Design Improvement Strategy of Operational Performance Loading Unloading Containers Using SWOT and ANP Methods

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Abstract

Key Performance Indicators (KPI) The Main Port Authority Office targets to achieve YOR of operational performance in a container terminal operator that handles loading unloading services for domestic and international containers in the amount of 60% for 2020-2024, but the realization is only achieved less than 40%. In line with the decline of throughput data from 2019 before the pandemic. This study aims to identify the internal and external factors, propose alternative strategies, and determine strategic priorities to improve the operational performance of loading unloading. The research method used is SWOT-ANP. The identification results obtained internal factors in the form of domestic and international container shipping services as the highest strength factor, then the highest weakness factor in the form of loading unloading equipment replacement. While external factors in the form of having good relationships with stakeholders, port unions, and local governments as the highest opportunity factor, then one of the highest threat factors is intense competition in container terminal services, especially with terminals at overseas ports. There are 6 alternative strategies proposed, with 2 strategic priorities that have the highest weight including expanding market share by adding new services and improving service quality through additional operational equipment capacity.

Keywords
Analytical Network Process, Operational Performance, SWOT, Throughput, YOR

1. Introduction

Indonesia is the largest Archipelagic State in the world. Its strategic location between the Indian Ocean and the Pacific Ocean makes the maritime sector important. This can be seen from the volume of container cargo, which is increasing gradually at a rate of about 7.7%. (Syafaaruddin, 2015). Therefore, ports have a big role, namely as the main means of distributing goods by sea, both exports and imports. The port is also an economic gateway in the form of facilities as well as a determinant of trade activities between islands and countries.

Ports have an important role in the growth of industry and trade which can contribute directly to national development. According to Arianto Patunru et.al (in Khusyairi & Hisyam, 2016) that world trade by sea reaches 85%, while trade in Indonesia by sea is 90%. Based on the Regulation of the Minister of National Development Planning/Head of the National Development Planning Agency of the Republic of Indonesia Number 2 of 2021 in the Draft Government Work Plan for 2022, it provides an illustration that the volume of world trade is expected to increase 7.2% in 2021, after being estimated to decrease 9.2% in 2020. That certainly encourages Indonesia, which is a developing country as well as the origin of export goods traded in Europe, America, and East Asia, to develop port facilities with the best integrity to provide optimal container terminal services. But one of the major terminals in Indonesia had a declining throughput graph before the pandemic followed by YOR performance that was less than the standard. Therefore, this research was conducted, by formulating strategies to improve the operational performance of loading unloading containers so can optimize port facilities.

However, before making decisions in developing and improving strategies and anticipating fluctuations of loading unloading volumes entering and leaving the terminal, it is necessary to carry out a comprehensive evaluation and analysis through research activities. And it is expected that container terminals have more ability to absorb cargo and gain a higher market share in improving performance at the world port level. Mulyadi (in Aswirah et al, 2013)

provides ideas related to performance, namely the operational effectiveness of an organization based on previous goals, standards, and criteria on a regular basis, where basically the organization is operated by human resources in its implementation. Based on the Decree of the Director General of Sea Transportation Number: UM.002/38/18/DJPL-11 concerning Port Operational Service Performance Standards, what is meant by operational service performance is the measurable work achieved by ports in carrying out ship services, goods and utilization of facilities and equipment. within a certain period of time and units.

There are some studies about SWOT-ANP. Liu et al, (2018) studied an ANP-SWOT approach for ESCOs industry strategies in Chinese building sectors, empirical results show some of the best strategies, there were recommended three main actions, coded WO1, WT1, and SO2.Gençet al, (2018) studied an evaluation of natural gas strategies of turkey in east Mediterranean region: a strengths-weaknesses-opportunities-threats and analytic network process approach, the results showed that SO2 and ST1 strategies were determined as the best strategies. From several published journals, many industries have used the SWOT-ANP method, but its application to the maritime industry, especially the operational performance of container terminals is still minimal and rarely encountered, therefore this research can be used as an update of methods in the field of academics and optimization at ports.

The remaining of this paper is organized as follows. Section 2 presents the literature review which discusses related to previous research. The methodology presented in section 3, including the research stages, processing & data analyst, and output of the research. Section 4 discusses about the data collection. The results and discussion presented in section 5. Whereas Section 6 finally presents the conclusions and future research directions derived from this paper.

1.1 Objectives

The objectives to be achieved from this research are to analyze internal and external factors that affect the operational performance of loading unloading, to propose alternative strategies and to determine the priority level of strategies in improving loading unloading operational performance.

2. Literature Review

Based on the research objectives to be achieved, it is necessary to identify what factors affect the operational performance of loading and unloading containers, both internal and external factors of the company. Identifying the company's internal and external factors using indicators that refer to previous research journals as Jourdan (2018) and Panimba (2019) because both journals have the same object as this research, which is related to the port business and container terminals.

Several previous studies as (Retmawan, 2020) and (Kasutjianingati, 2020) used the IFE and EFE matrix to evaluate the company's internal and external factors. The IFE matrix evaluates the tendency of a company's internal performance whether it is more inclined to elements of strength or weakness. While the EFE matrix evaluates the tendency of influences from external companies, aspects of opportunities, or threats that dominate (Syukron, 2014). The IE matrix aims to obtain a more detailed business strategy at the corporate level, where there are nine strategic cells in its composition. Determining the main goal in exploiting a strong position or overcoming existing barriers to a more specific strategy search model can use the help of the Grand Strategy matrix (Rangkuti, 2016).

One of the tools for compiling the company's strategic factors is the SWOT matrix, it can provide alternative strategy proposals, which can also provide a clear picture of the external opportunities and threats that must be faced, which will be adjusted to the company's strengths and weaknesses (Rangkuti, 2016). Based on previous research journals such as Liu et al (2018) who used SWOT analysis in proposing alternative strategies for the development of the ESCO industry in China, then research by Gençet al (2018)who adopted SWOT in the formulation of strategies related to natural gas in Turkey in the eastern Mediterranean region, as well as in the preparation of development strategies by (Kasutjianingati, 2020).All these studies related to SWOT show it is a good analytical method for solving problems from a strategic perspective. However, SWOT cannot be a method for ranking strategies and factors, but the dependence between elements will affect strategy priorities. Thus, it is necessary to have other analytical tools like the Analytical Network Process (ANP) to determine the dependencies between of factors and strategic priorities (Genç et al, 2018).

ANP is a method for making decisions when analyzing the decisions of communities, governments, and companies. Where all the factors and criteria, both tangible and intangible, relate to the best decision making, as well as dependence and feedback, both inner dependence and outer dependence (Darmawaran, 2018). Determine strategic priorities using the Analytical Network Process (ANP) approach starting from ANP modeling, then a pair

comparison matrix is carried out in which there are relationships between elements in one cluster (inner dependence) and relationships between elements between different clusters (outer dependence), after the results obtained in the form of priority priorities, the data processing process can be done with the help of Super Decision Software Sugiyono (in Novitasari et al, 2020). ANP was chosen as a method of determining strategic priorities in improving the operational performance of loading unloading containers in this study because it can analyze the dependence of all elements in SWOT (Liu et al, 2018).

3. Methods

This research begins with a field study to obtain information related to problems that occur in container loading and unloading operations, then proceed with problem identification and literature study. The first analysis is carried out by identifying the company's internal and external factors through FGD, then the data was processed using a questionnaire to fill out the IFE EFE matrix, for obtaining strategic proposals using the SWOT matrix, while for strategic priorities using ANP through the FGD process and distributing questionnaires with the help of Super Decision Software.

Table 1 Processing and Data Analyst

Stages	Purpose	Analysis Tool	Output
I	Identify internal and external factors	Fact finding with FGD	Internal and external factors
II	Propose alternative strategies	SWOT	Alternatives strategies
III	Determine strategic priorities	ANP	Strategic priorities

4. Data Collection

This article is based on data from one container terminal in Indonesia. In particular, the container terminal serves both domestic and international services. The analysis refers to data over 5 years, from 2017 to 2021 as secondary data, while the primary data was obtained from observation, FGD, and questionnaires taking into account the opinions of port business development experts. The expert judgments in this research are company internal parties who have experience and experts in their fields for more than 10 years.

5. Results and Discussion

The first analysis is to identify internal and external factors that affect the operational performance of loading unloading containers through FGD, after obtaining these factors, then analyzed using the IFE and EFE matrix to be weighted and know which factors are the most influential, it's presented in tables 2 and 3.

Table 2 Matrix Internal Factor Evaluation (IFE)

		Bobot	*Rating*	Skor
No	***Strength***			
1	Maintenance of loading unloading equipment	0,12	4	0,48
2	Terminal facilities readiness	0,12	4	0,47
3	Employee competence and training	0,11	3	0,33
4	Domestic and international container shipping services	0,14	4	0,55
5	Operational performance measurement (KPI)	0,11	3	0,33
6	Ship schedule setting	0,11	4	0,45
7	Payment/Transaction	0,11	3	0,33
TOTAL				2,94
No	***Weakness***			
1	Loading unloading equipment replacement	0,07	2	0,14
2	Limited tool capacity in the terminal	0,03	2	0,06
3	Employee performance measurement (KPI)	0,02	1	0,02
4	Lack of cooperation with service users regarding the renewal of operational system implementation	0,02	1	0,02
5	High dependence on equipment and information technology vendors	0,04	1,67	0,07
TOTAL				0,31
	TOTAL IFE			3,25

Based on the calculation of internal strategic factors, the main strength is domestic and international container shipping services, with a score of 0.55. The strategic factor that became the main weakness is loading unloading equipment replacement, with a score of 0.14. And the total score of IFE Matrix is 3.25. The results of the analysis external factors are presented in table 3.

Table 3 Matrix External Factor Evaluation (EFE**)**

		Bobot	*Rating*	Skor
No	***Opportunity***			
1	Foreign exchange fluctuation	0.09	3	0.26
2	Port service tariff policy	0.09	3	0.26
3	Potential to expand market share in cooperation with other parties	0.13	4	0.53
4	Have a good relationship with stakeholders, port unions, and local government	0.14	4	0.55
5	Increased special requests of service users	0.09	3	0.27
6	Geographical conditions	0.12	3	0.40
7	Use of electricity to replace diesel fuel	0.09	3	0.27
TOTAL				2.54
No	***Threat***			
1	Fuel price fluctuation	0.04	1	0.04
2	Government regulations on port management can change at any time	0.04	1	0.04
3	Development of loading unloading equipment that is vulnerable to changes in sea transportation technology	0.07	2	0.14
4	The development of a terminal operating system that is vulnerable to changes in sea transportation technology	0.06	1	0.08
5	Tight competition in container terminal services, especially with terminals at overseas ports	0.07	2	0.14
6	Weather conditions	0.06	2	0.13
TOTAL				0.57
	TOTAL EFE			3.11

The highest score on the opportunity factor is having a good relationship with stakeholders, port unions, and local government, which is 0.55. Meanwhile, one of the threat factors with the highest score is a tight competition in container terminal services, especially with terminals at overseas ports, which is 0.14. With the results of the total IFE matrix score of 3.07.

Then, process the IFE EFE matrix data into an IE matrix. The calculation is obtained through a weighted $\Sigma\bar{X}$ on an IFE matrix of 3.25 which functions as the x-axis. Meanwhile, the EFE matrix has a weighted $\Sigma\bar{X}$ of 3.11 which functions as the y-axis. The analysis will be obtained as shown in Figure 1.

	Tinggi 3.0 – 4.0	Rata-rata 2.0 – 2.99	Rendah 1.0 – 1.99
Tinggi 3.0 – 4.0	**Kuadran I (3,25;3,11)**	**Kuadran II**	**Kuadran III**
Rata-rata 2.0 – 2.99	**Kuadran IV**	**Kuadran V**	**Kuadran VI**
Rendah 1.0 – 1.99	**Kuadran VII**	**Kuadran VIII**	**Kuadran IX**

Figure 1 Matrix Grand Strategy

IE Matrix analysis shows that the company is in the quadrant I position. So the appropriate strategy is the growth strategy used to achieve growth to increase market share and recommended to use a concentration strategy through vertical integration to increase business strength or the company's competitive position.

To formulate a more specific strategy, this research used the Grand Strategy Matrix, which is obtained by calculating the difference score in the IFE matrix of 2.63 as the x-axis, and the difference score in the EFE matrix of 1.97 as the y-axis. The analysis will be obtained as shown in Figure 2.

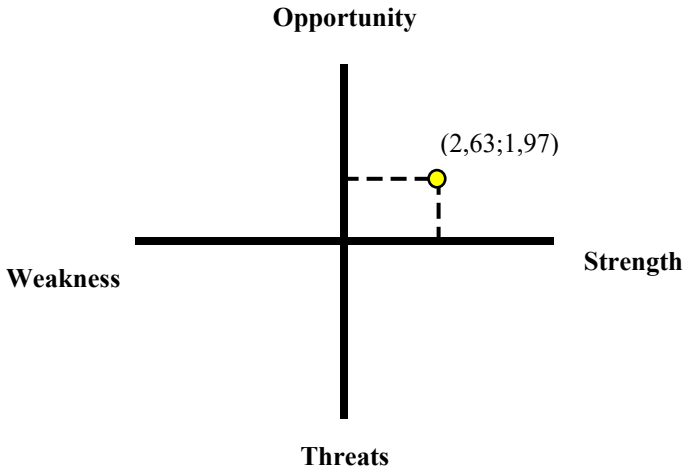

Figure 2 Grand Strategy Matrix

Based on Figure 2, the position of the container terminal is in quadrant I which is known as the SO (Strength – Opportunity) quadrant. Companies in this quadrant are advised to carry out a strategy that uses the company's internal strengths by taking advantage of the company's external opportunities to obtain optimal profits in increasing business growth.

After compiling the IFE & EFE matrix, IE matrix, and Grand Strategy matrix, the next step is to formulate a SWOT strategy that will produce alternative strategies to improve container loading unloading operational performance. The details are presented in Table 4.

Table 4 SWOT Matrix

Internal Factors / **External Factors**	**Strength**	**Weakness**
	Maintenance of loading unloading equipment Terminal facilities readiness Employee competence and training Domestic and international container shipping services Operational performance measurement (KPI) Ship schedule setting Payment/Transaction	Loading unloading equipment replacement Limited tool capacity in the terminal Employee performance measurement (KPI) Lack of cooperation with service users regarding the renewal of operational system implementation High dependence on equipment and information technology vendors
Opportunity	**SO**	**WO**
Foreign exchange fluctuation Port service tariff policy Potential to expand market share in cooperation with other parties Have a good relationship with stakeholders, port unions, and local government Increased special requests of service users Geographical conditions Use of electricity to replace diesel fuel	Expand market share by adding new services(S1) (S2) (S3) (S4) (S5) (O3) (O4) (O5) (O6) Provide innovation and development of facilities at ports, both infrastructure and superstructure to go "Green Port" in order to increase loading and unloading efficiency and productivity(S2) (S4) (S5) (O3) (O4) (O5) (O6) (O7) Encouraging business acceleration in container unloading services by optimally utilizing the geographical position of TPS as the gateway to Eastern Indonesia (S3) (S7) (O6)	Improve service quality through additional operational equipment capacity (W1) (W2) (O3) (O4) (O5) (O6
Threat	**ST**	**WT**
Fuel price fluctuation Government regulations on port management can change at any time Development of loading unloading equipment that is vulnerable to changes in sea transportation technology The development of a terminal operating system that is vulnerable to changes in sea transportation technology Tight competition in container terminal services, especially with terminals at overseas ports Weather conditions	Develop marine transportation technology both in operational systems and loading unloading equipment (S4) (T4) (T5)	Providing education through periodic socialization when there are changes to the operational system, both for employees and the shipping line (W4) (T3) (T4) (T5)

Based on Table 4, There are 6 alternative strategies proposed in the SWOT matrix, 3 SO (Strength-Opportunity) strategies, 1 WO (Weakness-Opportunity) strategy, 1 ST (Strength-Threat) strategy, and 1 WT (Weakness-Threat) strategy. The six strategies were obtained by looking at the relationship between interrelated factors and formulating alternative strategy proposals using references from previous research journals with objects in the same field. Then the last stage in this study is to analyze the output of the SWOT matrix to obtain strategic priorities using ANP. Figure 3 presents the ANP network model obtained from the FGD with expert judgments.

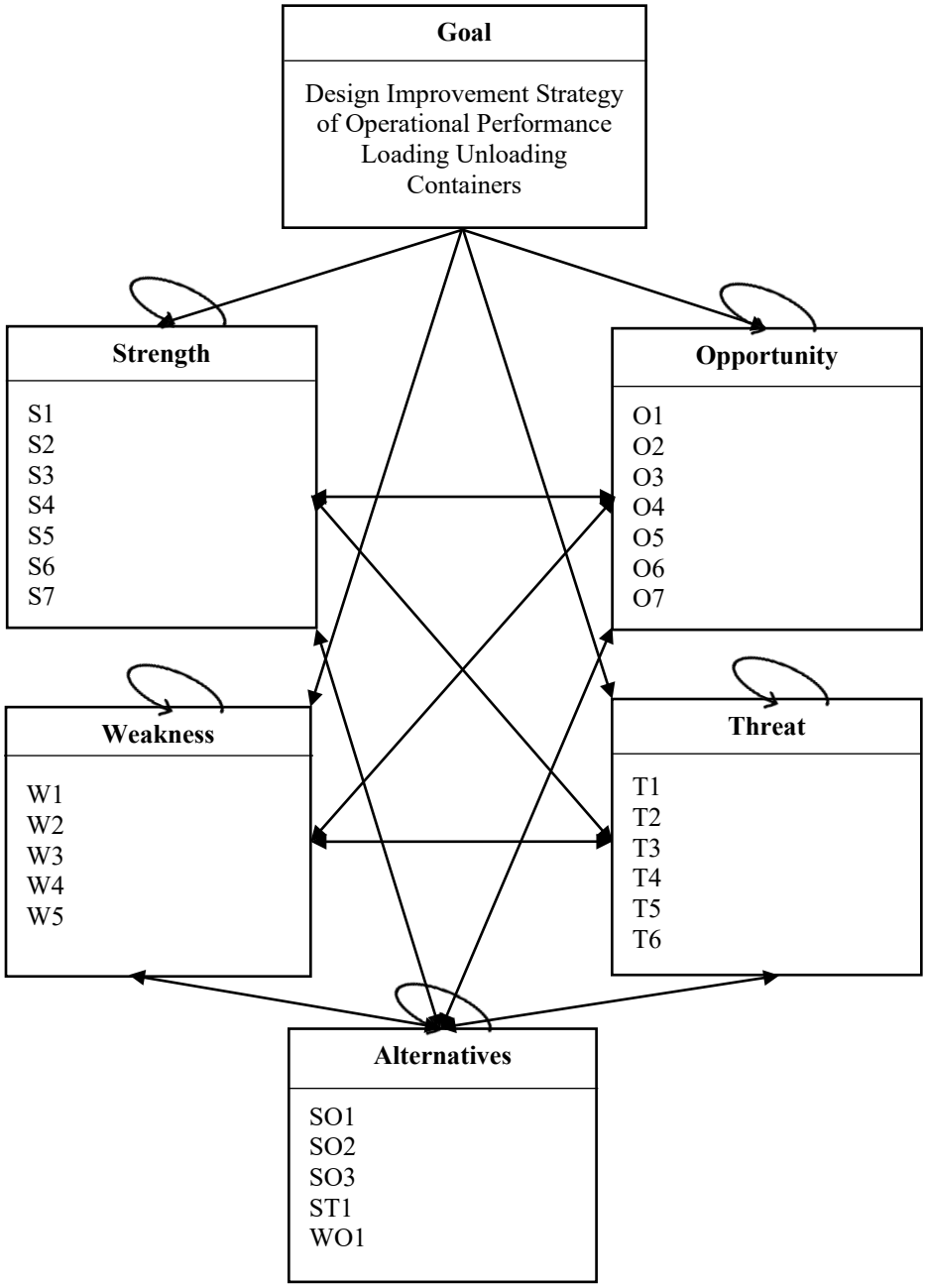

Figure 3 ANP Network Model

Based on Figure 3, there is a relationship between clusters and nodes in the ANP network model, this shows the interaction and dependencies between elements. After getting the network model framework from ANP, then weighted by 3 expert judgments, the data will be processed using Super Decision software provided that the consistency ratio must be less than 0.1, and the results will be obtained as in Figure 4.

Name	Graphic	Ideals	Normals	Raw
SO1		1.000000	0.332433	0.120893
SO2		0.557060	0.185185	0.067345
SO3		0.170261	0.056600	0.020583
ST1		0.384887	0.127949	0.046530
WO1		0.676169	0.224781	0.081744
WT1		0.219748	0.073051	0.026566

Figure 4 Results of Priority Strategy Operational Performance Loading Unloading Containers

The strategic priority order is obtained based on importance and weight, first is the SO1 strategy with a weight of 0.332433, second is the WO1 strategy with a weight of 0.224781, after that the SO2 strategy with a weight of 0.185185, fourth is the ST1 strategy with a weight of 0, 127949, then the WT1 strategy with a weight of 0.073051, and the last one is the SO3 strategy with a weight of 0.056600. The greater the weight indicates that the strategy has higher importance.

6. Conclusion

Based on and discussion related to research, conclusions can be drawn:

1. The identification results obtained internal factors in the form of domestic and international container shipping services as the highest strength factor, then the highest weakness factor in the form of loading unloading equipment replacement. While external factors in the form of having good relationships with stakeholders, port unions, and local governments as the highest opportunity factor, then one of the highest threat factors is intense competition in container terminal services, especially with terminals at overseas ports
2. There are 6 alternative strategies proposed in the SWOT matrix, 3 SO (Strength-Opportunity) strategies, 1 WO (Weakness-Opportunity) strategy, 1 ST (Strength-Threat) strategy, and 1 WT (Weakness-Threat) strategy.
3. Two strategic priorities were obtained with the highest weight. The first strategy is to expand market share by adding new services then the second strategy is to improve service quality through additional operational equipment capacity.

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Biography

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