Structural Model of Rubber Tyred Gantry Operational Performance Management at New Makassar Petikemas Terminal 1

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Abstract

Terminal Petikemas *New* Makassar Terminal 1 or commonly referred to as TPKNM Terminal 1, in handling containers, especially exports, is expected to be better. Therefore, a study is needed to improve the loading and unloading service system so that the port can optimize operational performance, especially in supporting facilities for loading and unloading activities such as RTG cranes. There are 4 objectives of this study, namely; to determine the effect of the number of container loading and unloading, the number of head trucks, and the number of reach stackers on the number of RTG crane tools; to determine the effect of the number of container loading and unloading, the number of head trucks, and the number of reach stackers in effective time; and to determine the effect of the number of RTG cranes on effective time. This type of research uses quantitative research with a sample of 105 ships. Data collection was carried out for ± 2 months and the data processing method in this study was the SEM method using AMOS software and for modeling using SPSS software. The results of this study, namely the number of loading and unloading, the number of RTG cranes, and the number of head trucks, have a significant effect on the RTG crane. Then there is a significant indirect influence between loading and unloading on effective time mediated by RTG where the value of H 1 has th > ttable (5%) or 7.48 > 1.98. Then for the value of H 2 shows -0.48 < 1.98 and the value of H 3 also shows a value of 0.44 < 1.98, so that the indirect influence is insignificant or there is no need for mediation between the head truck and the reach stacker on effective time.

Introduction

Terminal Petikemas *New* Makassar Terminal 1or abbreviated as TPKNM Terminal 1 is one of the businesses in PT Pelabuhan Indonesia Regional IV (Persero). By having 18 units of Rubber Tyred Gantry (RTG) cranes, the potential for transhipment of goods in the TPKNM Terminal 1 field is so large, it requires an increase in services both from operational services and facility services. In operational services, it is necessary to increase the speed of service and in facility services, it is necessary to add loading and unloading equipment, one of which is such as RTG crane to support the speed of operations in the field, especially for container stacking operations from head trucks to stacking fields or vice versa. It is expected that the ability of TPKNM Terminal 1 in handling containers, especially exports, will be better. So that there can be an increase in container flow at the port of Makassar which will generate higher profits. Therefore, a study is needed to improve the loading and unloading service system at TPKNM Terminal 1 so that the port can optimize operational performance, especially in supporting facilities for loading and unloading activities such as RTG cranes. The study aims to determine the conditions and models for the operational performance of RTG crane loading and unloading equipment. The objectives of this study are: to determine the effect of the number of loading and unloading containers, the number of head trucks, and the number of reach stackers on the number of RTG cranes; to determine the effect of the number of container loading and unloading, the number of head trucks, and the number of reach stackers on effective time; and to determine the effect of the number of RTG cranes against effective time. The benefits are that the results of writing in this study can provide information to the port related to the performance model of the RTG crane tool in handling container loading and unloading, it is expected to optimize the performance of the New Makassar Terminal 1 Container Terminal with this research, and is expected to be used as a reference for other researchers who want to conduct research on the same topic.

Method

The location of the research was at TPKNM Terminal 1 in the area of PT Pelabuhan Indonesia (Persero) Regional IV Makassar Branch which is at Jalan Nusantara No. 329, Pattunuang Village, Wajo District, Makassar City, South Sulawesi. The primary data obtained were 105 ships where data on the number of loading and unloading, effective time, number of RTG cranes, number of head trucks, and number of reach stackers used. And secondary data obtained by citing existing documents at the agency concerned, namely

TPKNM Terminal 1 such as data on tool capacity, data on the number of tool facilities, tool age, TPKNM Terminal 1 layout, and others.

Data Type

This study uses a quantitative research method with a descriptive approach. According to Sugiyono(2013),Quantitative research methods can be interpreted as research methods based on the philosophy of positivism, used to examine certain populations or samples, sampling techniques are generally carried out randomly, data collection uses research instruments, data analysis is quantitative/statistical in nature with the aim of testing hypotheses that are has been established. And the descriptive method is a formulation of the problem with regard to the question of the existence of independent variables, either only on one variable or more (stand-alone variables). The data used in this study is by using the following data:

1. Primary data

    Data obtained by observing the service time of RTG cranes, namely the number of loading and unloading data, effective time, the number of RTG cranes, the number of head trucks, and the number of reach stackers used.

2. Secondary Data

    Data obtained by citing existing documents at the agency concerned, namely TPKNM Terminal 1 such as data on tool capacity, data on the number of tool facilities, tool age, TPKNM Terminal 1 layout, and others.

Results and Discussion

Data processing

The AMOS software program stands for Analysis of Moment Structures or in other words is an analysis of the mean and covariance structures which are the most important parts of the analysis using SEM. In this study, tests were carried out regarding the analysis of the effect of the RTG tool which consisted of 5 variables, namely the loading and unloading variable, the head truck variable, the reach stacker variable, the RTG variable, and the effective time variable.

Measurement Model Testing Analysis

To test the hypothesis with the measurement model, you will see the probability number (p). The results of SEM data analysis with the measurement model can be seen in Fig1below this.
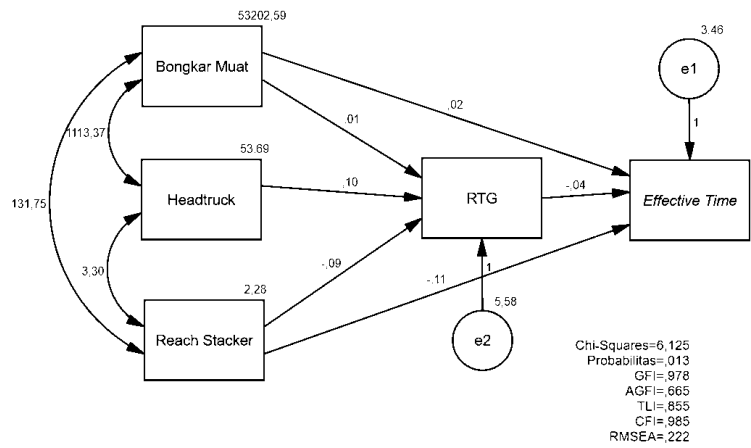

Figure 1. AMOS software output results

To find out the model meets the criteria for a good model, then if it meets the criteria. These criteria include a small Chi-Square value; probability > 0.05; GFI value > 0.90; AGFI value > 0.90; TLI value > 0.9; CFI value > 0.90; and RMSEA value < 0.08. In the picture above, the results of running through the AMOS software are obtained with the result that the Chi-Squares is small, the probability value is significant, the GFI value is included as fit, the AGFI value is not fit, the TLI value is not fit, the CFI value is included as fit, and the RMSEA value is not fit. From the results of testing the hypothesis of this model, it can be seen that this model is in accordance with the data or fit to the data used in this study. For the calculation of the hypothesis on the measurement model, it can be seen in Table 1 below.

Table 1 Measurement Model Testing

Model	NPAR	CMIN	DF	P	CMIN/DF
Default models	14	6,125	1	0.013	6,125
Saturated model	15	0.000	-	-	-
Independence models	5	362,270	10	0.000	36,227

For the DF calculation results to produce a value of 0 in the saturated model or identified model, then the model is included as just identified which is a model that has been identified so that an estimation of the model assessment is not needed. The CMIN value describes the likelihood ratio test statistic in which the

Chi-Square value is very sensitive to the sample size. There is a tendency that the Chi-Square value will always be significant. Therefore, if the Chi-Square value is significant, it is advisable to ignore it and look at other goodness fit measures. For the probability number p in the Default Measurement Model CMIN is the value of p (probability level) which is 0.013 because the p number is 0.013 <0.05 which should be p> 0,

Structural Model Testing Analysis

After testing the measurement model is done, then testing the structural model. To make a structural model, by changing the order of the measurement model components. This is because the parts of the structural model come from the measurement model. The relationship between constructs that have a causal relationship (cause and effect) is called a structural model. The following Figure 2 below is an image of the SEM model from the results of the structural model testing analysis.
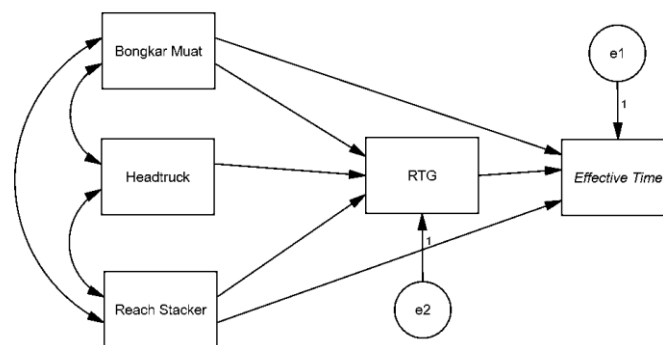

Figure 2 Structural Model Testing Analysis

Structural model testing will look for hypothetical values, such as:

H1 = loading and unloading against the head truck

H2 = Head truck to RTG

H3 = Reach stacker to RTG

H4 = RTG to effective time

H5 = Loading and unloading against effective time

H6 = Reach stacker to effective time

After testing the structural model is done. So, the results of testing the hypothesis where the results of testing the results of all hypotheses are significant, can be seen in Table 2 below.

Table 2 Structural Model Hypothesis Test Analysis

hypothesis	Track	β	SE	CR	P	Results
H1	BM→RTG	0.008	0.001	6,093	0.001	Significant
H2	HT→RTG	0.100	0.042	2,382	0.017	Significant
H3	hospital→RTG	-0.085	0.166	-0.514	0.607	Significant
H4	RTG→ET	-0.037	0.075	-0.490	0.624	Significant
H5	BM→ET	0.021	0.001	17,824	0.001	Significant
H6	hospital→ET	-0.112	0.130	-0.856	0.392	Significant

Interpretation of Analysis Results

Based on the results of the analysis of the structural model hypothesis test, it can be concluded in Table 3 below:

Table 3 Output Result of Structural Model Hypothesis Test

hypothesis	Track	*Estimates*
H1	BM→RTG	0.571
H2	HT→RTG	0.216
H3	hospital→RTG	-0.038
H4	RTG→ET	-0.025
H5	BM→ET	0.957
H6	hospital→ET	-0.034

From the table above, it can be seen that the output results show that there is a direct relationship between loading and unloading and RTG and there is also an indirect relationship between loading and unloading and effective time. Loading and unloading has a positive effect on RTG with a standardized coefficient of 0.571 and a significant p value of 0.001. Head trucks also have a positive effect on RTG with a standardized

coefficient of 0.216 and a significant p value of 0.017. Reach stacker has a positive effect on RTG with a standardized coefficient of -0.038 and is significant at a p value of 0.607. Likewise, RTG has a positive effect on effective time with a standardized coefficient of -0.025 and is significant at a p value of 0.624. Loading and unloading also has a positive effect on effective time with a standardized coefficient of 0.957 and a significant p value of 0.001.

R square is a value that shows how much the independent variable (exogenous) affects the dependent variable (endogenous). R squared is a number that ranges from 0 to 1 which indicates the magnitude of the combination of independent variables that jointly affect the value of the dependent variable. The following below is Table 4 which is the result of the R-Square analysis.

Table 4 R-Square

Parameter	*Estimates*
RTG	0.516
ET	0.861

R-Square on the RTG tool is 0.516 which means the RTG variability which can be explained by the variability of loading and unloading variables, head trucks, and reach stackers is 51.6%. While the R-Square effective time is 0.861 which means the variability of effective time which can be explained by loading and unloading, head truck, and reach stacker variables is 86.1%.

In using the tools in the SPSS software, to determine the effect of the correlation between variables, it is only divided into 2 parts, namely the dependent variable and the independent variable. Thus, the intervening variable becomes an independent variable where the Y variable becomes the X4 variable in the SPSS software.

For testing on the effective time variable, it is carried out using the multiple linear regression method. The test results on the SPPS software using the multiple linear regression method are as follows.

Table 5 Effective Time Multiple Linear Regression Test Results

Model	*Unstandardized Coefficients*		*standardized Coefficients*	t	Sig.
	B	*std. Error*	Betas		
(Constant)	67,697	74,406		0910	0.365
X1	1943	0.125	0.900	15,514	0.000
X2	8,301	3,370	0.122	2,463	0.015
X3	-13,723	12,962	-0.042	-1,059	0.292
X4	-7,969	7,644	-0.054	-1,042	0.300

From the table above, it can be seen that the constant value a = 67.697 which shows that the effect is in the

same direction between the independent variables and the dependent variable. This shows that if all the independent variables do not change, then the ET value is 67.697. As for the value of the regression coefficient X1 = 1.943 which means that it has a direct effect and if loading and unloading increases by 1% then the effective time will also increase by 1.943. Likewise, the value of the regression coefficient X2 = 8.301 which means that it has a direct effect and if the head truck increases by 1% then the effective time will also increase by 8.301. Then for the value of the regression coefficient X3 = (-13, 723) which means that it has the opposite effect and if the reach stacker increases by 1% then the effective time will decrease by (-13,723). Then for the value of the regression coefficient X4 = (-7.969) which means it has the opposite effect and if the RTG crane increases by 1% then the effective time will decrease by (-7.969).

Partial Significance Test (t test)

The Partial Significant Test or t test is used in research to determine the ability of each independent variable to influence the dependent variable, to test whether the independent variable (X) individually has a significant relationship or no significant relationship to the dependent variable (Y). The formula used is as follows:

t table = (α/2 ; nk-1)

t table = (0.05/2 ; 105-4-1)

t table = (0.025;100) [Look at the distribution of ttable values]

t table = 1.98

Criteria for decision making, namely:

a. If t count > t table, then there is an influence of the independent variable on the dependent variable

b. If t count < t table, then there is no effect of the independent variable on the dependent variable

Table 6 Results of Partial Significant Test (t test) Effective Time

Model	*Unstandardized Coefficients*		*standardized Coefficients*	t	Sig.
	B	std. Error	Betas		
(Constant)	67,697	74,406		0910	0.365
X1	1943	0.125	0.900	15,514	0.000
X2	8,301	3,370	0.122	2,463	0.015
X3	-13,723	12,962	-0.042	-1,059	0.292
X4	-7,969	7,644	-0.054	-1,042	0.300

a. Dependent Variable: effective time

Effective Time hypothesis testing

1) Hypothesis Testing 1

It is known that the significance value for the effect of the amount of loading and unloading on the effective time (ET) is t count 15.514 > 1.98. So, it can be concluded that there is an influence of the variable number of loading and unloading on the effective time variable.

2) Hypothesis Testing 2

It is known that the significance value for the effect of the number of head trucks on the effective time (ET) is t count 2.463 > 1.98. So, it can be concluded that there is an influence of the variable number of head trucks on the effective time variable.

3) Hypothesis Testing 3

4) It is known that the significance value for the effect of the number of reach stackers on the effective time (ET) is t count -1.06 <1.98. So it can be concluded that there is no influence of the reach stacker variable on the effective time variable.

5) Hypothesis Testing 4

It is known that the significance value for the influence of the number of RTG cranes on the effective time (ET) is it count -1.04 <1.98. So, it can be concluded that there is no effect of the variable number of RTG cranes on the effective time variable.

Simultaneous Significant Test (Test F)

Simultaneous significant test or F test is a test conducted to see the overall ability to influence the independent variable (X). In the analysis of the effective time model, the variables to be included are the number of loading and unloading vehicles, the number of head trucks, the number of reach stackers, and the number of RTG cranes to explain the diversity of independent variables, and to determine whether all variables have a regression coefficient equal to zero.

Table 7 Effective Time F Test Results

Model	*Sum of Squares*	df	*MeanSquare*	F	Sig.
1 *Regression*	22602016.938	4	5650504.234	165,185	0.000b
residual	3420709024	100	34207090		
Total	26022725.962	104			
a. Dependent Variable: Z					
b. Predictors: (Constant), X4, X3, X2, X1					

To test the statistical hypothesis above, an F test was carried out at the level of $\alpha = 5\%$. If F count > F table 5%, then the regression line equation model is accepted or variable X together can predict variable Y.

F table = F (k;nk)

F = (4;101)

F = 2.46

The calculated F value is 165.185 > F table 2.46. So it can be concluded that there is a simultaneous influence of the independent variable (X) on the dependent variable (Y).

Determinant Test

The results of the determinant test explain the value of the correlation/relationship (R). The following below in Table 9 is the result of the effective time determinant test.

Table 8 Effective Time Determinant Test Results

Model R	R Square	Adjusted R Square	std. Error of the Estimate
1 0.932a	0869	0.863	184.95159

a. Predictors: (Constant), X4, X3, X2, X1

Based on the table above, the results of the overall regression analysis are obtained where the value of R Square Effective time is 0.87 indicating that the correlation value or relationship variable is the number of loading and unloading variables, the number of head trucks, the number of reach stackers, and the number of RTGs have a strong relationship level of :

D=R2 x 100%

D = 0.869 x 100&

D = 86.9 %

Conclusion

Based on the research that has been carried out at the Makassar Container Terminal Terminal 1 with the results of data analysis that has been obtained, it can be concluded that: 1) From the results of the structural model hypothesis test that has been carried out using the AMOS software, it results that there is a direct relationship between loading and unloading to RTG and there is also an indirect relationship between loading and unloading and effective time. Loading and unloading has a positive effect on RTG with a standardized coefficient of 0.571 and a significant p value of 0.001. Head trucks also have a positive effect on RTG with a standardized coefficient of 0.216 and a significant p value of 0.017. Reach stacker has a positive effect on RTG with a standardized coefficient of -0.038 and is significant at a p value of 0.607, Likewise, RTG has a positive effect on effective time with a standardized coefficient of -0.025 and is significant at a p value of 0.624. Loading and unloading also has a positive effect on effective time with a standardized coefficient of 0.957 and a significant p value of 0.001. Reach stacker has a positive effect on effective time with a standardized coefficient of -0.034 and is significant at a p value of 0.392. Thus, it can be concluded that the number of loading and unloading, the number of RTG cranes, and the number of

head trucks, has a significant effect on RTG cranes. There is an influence from loading and unloading, RTG cranes, and Head Trucks on the RTG crane tool. 2) From the results of the Sobel test that was carried out using Microsoft Excel, it can be concluded that H1 has th > ttable (5%) or 7.48 > 1.98. Then there is a significant indirect effect or there is mediation. Therefore, the loading and unloading relationship with the effective time is mediated by the RTG. Then for the H2 value it shows -0.48 <1.98, so the indirect effect is insignificant or there is no need for mediation between the head truck and the effective time. Then, H3 also shows a value of 0.44 <1.98 which is where the indirect effect is insignificant or there is no need for mediation between the reach stacker and the effective time. 3) Based on the results of the structural model hypothesis test that has been carried out, there is a significant effect of RTG on effective time. The RTG tool has a positive effect on effective time with a standardized coefficient of -0.025 and is significant at a p value of 0.624. 98 then the indirect effect is insignificant or there is no need for mediation between the head truck and the effective time. Then, H3 also shows a value of 0.44 <1.98 which is where the indirect effect is insignificant or there is no need for mediation between the reach stacker and the effective time. 3) Based on the results of the structural model hypothesis test that has been carried out, there is a significant effect of RTG on effective time. The RTG tool has a positive effect on effective time with a standardized coefficient of -0.025 and is significant at a p value of 0.624. 98 then the indirect effect is insignificant or there is no need for mediation between the head truck and the effective time. Then, H3 also shows a value of 0.44 <1.98 which is where the indirect effect is insignificant or there is no need for mediation between the reach stacker and the effective time. 3) Based on the results of the structural model hypothesis test that has been carried out, there is a significant effect of RTG on effective time. The RTG tool has a positive effect on effective time with a standardized coefficient of -0.025 and is significant at a p value of 0.624. there is a significant effect of RTG on effective time. The RTG tool has a positive effect on effective time with a standardized coefficient of -0.025 and is significant at a p value of 0.624. there is a significant effect of RTG on effective time. The RTG tool has a positive effect on effective time with a standardized coefficient of -0.025 and is significant at a p value of 0.624.

COMPETING INTERESTS

The author has no competing interests to declare.

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References

Ahmed, Nadeem., Rasheed, Anwar., & Jehanzeb, Khawaja. (2012). An Exploration of Predictors of Organizational Citizenship Behaviours and Its Significant Link to Employee Engagement. *International Journal of Bussiness, Humanities, and Technology, 2(4), 100-106.*

Aketch, J., R., Odera, O., Chepkuto, P., Okaka, O. 2012. Effects of Quality of Work Life on Job Performance: Theoretical Perspectives and Literature Review. *Journal of Social Sciences. Vol. 4(5): 383-388.*

Al-Ahmadi, H. 2009. "Factors Affecting Performance of Hospital Nurses in Riyadh Region, Saudi Arabia", *International Journal of Health Care Quality Assurance, Vol. 22, No. 1, pp. 40-54.*

Alniacik, E., Umik., Erat, S., Ackin K. 2013. Does Person-Organization Fit (P-O Fit) Moderate The Effects of Affective Commitment and Job Satisfaction on Turnover Intentions?. *Social and Behavioral Sciences 99 274 – 281*

Astuti, S, D. 2011. Model Person-Organization Fit (P-O Fit) (P-O Fit Model) Terhadap Kepuasan Kerja, Komitmen Organisasional dan Kinerja Karyawan. *Jurnal Bisnis dan Ekonomi. Vol. 17, No. 1, pp 43-60*

Dewi, IK (2020). Analysis of Measuring Customer Service Quality Online Using the Structural Equation Model Method (Case Study of Bank Mandiri Tangerang Harvest Bintaro). Thesis. Syarif Hidayatullah State Islamic University. Jakarta.

Djamaluddin, A. (2022). Manajemen Operasional Pelabuhan. Upt Unhas Press. Makassar.

Djamaluddin, A. (2021). Manajemen Pelabuhan dan Terminal. Upt Unhas Press. Makassar.

Fahirah, AA and Djamaluddin, A. (2020). Analysis of Container Yard Loading and Unloading Time (Case Study at Makassar New Port). Thesis. Department of Marine Engineering, Faculty of Engineering, Hasanuddin University.

Ghozali, Imam. (2014). Structural Equation Modeling, Alternative Method with Partial Least Square (PLS). Edition 4. Semarang: University Publishing Agency.

Gurning, R. O. S. (2007) *Manajemen bisnis pelabuhan*. Surabaya: APE Publishing.

Junaidi. (2021). AMOS and Structural Equation Modeling (SEM) applications. Upt Unhas Press. Makassar.

Karim, NB and Djamaluddin, A. (2019). Analysis of Loading and Unloading Time on the Rubber Tyred Gantry (RTG) Crane Equipment at PT Makassar Container Terminal (Case Study at PT Makassar Container Terminal). Thesis. Department of Marine Engineering, Faculty of Engineering, Hasanuddin University, Gowa.

Primary, AP (2019). Analysis of Factors Affecting Community Compliance in Paying Zakat on Oil Palm Plantations (Structural Equation Modeling Approach). Thesis. Ar-Raniry State Islamic University. Banda Aceh.

Sugiyono. (2013). Quantitative Qualitative Research Methods And R&D. Alphabet. Bandung.

Siswoyo, H. (2017). SEM Methods for Management Research, AMOS, LISREL PLSI. PT Luxima Metro Media 2017.