rail, and condition of the bolts and twistlock.

When carrying out loading and unloading activities, all aspects must be considered to support smooth operations so that can walk in accordance with the objective. According to Zatayu and Priyono (2018) in *The Container System* book, loading and unloading activities are activities that move goods from land transportation, and to carry out these cargo transfer activities, adequate facilities or equipment are required in a service method or procedure. The smoothness of loading and unloading is measured through the performance of all loading and unloading equipment and is expressed by the number of containers that can be unloaded and loaded by a Quay Container Crane or expressed by its loading and unloading speed using GCR (Gross Crane Rate) and VOR units (Pjevcevic et al., 2017; Yu et al., 2019), the more output produced, the better the quality of the container terminal and of course there will be many shipping companies that will carry out loading and unloading of containers at the terminal.

GCR is the number of container boxes that can be moved by one crane in 1 (one) hour. The higher the GCR number, the higher the quality of the crane's performance in carrying out unloading and loading (Ardi & Ayu, 2017). GCR Koja TPK 26 boxes per hour. and VOR (Vessel Operating Rate), which indicates the loading and unloading operational performance. The VOR is the number of container boxes that a terminal can load or unload from the hold of a single ship in one hour. Similar to the GCR, the higher the VOR, the higher is the loading and unloading quality. The VOR at TPK Koja was 65 boxes per hour.

Table 1. Data of GCR and VOR Containers in 2018

Month	GCR	VOR
January	23.20	64.23
February	26.44	65.40
March	26.09	66.73
April	25.10	61.40
May	26.01	65.10
June	25.05	60.68
July	26.07	70.31
August	22.27	57.04
September	21.28	60.36
October	25.03	61.97
November	26.10	63.07
December	26.03	66.30
Average	**24.80**	**63.54**

Source: Joint Operation TPK Koja, 2018

Based on Table 1, the Gross Crane Rate (GCR) and Vessel Operating Rate (VOR) performance at Joint Operation TPK Koja during 2018 showed fluctuating values each month. The highest GCR value occurred in February at 26.44 boxes per hour, while the lowest was recorded in September at 21.28 boxes per hour. Meanwhile, the highest VOR value was achieved in July at 70.31 boxes per hour, whereas the lowest occurred in August at 57.04 boxes per hour. Overall, the average GCR during 2018 was 24.80 boxes per hour, while the average VOR reached 63.54 boxes per hour. These results indicate that the loading and unloading operational performance at TPK Koja was relatively stable throughout the year, although several months experienced decreases in operational productivity due to operational constraints and equipment conditions.

2.1 Study previously

Research conducted by Marzuki (2008) stated that the productivity of container loading and unloading equipment is fundamentally important because it supports the success of ship entry and exit. The time-effectiveness costs incurred during container loading and unloading affect the efficiency and effectiveness of each task. Productivity at container ports is a measure of the work performed at these ports. The analysis techniques used in this study were Confirmatory Factor Analysis and Full Model of Structural Equation Model (SEM), supported by SPSS 14, AMOS 4.01, and MANOVA.

The delivery of goods, cruise companies use containers as an alternative to ensure proper protection of goods. PT Pelayaran Meratus is a shipping company that ships goods in containers. Container shipments are performed at container docks. This study aims to develop a quantitative model that can be used to identify the factors influencing the shipping process in a way that is significant to loading and unloading productivity. The problem was solved using multiple linear regression with dummy variables. Four stages were performed to analyze the obtained regression model.

Research conducted by Handajani (2004) explains that Tanjung Emas Port, Semarang is a large port, and in addition to serving passenger and general goods transportation, it also serves loading and unloading of containers. The volume of goods shipped using containers through Tanjung Emas Port has continued to increase annually. However, container services at the container terminal of Tanjung Emas Port, Semarang, are currently experiencing several obstacles that affect the speed of container services. These obstacles are caused by, among others: (1) the less than optimal use of gantry cranes and rubber-tyred gantries

in serving container loading and unloading, (2) the less than orderly arrangement of containers in the stacking yard, (3) the service time of trucks from outside carrying export containers that coincide with the truck chassis serving loading onto ships, thus slowing down a process; the same thing also occurs in the unloading (import) process, and (4) the number of truck chassis does not meet the standard operational configuration. This study aims to improve the efficiency of container services by improving the container arrangement system in the container yard according to the ship loading sequence and providing an estimate of the number of truck chassis required to achieve optimal gantry crane production. The research method used is primary data collection through field surveys, and secondary data obtained from related agencies. Data analysis was performed using queuing theory, and container flow forecasting was performed using SPSS software.

3. Methodology

This research is located at the Operational Cooperation (KSO) of the Koja Container Terminal on Jl. Digul No.1, Tanjung Priok, Jakarta 14310, Indonesia. The time study was conducted from November 2018 to January 2019. The population in the study This is the Quay Operator Container Crane, which has 37 respondents. Sampling technique The sampling technique used in this study was a non-probability technique, namely a saturated sample. Therefore, the sample in this study comprised all 37 Quay Container Crane operators at TPK Koja. The research method used quantitative data. The data sources are primary and secondary data. The primary data in this study were obtained from the respondents' answers to the questionnaire. Secondary data include reading books, literature, journals, and various existing sources (Siregar, 2012; Sugiyono, 2010, 2015).

4. Results and Discussion

From the data obtained, the results regarding the respondents' ages were obtained. The majority of respondents were aged 41–45 years (14 respondents, 37.8%), followed by 36–40 years (11 respondents, 29.8%), > 45 years (6 respondents, 16.2%), 31–35 years (4 respondents, 10.8%), and respondents with the lowest age 26–30 years as many as 2 respondents (5.4%). From the data processed above, it can be concluded that most of the QCC operator respondents at the Koja Container Terminal KSO were aged 41–45 years.

From the aspect of education level obtained that Senior High School as much as 27 respondents with a percentage of 73%, respondents with D3 education were 8 respondents with a percentage of 21.6%, respondents with a bachelor's degree as much as 2 respondents with a percentage of 5.4%, and respondents with a Master's degree were 0 people with a percentage of 0%. So it can be concluded that most of the respondents who are QCC operators in KSO Koja Container Terminal have a final education of Senior High School with a percentage of 73%.

In terms of length of service, it can be seen that the length of time respondents have worked at KSO TPK Koja is 6–10 years as many as 3 people with a percentage of 8.1%, respondents who have worked for 11–15 years as many as 11 people with a percentage of 29.8%, and respondents who work > 15 years as many as 23 people with a percentage of 62.1%. From the data above, it can be concluded that based on the length of service of respondents in KSO TPK Koja, most were > 15 years (62.1%), and the lowest were 6–10 years, as many as 3 people (8.1%).

Based on the length of work as an operator, it can be seen that the length of time respondents worked as QCC operators was 1–3 years, with 12 people (32.4%) working in this range. Respondents who worked as QCC operators for 4–5 years were as many as 14 people with a percentage of 37.9%, respondents who worked during 5–10 years were as many as 6 people with a percentage of 16.2%, and respondents who

worked for 11–15 years were as many as 5 people with a percentage of 13.5%. From the respondent data above, it can be concluded that based on the length of work of respondents as QCC operators, the highest number is 4–5 years, namely 14 people or with a percentage of 37.9%, and the lowest is 11–15 years old, as many as 5 people or with a percentage of 13.5%.

The results of the validity and reliability tests using SPSS showed that all questions were valid and reliable.

4.1 Discussion And Test Hypothesis Influence Performance Quay Container Crane (X) To Smooth Loading and Unloading (Y) of Containers at the Koja Container Terminal KSO in 2018

4.1.1 Simple Linear Regression Analysis

Table 2. Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	9.679	6.422		1.507	0.141
Performance QCC	0.696	0.153	0.610	4.556	0.000

a. Dependent Variable: Smoothness Activity Demolish Load
Source: Processed results of SPSS 24.00

Based on Table 2, the results of the SPSS method show that the regression and correlation analyses both have a strong and close relationship between each variable. Simple linear regression analysis was used to determine the extent of the influence of quay container crane performance (X) on the smoothness of loading and unloading activities (Y). Before that, the regression model was first determined using a simple linear regression equation with the formula: $Y = a + bX$. Based on Table 2, the value of a as a constant is 9.679, and the value of b is 0.696. Thus, the simple linear regression equation obtained is: $Y = 9.679 + 0.696X$.

4.1.2 Analysis Coefficient Correlation

This correlation technique is used to find relationships and prove the influence of the relationship between independent and dependent variables. Therefore, it is necessary to conduct a correlation analysis between the research variables. The results are presented in the table below.

Table 3. Results of Correlation Coefficient Analysis

Variable		**Performance QCC**	**Smoothness Unloading and Loading**
Performance QCC	Pearson Correlation	1	0.610**
	Sig. (2-tailed)		0.000
	N	37	37
Smoothness Unloading and Loading	Pearson Correlation	0.610**	1
	Sig. (2-tailed)	0.000	
	N	37	37

*** Correlation is significant at the 0.01 level (2-tailed).*
Source: Results Processed by Simple Linear Regression Analysis using SPSS Ver. 24.00

Based on Table 3, it is known that the relationship (correlation) between the performance of the quay container crane and the smoothness of loading and unloading activities is 0.610 (r_{xy}), which is in the interval 0.60–0.799 (Table IV.39). This indicates that the influence of variable X on variable Y is strong. Based on the correlation coefficient table above, both variables have a significant influence because sig 2 tail (significant) is less than < 0.05 with data, namely QCC performance of (0.00) and smooth loading

and unloading of (0.00).

4.1.3 Analysis Coefficient Determinant

For know how much big percentage performance QCC to smoothness activity container loading and unloading can be done by calculating the determining coefficient, with the formula according to Sugiyono (2015) as follows:

$$KP = r^2 \times 100\%$$

Information:

- KP = Coefficient Determinant
- r^2 = Correlation Coefficient Squared

With the formula above, it can be written as follows:
$KP = r^2 \times 100\%$
$= (0.610)^2 \times 100\%$
$= 0.3721 \times 100\%$
$= 37.2\%$

Table 4. Results of Coefficient of Determination Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.610[a]	0.372	0.354	4.01817

a. Predictors: (Constant), Performance QCC
Source: Results processed questionnaire (SPSS Ver. 24.00)

Based on Table 4, the value of the coefficient of determination (KP) can be used to determine the proportion of the independent variable in explaining the dependent variable. The coefficient of determination R square of 0.372 which shows that 37.2% of the quay container crane performance contributes to the smoothness of loading and unloading activities, while the remaining 62.8% (100% - 37.2%) is related to other variables that were not measured in this study.

4.1.4 Analysis Test Hypothesis

Based on the calculations, the calculated t value is 5.746 and the t-table value is 2.030. Because the calculated t value $>$ t-table, that is, $5.746 > 2.030$, then H_0 is rejected and H_a is accepted, meaning that there is a significant positive influence between variable X (QCC performance) on variable Y (smoothness of loading and unloading activities). Therefore, the assumption that quay container crane performance positively influences the smoothness of loading and unloading activities is proven true.

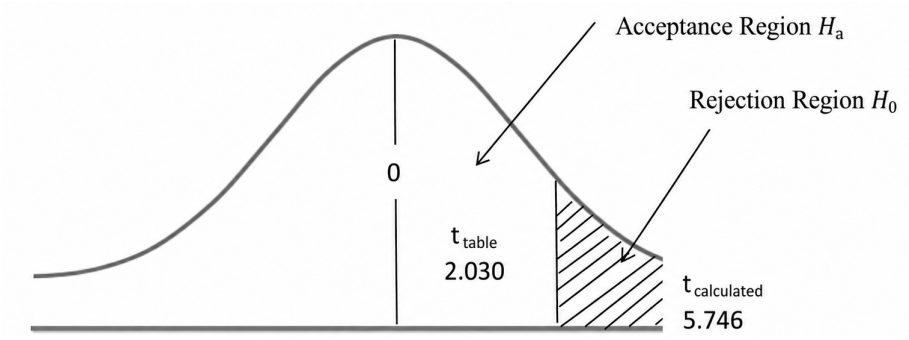

Figure 1. Travel Websites Traffic
Source: Similarweb.com, 2020

Figure 1 shows that the calculated t is in the rejection area of H0. This means that there is a positive and significant influence because the total calculated t is greater than the total t table between variable X (quay container crane performance) and variable Y (smoothness of container loading and unloading activities).

5. Conclusions

Based on the results of the analysis and discussion in the previous chapter regarding the influence of quay performance, the performance of the Quay Container Crane (QCC) as variable X has a very good level with an average value of 4.41. This indicates that QCC performance at Koja Container Terminal KSO in 2018 has a strong positive contribution to the company's operational service quality, particularly in supporting container terminal service users. Meanwhile, the smoothness of container loading and unloading activities as variable Y is categorized as good, with an average value of 4.14, indicating that operational activities run effectively and are well supported by existing performance factors.

Based on the statistical analysis, the simple linear regression equation obtained is $Y = 9.679 + 0.696X$, which means that an improvement in QCC performance will increase the smoothness of loading and unloading activities by a coefficient of 0.696. Furthermore, the correlation coefficient value of $r_{xy} = 0.610$ indicates a strong relationship between variable X and variable Y. The coefficient of determination shows that the influence of QCC performance on operational smoothness is 37.2%, while the remaining 62.8% is influenced by other factors not examined in this study. Hypothesis testing results also show that $t_{count} > t_{table}$ (5.746 > 2.030), so H_0 is rejected and H_a is accepted, meaning that QCC performance has a positive and significant effect on the smoothness of loading and unloading activities at Koja Container Terminal KSO in 2018.

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Author Contributions

LL conceptualized and designed the study, performed the data collection, analyzed the results, contributed to the writing of the original draft. DRF contributed to the analysis and interpretation of the data, and reviewed the manuscript. Both authors approved the final manuscript and agreed on the contents for

publication.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this study. This research was conducted independently, and no financial or personal relationships influenced the results or interpretation of the findings.

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