The Strategy Determination to Improve Marine Security Using SWOT-AHP

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Abstract: The high number of crimes and violations occurring in the Indonesian sea shows that marine security in Indonesia is still weak. To improve maritime security requires planning a good maritime security strategy by analyzing strengths, weaknesses, opportunities and threats. This study aims to determine the best strategy to improve marine security in Indonesia. Therefore, in this study, the combination of SWOT and AHP methods was used to compare the best alternative strategies. The results of the combination of the SWOT and AHP methods recommend the following decisions: First is the strength-opportunity strategy (SO) with a value of 0.51, namely by utilizing all the power to seize and take advantage of the opportunity as much as possible, the SO strategy uses the internal strengths of the agency to take advantage of external opportunities. Second is the strength-threat strategy (ST) with a weight value of 0.26, which uses the power possessed by the agency to overcome threats, the ST strategy uses internal forces of the agency to avoid or reduce the impact of external threats. Third is the weakness-opportunity strategy (WO) with a weight value of 0.17, which utilizes the existing opportunities by minimizing existing weaknesses, the WO strategy aims to improve internal weaknesses by utilizing external opportunities. The fourth is the weakness-threat strategy (WT) with a weight value of 0.08, namely activities that are defensive and try to minimize weaknesses and avoid threats, the WT strategy aims to reduce internal weaknesses by avoiding external threats.

Keyword: SWOT-AHP, Strategy, Marine Security

1. Introduction

The unitary state of the Republic of Indonesia (NKRI) is an archipelago consisting of 17,504 islands and has a coastline of 81,290 kilometers. As an archipelagic country with 80% of the sea area and 20% of land area, threats to Indonesia's sovereignty and territory are at sea [1]. The percentage of this threat is increasing because Indonesia's geographic position is in world trade traffic. Every day hundreds of ships, both merchant and military ships pass through Indonesian waters through Sea Lanes of Communication (SLOC) and Sea Lines of Oil Trade (SLOT). The Indonesian Sea has a very important function for the Unitary State of the Republic of Indonesia (NKRI), namely, the sea as a unifying media of the nation, the sea as a medium of transportation, the sea as a media resource, the sea as a media for defense and security, and the sea as a media for diplomacy [2][3].
The high number of crimes and violations occurring in the Indonesian sea shows that the Indonesian sea is not safe. Violations that have been captured throughout the years 2005 - 2012 have increased. Supposedly the quality and quantity of the Government is able to secure the Indonesian sea area from various threats both illegal logging, illegal fishing, illegal mining and violation of border areas [4][5][6]. This is due to several factors, namely: (a) Determination of the boundaries of Indonesia's marine territories that are not yet clear, (b) The Indonesian Sea is connected to the Indonesian Archipelago Sea Channel (ALKI I and II), (c) Weak coordination between institutional agencies that handle safeguarding Indonesia's maritime border areas, (d) The area of Indonesian waters that must be secured, (e) Limitations on the number of surveillance vessels, (f) The lack of budget provided by the State for operational costs, (g) Lack of precisely the Government's decision in determining the operational management of Indonesian marine safeguards, (h) The occurrence of overlapping the task of the institution responsible for carrying out sea security. Based on the above factors, the Government is deemed to be more careful, fast and precise in deciding what strategies to take in Indonesia's maritime security operations [7][8][9].

The establishment of the Marine Security Agency (Bakamla) is a mandate of Law Number 32 of 2014 concerning Marine Affairs. Bakamla is authorized to carry out security, safety and law enforcement patrols at sea. The formation of Bakamla is a form of the seriousness of the Indonesian people in order to strengthen the supremacy of sovereignty and law in the Indonesian sea territory. The formation of Bakamla has changed the government paradigm in managing security, safety and law enforcement in the sea which has been considered inefficient and effective [10][11]. With the change in governance of the duties and authority of Indonesia's marine security institutions, it is necessary to conduct a study and analysis of the strengths, weaknesses, opportunities and threats of the Indonesian model of maritime security. To improve Indonesia's marine security, a good strategy is needed to plan the potential of Indonesia's natural resources and human resources.

Analysis of internal and external factors is a very important factor in formulating strategies for increasing sea security in Indonesia. Whereas external analysis is used to identify opportunities and threats that may occur, external analysis consists of the macro environment (political power, socio-cultural strength, demographic and environment, government policy, technological strength and competitive power) [2][6][9][12]. In formulating Indonesia's strategy to increase sea security, researchers chose the SWOT-AHP method as a tool to analyze internal and external factors that could improve Indonesia's maritime security [13][14][15][16][17][18]. AHP is used to assess the level of importance of each internal and external factors while at the same time assessing the level of strategic importance that will be chosen to improve Indonesia's marine security, namely: Strengths-Opportunities (SO) Strategies, Weaknesses-Opportunities (WO) Strategies, Strengths-Threats (ST) Strategies and Weaknesses – Threats (WT) Strategies.

2. Material and Methods

This research was conducted by designing a decision support system in order to be able to determine the best strategy to improve Indonesia's marine security based on internal and external factors by using the SWOT method as a reference for the preparation of alternatives and Analytic Hierarchy Process (AHP) used for ranking the best decision making alternatives. An overview of the research stages can be seen in Figure 1.

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**Figure 1. research stage**
SWOT analysis is a systematic identification of various factors to formulate a company or agency strategy. This analysis is based on maximizing strengths and opportunities, in contrast to minimizing weaknesses and threats [14][19]. AHP is one method to assess the level of importance in each criterion, sub-criteria for determining the best decision alternative, AHP method works with a hierarchical approach to solve multi-criteria problems.

The combination of SWOT and AHP is the use of a hierarchical structure for the strategic planning process based on the SWOT study, the use of quantitative techniques to estimate the efficiency value of the ideal strategy for each proposed strategy [13][20]. The hierarchical structure is composed of four levels, namely the first level is the goal that must be achieved (Goal), the second level is to compile the SWOT criteria namely strength (S), weakness (W), opportunity (O) and threat (T), the third level is to compile sub-criteria based on factors included in SWOT members, the fourth level is based on strategies that must be evaluated and compared. The composition of criteria, sub-criteria and alternatives are arranged as follows:

A. Criteria:
   1. Strength (S)
   2. Weakness (W)
   3. Opportunity (O)
   4. Threat (T)

B. Sub-criteria:
   1. Strength Sub-criteria (S):
      • S1 = Indonesia as a maritime country
      • S2 = Very High Government Support for Marine Security
      • S3 = The establishment of the Indonesian Marine Security Agency in 2014
      • S4 = Establishment of Task Force 115
      • S5 = The existence of rules and regulations that apply in the sea
      • S6 = Application of MCS Technology (Monitoring, Controlling, Surveillance)

   2. Weakness Sub-criteria (W):
      • W1 = Lack of the number of supervisory and patrol boats
      • W2 = Lack of operational costs for marine security
      • W3 = Limited facilities and infrastructure at sea
      • W4 = Weak law enforcement system at sea
      • W5 = Overlapping institutions that have authority at sea
      • W6 = The performance of the Indonesian Marine Security Agency is not yet optimal

   3. Opportunity Sub-criteria (O):
      • O1 = Indonesia as the world's maritime axis
      • O2 = The potential of natural resources in the sea is very high
      • O3 = Indonesia has 3 ALKI lines
      • O4 = Indonesia has 12 institutions that have authority in the sea
      • O5 = Construction of military bases in the border region
      • O6 = Reform of Indonesia's marine security governance

   4. Threat Sub-criteria (T):
      • T1 = High crime of illegal fishing and smuggling
      • T2 = High levels of drug smuggling by sea
      • T3 = Indonesia has many sea borders with neighboring countries
      • T4 = There are hundreds of foreign ships passing through the Indonesian sea every day
      • T5 = Criminals in the Indonesian sea have high-tech vessels
      • T6 = Law enforcement officers and entrepreneurs often commit crimes
C. Alternatif (A):
1. SO Strategy (Strength - Opportunities)
2. ST Strategy (Strength - Threat)
3. WO Strategy (Weaknesses - Opportunities)
4. WT Strategy (Weaknesses - Threats)

Analytic Hierarchy Process (AHP) can solve complex multicriteria problems into a hierarchy. Complex problems can be interpreted that the criteria of a problem are so many (multicriteria), unclear problem structures, uncertainty of opinion from decision makers, decision makers of more than one person, and inaccuracies of available data.

The AHP model that distinguishes it from other decision-making models is that there is no need for absolute consistency requirements. With the AHP model using decision maker perception as input, the inconsistencies that occur may occur because humans have limitations in expressing their perceptions consistently, especially if they have to compare many criteria. Based on this condition, the decision maker can state that the perception will be consistent later or not.

The measurement of the consistency of a matrix itself is based on maximum eigen value \[ \lambda_{\text{max}} \]. Thomas L. Saaty has proved that the consistency index of an ordered matrix can be obtained by the following formula:

\[
CI = \frac{\lambda_{\text{max}} - n}{(n - 1)} \quad \text{......... (1)}
\]

CI = index consistency, \[ \lambda_{\text{max}} = \text{The largest eigenvalue of an ordered matrix n, } n = \text{Order matrix} \]

If CI is zero, the pair wise comparison matrix is consistent. The inconsistency limit set by Thomas L. Saaty was determined using the Consistency Ratio (CR), which is the comparison of the consistency index with the Random Index (RI) value obtained from an experiment by the Oak Ridge National Laboratory and then developed by the Wharton School and shown as table 1. This value depends on the order matrix n. Thus, the Consistency Ratio can be formulated as follows:

\[
CR = \frac{CI}{RI} \quad \text{......... (2)}
\]

CR = Consistency Ratio, RI = Random Index

5. Result and Discussion
According to the 2015 Indonesian Defense White Paper document, the national interest is to maintain the standing of the Republic of Indonesia based on Pancasila and the 1945 Constitution of the Republic of Indonesia and ensure the smooth development of the National in order to realize the National goal. Whereas the National Goals are listed in the Preamble of the 1945 Constitution of the Republic of Indonesia, namely protecting all Indonesians and all of Indonesia's bloodshed, advancing public welfare, educating the lives of the nation, and participating in world order based on independence, lasting peace and social justice. Therefore, this study aims to determine the best strategy to improve marine security in Indonesia by analyzing internal and external factors using the SWOT-AHP method, the stages of the analysis process based on images. can be explained as follows:

5.1. SWOT Analysis Results

SWOT analysis is the identification of various factors systematically to formulate a company or institution strategy. This analysis is based on logic that can maximize strengths and opportunities but can simultaneously minimize weaknesses and threats.

Internal factors are strengths and weaknesses. Based on the results of literature studies and interviews with several experts compiled factors including strength and weakness. While, External factors that determine strategy are opportunities and threats. Based on the results of literature studies and interviews with several experts, factors including opportunities and threats. To make a good strategy, an agency needs to combine internal and external factors into a strategy. there are 4 (four) combinations of strategies that can be used by agencies, namely: Strengths and Opportunities (SO), Strengths and Threats (ST), Weaknesses and Opportunities (WO), Weaknesses and Threats (WT).
5.2. AHP Analysis Results

After analysis of internal and external factors are prepared using SWOT, then the next is to analyze the interests for each criterion, sub-criteria and alternative decisions using the Analytic hierarchy process (AHP) method [21][22].

5.3. SWOT-AHP Analysis Results

The results of the analysis of internal and external interest factors through the distribution of questionnaires to the Government and academics who understand the conditions of Indonesian maritime security, the following are presented the final results of the assessment of the level of importance in each criteria, sub-criteria and alternatives.

a. Criteria Assessment Results

The results of the comparison of interests between the strength (S), weakness (W), opportunity (O) and threat (T). Based on the results of calculations using AHP in table.4 obtained eigen vector values and the process of testing the consistency of decision makers’ judgment obtained by Strength (S) = 0.563, Weaknesses (W) = 0.049, Opportunities (O) = 0.338 and Threats (T) = 0.049.

b. Sub-Criteria Assessment Results

The first stage is analyzing the interests between strength sub-criteria with 6 (six) sub-criteria, namely: Indonesia as a maritime country (S1), very hight government for marine security (S2), the establishment of Indonesian marine security agency in 2014 (S3), establishment of task force 115 (S4), the existence of the rules and regulations that apply in the sea (S5) and application of MCS (monitoring, controlling and surveillance) Technology (S6), as shown in table 5. Based on the results of the sub-criteria calculation in the strength criteria in table 5, the values of local priorities and the process of consistency of the decision-making assessment obtained by the sub-criteria strength (S1) = 0.028, (S2) = 0.443, (S3) = 0.156, (S4) = 0.106, (S5) = 0.223 and (S6) = 0.044.

The second stage is analyzing the interests of sub-criteria weaknesses, there are 6 (six) sub-criteria, namely: lack of the number of supply and patrol boats (W1), lack of operational costs for maritime security (W2), limited facilities and infrastructure at sea (W3), weak law enforcement system at sea (W4), overlapping institutions that have authority at sea (W5) and the optimal performance of the Indonesian marine security agency is not yet (W6), as shown in table 6. Based on the results of the sub criteria criterion weakness in table 6 obtained the local priorities value and the process of testing the consistency of the decision maker's assessment, the final results obtained the weight values as follows: (W1) = 0.069, (W2) = 0.292, (W3) = 0.024, (W4) = 0.066, (W5) = 0.275 and (S6) = 0.275.

The third stage analyzes the importance of sub-criteria of opportunity with 6 (six) sub-criteria, namely: Indonesia as the world’s maritime exis (O1), the potential of natural resources in the sea is very high (O2), Indonesia has 3 (tree ) ALKI lines (O3), Indonesia has 12 institutions that have authority in the sea (O4), construction of military bases in the border region (O5) and reform of Indonesia’s marine security governance (O6), as shown in table 7. Based on the results of the sub criteria criterion opportunity in table 7 obtained the local priorities value and the process of testing the consistency of the decision maker's assessment, the final results obtained the weight values as follows: (O1) = 0.062, (O2) = 0.027, (O3) = 0.069, (O4) = 0.278, (O5) = 0.269 and (O6) = 0.296.

The fourth stage analyzes the importance of sub-criteria of threat with 6 (six) sub-criteria, namely: high crime of ilegal fishing and smuggling (T1), high level of drug smuggling by sea (T2), Indonesia has many sea border with neighboring countries (T3), there are hundreds of foreign ships passing throught the Indonesia sea (T4), criminal in the Indonesian sea have high tech vessels (T5) and law enforcement officers and entreprenuer often commit crimes (T6), as shown in table 8. Based on the results of the sub criteria criterion threat in table 8 obtained the local priorities value and the process of testing the consistency of the decision maker's assessment, the final results obtained the weight values as follows: (T1) = 0.229, (T2) = 0.072, (T3) = 0.034, (T4) = 0.143, (T5) = 0.282 and (T6) = 0.302.
c. Alternative Assessment Results

The last process in this SWOT-AHP analysis is to calculate the final value of the decision that has been determined into 4 (four) parts of the strategy, namely: Strength - Opportunities (SO), Strength-Threats (ST), Weaknesses-Opportunities (WO) and Weaknesses-Threat (WT). Each decision alternative must be compared with each sub-criterion, the results of the comparison of the level of alternative importance will be multiplied by the criteria weighting value, so that the final decision value can be obtained as in Table 9.

Based on the final results in table 9, it shows that the SWOT-AHP analysis recommends several strategies based on the level of importance for each criterion and sub-criteria. The first recommendation is Strengthening Opportunities (SO) with a weight value = 0.51, which means that this strategy aims to take advantage of the opportunities to improve Indonesia's existing maritime security by maximizing the internal strength of the Indonesian government. The second recommendation is the Strength - Threats (ST) strategy with a weight value = 0.26 meaning that this strategy aims to reduce or minimize the threats that occur in the Indonesian sea by optimizing the strength of the Government of Indonesia. The third recommendation is Weaknesses-Opportunities (WO) with a value of weight = 0.17 which means that this strategy aims to improve and improve the weaknesses of the Indonesian government in order to take advantage of or take advantage of the opportunity to improve Indonesia's maritime security. The fourth recommendation is the Weaknesses-Threat (WT) strategy with a weight value = 0.08, meaning that this strategy aims to improve the existing weaknesses in Indonesian maritime security to minimize threats, this strategy is a strategy to survive in competition.

6. Conclusion

Based on the identification of internal and external factors of Indonesian maritime security using the SWOT and AHP methods can be concluded as follows: First is the strength-opportunity strategy (SO) with a value of 0.51, namely by utilizing all the power to seize and take advantage of the opportunity as much as possible, the SO strategy uses the internal strengths of the agency to take advantage of external opportunities. Second is the strength-threat strategy (ST) with a weight value of 0.26, which uses the power possessed by the agency to overcome threats, the ST strategy uses internal forces of the agency to avoid or reduce the impact of external threats. Third is the weakness-opportunity strategy (WO) with a weight value of 0.17, which utilizes the existing opportunities by minimizing existing weaknesses, the WO strategy aims to improve internal weaknesses by utilizing external opportunities. The fourth is the weakness-threat strategy (WT) with a weight value of 0.08, namely activities that are defensive and try to minimize weaknesses and avoid threats, the WT strategy aims to reduce internal weaknesses by avoiding external threats. A defensive and aggressive strategy to improve Indonesia's maritime security must be carried out immediately by the Government of Indonesia by optimizing existing strengths and opportunities.

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8. References

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