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Optimization Of Container Stacking Productivity At East Kalimantan Container Port Using Swot Method

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A b s t r a c t

Based on the PM Perhubungan, the dwelling time limit at the Port is 3 days, in fact the stacking of containers at the Container Port lasts more than 3 days and causes the stacking of containers to be less than optimal and productive. This study aims to provide recommendations for strategies to optimize the productivity of container stacking at the Container Port. The analysis of this research strategy uses a SWOT analysis which produces the type of recommended strategy for the Container Port is the WT (Weakness-Threats) strategy consisting ofimproving supporting facilities for container stacking services, increasing stacking rates, and improving the quality of human resources through training.

Keywords : Dwelling Time, Container, Container Port, SWOT

1. Introduction

The high demand for shipping goods using containers affects the density of container loading and unloading activities which causes problems in the function of container port facilities. One of the problems is found in the container yard facility. Containers that are being loaded and unloaded will be stored first in the container yard. Storing containers in the container yard for too long causes the effectiveness value of container yard usage to increase [1]. High container yard effectiveness can reduce the optimization of container stacking productivity. Therefore, the higher the flow of loading and unloading activities, the Container Port needs to control the planning of handling loading and unloading activities so that activities can be carried out smoothly following the increasing development of loading and unloading flows [2].

The factor causing the problem of optimizing container stacking productivity comes from the container dwelling time [1]. Based on the Minister of Transportation, article (2) paragraph (1), the dwelling time limit at the Port is 3 days. In fact, containers are stacked for days and exceed the standard dwelling time of the port, which is 3 days, due to the late delivery process by service users.. PReducing dwelling time figures needs to be done so that container loading and unloading activities are higher and container stacking productivity is better.[3]. Optimization of container stacking productivity needs to be done using the SWOT method. Research on container stacking has been conducted [1] [2] [3]. This research was conducted to determine recommended strategies that can be carried out by container ports to optimize container stacking productivity. From several previous studies, no research was found that optimized container stacking productivity using fishbone diagrams and the SWOT (Strengths, Weaknesses, Opportunities and Threats) method. However, this study determines a handling strategy using the SWOT method. The strategy is carried out so that container stacking productivity at the Container Port becomes more optimal so that container loading and unloading activities run smoothly and there is no overcapacity in the container stacking yard.

2. Methodology

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This study focuses on the field conditions of container stacking that is overcapacity due to less than optimal productivity of container stacking at the port. The data processed in this study are based on the results of direct observation at the Container Port for 4 months. The methods in this study consist of basic research methods and data analysis methods as follows:

Basic Research Methods

- Fishbone Diagram
  This stage is used to determine the factors that affect the productivity of container stacking. The factors causing the problem of optimizing container stacking productivity are obtained from participatory observation, namely interacting directly in the field and conducting literature studies. The causal factors are grouped into 4 categories, namely activities, human resources (HR), facilities and the environment [4]. The categories used come from internal and external factors of the container port. The following is a fishbone diagram in Figure 1:

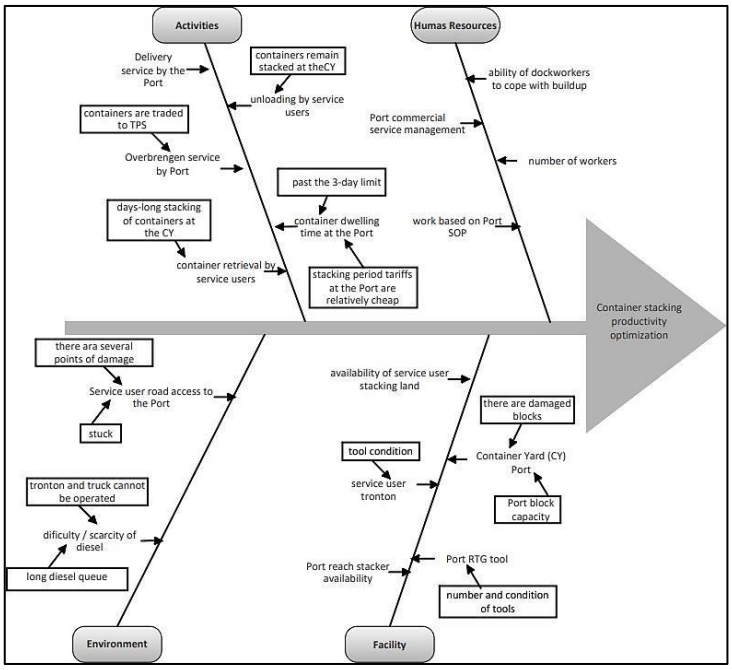

Fig. 1. Fishbone Diagram

Based on the fishbone diagram, a questionnaire or research instrument was prepared based on internal and external factors with an assessment using a Likert scale. Internal factors are conditions within the company consisting of the company's strengths and weaknesses. Meanwhile, external factors are factors related to conditions outside the company [4]. The following are research instruments based on internal and external factors of Container Ports in table 1:

Table 1. Research Instruments

No.	Internal Factors
1	The company provides delivery services to service users well and efficiently.
2	*Delivery*carried out after a long stacking of containers in the container yard, namely more than 3 days
3	*Dwelling time container*in container yard more than 3 days
4	Workers can effectively handle the stacking of containers in the container yard.
5	Service management always notifies service users to immediately make deliveries.
6	The number of company human resources meets the workforce needs
No.	Internal Factors
7	There are no damaged block area points in the Company
1	The company provides overbrengen services not in accordance with SOP properly
2	Overflow containernot transferred to TPS/Customs area according to SOP

3	The Company's container stacking period rates are relatively cheap
4	Workers do not master their field of work well
5	Workers do not carry out work according to applicable SOP
6	The company does not have sufficient number of RTG devices
7	The condition of the Company's RTG equipment often experiences damage
8	The company does not provide reach stacker assistance in the event of RTG damage.
9	The number of available block capacity is not enough
No.	External Factors
1	Containerpiled up for more than a few days in the container yard
2	Containercancelled loading still stacked in container yard
3	The number of human resources for container depot operators is still lacking
4	Container service users do not have storage space
5	Road access to the port is often congested
6	Long gas station queues for diesel tronton
1	It often happens that containers are not loaded onto ships
2	Container yardThe company becomes a storage area for container service users
3	The truck used by service users can operate well
4	There are several points of damage to the road to the port
5	The availability of solar is not sufficient
6	Diesel shortage for truck delivery

- Respondent Determination

The method of determining respondents uses the probability sampling technique, namely the proportionate stratified random sampling method. This method is used in types of populations that have elements/members that are not proportionally homogeneous [5]. The population in this study came from the company's division related to the research objectives according to the attributes of optimizing container stacking productivity. The number of research populations was 33 people from 7 commercial management, 15 operational implementers, 6 planning officers and 5 service users. Furthermore, the determination of the number of samples was carried out using the Slovin method. The following is the formula for determining the number of samples using the Slovin method [4]:

$$n = \frac{N}{1+N\,e^2} \quad \text{..... 2.1}$$

n =sample size

N =population size

e =precision value (0.05)

Equation 2.1 produces a value of n=30. So the number of samples used in this study is 30 people. The next stage is to determine the number of samples for each element/member in the population using the Proportionate Stratified Random Sampling method [5]. The following is the equation used to determine the number of samples of population elements:

$$\text{Strata} = \frac{\text{Jumlah Populasi Strata x Sampel}}{\text{Jumlah Populasi}} \quad \text{.....2.2}$$

Equation 2.2 produces a sample of 6 commercial management personnel, 14 operations personnel, 6 planning officers and 5 service users.

- Instrument Testing

Valid and reliable aThe instrument is measured using a validity test with the help of SPSS software [6]. The instrument is generally in the form of questions given to respondents in the form of a questionnaire to reveal an object. The research instrument used must be

valid and reliable. The validity test of this research was carried out using construct validity. Construct validity is carried out using statistical techniques of factor analysis to investigate various components of an object so that the questionnaire can be compiled based on these components [6]. The following is the validity test equation [6]:

$$r_{hitung} = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{(n\sum X^2 - (\sum X^2)(n\sum Y^2 - (\sum Y)^2)}} \quad (1)$$

Meanwhile, the reliability testing in this study used the internal instrument reliability in a continuous form by giving a score with a range of 1-5 according to the Likert scale using the Cronbach alpha formula as follows [6] :

$$r_{kk} = \left[\frac{k}{k-1}\right]\left[1 - \frac{\sum S_{b^2}}{S_{t^2}}\right] \quad (2)$$

The following are the results of processing the validity test and reliability test in table 1:

Table 2. Validity and Reliability Test

No	Instrument	Validity test count	rtable	Cronbach alpha value Reliability	Information	
					Valid	Reliable
1	Question 1 (X1.1)	0.484	0.361	0.417	Yes	Yes
2	Question 2 (X1.2)	0.503	0.361	0.417	Yes	Yes
3	Question 3 (X1.3)	0.668	0.361	0.417	Yes	Yes
4	Question 4 (X1.4)	0.603	0.361	0.417	Yes	Yes
5	Question 5 (X1.5)	0.542	0.361	0.417	Yes	Yes
6	Question 6 (X1.6)	0.403	0.361	0.417	Yes	Yes
7	Question 7 (X1.7)	0.482	0.361	0.417	Yes	Yes
8	Question 8 (X1.8)	0.440	0.361	0.417	Yes	Yes
9	Question 9 (X1.9)	0.473	0.361	0.417	Yes	Yes
10	Question 10 (X2.1)	0.503	0.361	0.588	Yes	Yes
11	Question 11 (X2.2)	0.544	0.361	0.588	Yes	Yes
12	Question 12 (X2.3)	0.608	0.361	0.588	Yes	Yes
13	Question 13 (X2.4)	0.428	0.361	0.588	Yes	Yes
14	Question 14 (X2.5)	0.778	0.361	0.588	Yes	Yes
15	Question 15 (X2.6)	0.532	0.361	0.588	Yes	Yes
16	Question 16 (X3.1)	0.380	0.361	0.751	Yes	Yes
17	Question 17 (X3.2)	0.450	0.361	0.751	Yes	Yes
18	Question 18 (X3.3)	0.490	0.361	0.751	Yes	Yes
19	Question 19 (X3.4)	0.785	0.361	0.751	Yes	Yes
20	Question 20(X3.5)	0.564	0.361	0.751	Yes	Yes
21	Question 21(X3.6)	0.822	0.361	0.751	Yes	Yes
22	Question 22 (X3.7)	0.797	0.361	0.751	Yes	Yes
23	Question 23 (X3.8)	0.415	0.361	0.751	Yes	Yes
24	Question 24 (X4.1)	0.798	0.361	0.695	Yes	Yes
25	Question 25 (X4.2)	0.639	0.361	0.695	Yes	Yes
26	Question 26 (X4.3)	0.788	0.361	0.695	Yes	Yes
27	Question 27 (X4.4)	0.646	0.361	0.695	Yes	Yes
28	Question 28 (X4.5)	0.615	0.361	0.695	Yes	Yes

Considerations for measuring the validity of each questionnaire item are by comparing r count to r table [6]. The results of the validity test in table 1 show that each question item is valid because r count > r table. The reliability of each questionnaire item is by comparing r (Cronbach alpha) > r table [6]. The results of the reliability test in table 1 show that each r (Cronbach alpha) > r table. The output of the frequency distribution of questionnaire answers is the mean and median values of each instrument. The results of the instrument that has a mean value > median value is called "strength" in internal analysis and "opportunity" in external analysis. Conversely, the question component that has a mean value < median value is called "weakness" in internal analysis and "threat" in external analysis [7]

Data Analysis Methods

• IFE (Internal Factor Evaluation) and EFE (External Factor Evaluation) Matrix

This analysis uses an assessment matrix in the form of weight values and rating values for Internal and External factors. The IFE matrix functions to obtain the largest to smallest strength and weakness values in the company. While the

EFE matrix functions to obtain the largest to smallest threat and opportunity values in the company.

The IFE and EFE factor rating assessment is carried out based on the assessment by two expert respondents in the field being studied [8]. The weight value is given based on the rating value with the total weight of the strengths and weaknesses for IFE not exceeding 1.00, the same as the weight on EFE. The results of the weighting and rating produce a score value. The total score value of IFE and EFE is used to determine the type of productivity optimization strategy for container stacking at the Container Port using the IE matrix.

The IE matrix is a way to determine alternative strategies based on the total IFE value weighted on the X axis and the total EFE value weighted on the Y axis [9]. The IE matrix grouping is divided into three large groups that have different strategies, namely [9]: (1) Cells I, II, and IV are called growth and development strategies. Suitable strategies are market penetration, market development and product development, backward integration, forward integration and horizontal integration. (2) Cells III, V and VII are called Maintain and Nurture strategies. Suitable strategies are market penetration and product development. (3) Cells VI, VIII and IX are called Harvest and Divestment strategies. The strategy in this condition is a release strategy.

• SWOT Matrix and Strategic Combination Planning Matrix

Determining strategy using the SWOT matrix to obtain a strategy based on strengths - opportunities (SO Strategy), strengths - threats (ST Strategy), weaknesses - opportunities (WO Strategy, and weaknesses - threats (WT Strategy) [4]. The next stage is determining the strategy using the strategy combination planning matrix, namely finding the highest total score value for the strategy combination [10]. The strategy combination with the highest total score is the strategy that can be recommended for the company.

3. Results

Based on the research data, the dwelling time of containers at the Container Port has exceeded the PM Transportation standard of 3 days. This causes the stacking of containers to be suboptimal. Therefore, a strategy analysis is needed to increase the optimization of container stacking productivity using SWOT analysis.

The process carried out in the research is the determination of internal and external factors including strengths, weaknesses, opportunities and threats. The data obtained are then analyzed with the IFE and EFE matrices, IE matrices, SWOT matrices, and combination strategy planning matrices with the following results:

3.1 IFE and EFE Analysis

The total score value of IFE and EFE is used to determine the type of productivity optimization strategy for container stacking at the Port. The following are the results of the IFE and EFE calculations:

Table 3. IFE Matrix

No.	Internal Factors	Weight	Rating	Score
1	The company provides delivery services to service users well and efficiently (S1)	0.026	1	0.026
2	*Delivery*carried out after a long stacking of containers in the container yard, namely more than 3 days (S2)	0.079	3	0.237
3	*Dwelling time container*in container yard more than 3 days (S3)	0.053	2	0.105
4	Workers can effectively handle the stacking of containers in the container yard (S4)	0.053	2	0.105
5	Service management always notifies service users to immediately make deliveries (S5)	0.105	4	0.421
6	The number of company human resources meets the workforce needs (S6)	0.105	4	0.421
7	There are no damaged block area points in the Company (S7)	0.026	1	0.026
	Total Power	0.447	17	1,342
	Internal Factors	**Weight**	**Rating**	**Score**
1	The company provides overbrengen services not in accordance with SOP properly (W1)	0.079	3	0.237
2	*Overflow container*not transferred to TPS/Customs area according to SOP (W2)	0.053	2	0.105
3	The Company's container stacking period rates are relatively cheap (W3)	0.105	4	0.421
4	Workers do not master their field of work well (W4)	0.026	1	0.026
5	Workers do not carry out work according to applicable SOPs (W5)	0.053	2	0.105
6	The company does not have sufficient number of RTG devices (W6)	0.026	1	0.026
No.	**Internal Factors**	**Weight**	**Rating**	**Score**
7	The condition of the Company's RTG equipment often experiences damage (W7)	0.053	2	0.105
8	The company does not provide reach stacker assistance when RTG damage occurs (W8)	0.105	4	0.421
9	The number of available block capacity is insufficient (W9)	0.053	2	0.105
	Number of Weaknesses	0.553	21	1,553
	Total Strengths & Weaknesses	1.00	38	2,895

Based on the IFE calculation in table 4.1, the total score of the internal factor is 2.895, which consists of the calculation results of the total score of the strength factor and the weakness factor. Meanwhile, the EFE calculation in table

4.1 obtained a total score of the external factor of 2.643, which consists of the calculation results of the total score of the opportunity factor and the threat factor.

ResultsThe total IFE score is placed on the vertical axis and the total EFE score is placed on the horizontal axis of the IE matrix. Based on the total IFE and EFE scores, it can be determined that the meeting point of the two vertical and horizontal axes is located in cell V, describing the strategic business unit in the hold and maintain condition. The strategies in this condition are market penetration strategy and product development strategy.

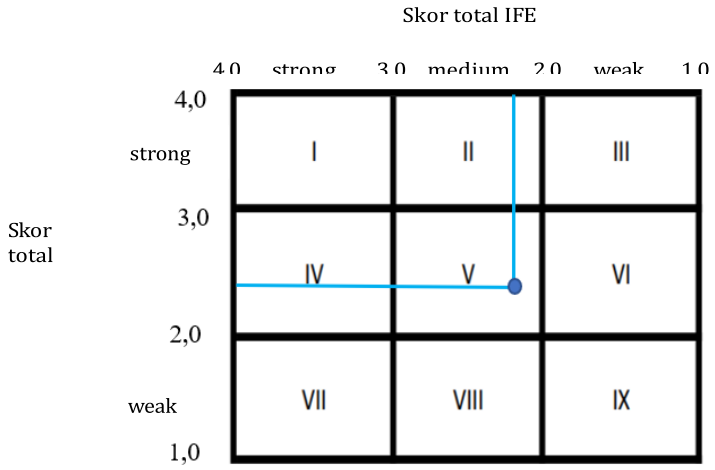

Fig. 2.IE Matrix

- SWOT Matrix and Strategic Combination Planning Matrix

The purpose of the SWOT matrix is to provide four main strategic alternatives, namely the strength-opportunity strategy (SO Strategy), the strength-threat strategy (ST Strategy), the weakness-opportunity strategy (WO Strategy, and the weakness-threat strategy (WT Strategy). The following table shows the 4 results of the SWOT Matrix in determining strategies for optimizing container stacking productivity at the Port:

Table 4. SWOT Matrix

IFE / EFE	Strength (Strength-S)	Weakness (Weakness-W)
	1. Delivery service is carried out well and efficiently 2. *Delivery*Delivery is carried out after the stacking of containers. Delivery is carried out after the stacking of containers for more than 3 days. 3. *Dwelling time*in container yard more than 3 days. 4. Workers effectively handle container stacking 5. Service management notifies service users to immediately make deliveries. 6. The number of human resources meets	1. *Overflow*not according to SOP 2. *Overflow container*not transferred to the Customs Area TPS 3. Container stacking period rates are relatively cheap 4. Workers do not master their field of work well 5. Workers do not comply with SOP 6. The company does not have enough RTGs 7. RTG often experiences damage 8. The company does not provide reach stacker assistance when RTG
	the workforce needs 7. There are no damaged block area points	is damaged. 9. The number of blocks available is not enough

Opportunity (Opportunity-O) 1. It often happens that containers are not loaded onto ships 2. *Container yard*The company becomes a place of accumulation for service users 3. The truck used by service users can operate well 4. There are several points of damage to the road to the port 5. The availability of solar is not sufficient 6. Diesel shortage for truck delivery	SO Strategy Leveraging strengths to take advantage of opportunities. 1. Maintaining good service quality to increase user satisfaction (S1, S2, S3, S4, S6, S7, O3, O2, O1) 2. Providing a service platform for inter- industry cooperation (S5,O4,O5,O6)	WO Strategy Correcting weaknesses by taking advantage of opportunities 1. Increased stacking rates (W1,W2,W3,O1,O2,O4,O5,O6) 2. Improving supporting facilities for container stacking services (W6,W7,W8,W9,O2,O3) 3. Improving the quality of human resources in handling backlogs through FGD and training (W4,W5,O1,O2)
Threats (Threats-T) 1. Containers stacked for more than a few days in the container yard 2. Containers that have not been loaded are still stacked in the container yard 3. The number of human resources for container depot operators is still lacking. 4. Container service users do not have storage space 5. Road access to the port is often congested 6. Long gas station queues for diesel tronton	ST Strategy Using force to avoid threats 1. Maintaining the quality of human resources in handling backlogs through FGD and training (S4,S6,T2,T3) 2. Maintaining good block area conditions in container yards (S1,S2,S3,S7,T1,T2) 3. Optimizing service management to respond to and handle service user problems. (S5,T5,T6,T4)	WT Strategy Reducing weaknesses and avoiding threats 1. Improving the quality of human resources through training (W4,W5,T1,T2,T3) 2. Increase stacking rates (W1,W2,W3,T1,T2,T4) 3. Improving supporting facilities for container stacking services (W6, W7, W8, W9, T1, T2, T5, T6)

The next stage is to determine the strategy that has the highest score value using the SWOT strategy combination planning matrix as follows:

Table 5. Strategy Combination Planning Matrix

IFAS EFAS	*Strength* (Strength)	*Weakness* (Weakness)
Opportunity (Opportunity)	SO Strategy: Using strengths to take advantage of opportunities = 2.521	WO Strategy Minimizing weaknesses by taking advantage of opportunities = 2.731
Threats (Threat)	ST Strategy: Using force to overcome threats = 2.806	*WT Strategy*: Minimize weaknesses to avoid threats = 3,017

The results of the strategy combination matrix show that the highest score is the Weaknesses – Threats strategy with a total of 3.01. This means that the strategy that should be used is the WT strategy, namely reducing weaknesses and avoiding threats.

4. Conclusions

Based on the SWOT analysis, the results of the strategy that should be used by the Company to optimize container stacking productivity are using the WT strategy. This strategy is carried out by reducing deficiencies and avoiding threats. There are three WT strategies, namely improving supporting facilities for container stacking services, increasing stacking rates, and improving the quality of human resources through training.

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