OPTIMIZATION OF KOARMADA I OPERATION PATTERN IN FACING THREAT OF TERRITORIAL VIOLATION IN NATUNA SEA WATERS

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ABSTRACT

Operation to secure border areas is an effort and activity to ensure the upholding of state sovereignty at land, sea and air borders with other countries, from all forms of threats and violations including survey and mapping activities. The limited ability of the KRI and the budget provided by the state as well as the need for security of Indonesia's maritime border areas, resulted in the need for a demand for thoughts on optimizing the deployment of KRI at the Aju bases and the operations sector in Natuna Sea waters, by taking into account the type of KRI, speed, endurance, radar coverage and costs. operation. So that the resulting composition of the KRI deployment at the initial base and the border area security operations sector in the waters of the Natuna Sea. This research discusses the optimization of the deployment of KRI at the initial base and in the operational sector in border area security operations in the Natuna Sea waters, to provide an optimal compromise solution between two different objective functions, namely coverage area and operating costs. This problem solving uses the Competitive Profile Matrix approach with the help of superdecision software for weighting the objective function. While the optimization of the KRI power distribution uses the transshipment model method, Goal Programming and Weighted Goal Programming, where all algorithms of the approach are resolved silmutaneously in a syntax using Lingo 11 optimization software.The result of this optimization is that the average coverage area effectiveness is achieved. 450,913 mil2 and the average operating cost efficiency is 40% of the stipulated budget.

Keywords : *Border Area Security Operations, CPM, Optimization Model, Transshipment, Goal Programming, Weighted Goal Programming, Coverage Area, Operating Costs.*

1. INTRODUCTION

The working area of Fleet I Command, which stretches from Sabang waters covering all Sumatra waters including the Malacca Strait to the Sunda Strait and the Natuna Sea, has a high level of vulnerability to law violations and security disturbances at sea. This is because these waters are mostly passed by international shipping and are bordered by neighboring countries. Conflicts that often occur are violations of maritime boundaries, unilateral claims by neighboring countries and other illegal activities. This potential border problem can cause problems related to the legal, economic, social, cultural, defense and security sectors of the country.

The dynamics of the development of the strategic environment, both global, regional and national, have created an increasingly complex spectrum of threats with implications for national defense. Several things that have an impact on security stability in various regions need to be examined, including the policy of the new President of the United States which has had a broad impact on instability in various regions, the increasing tensions in the South China Sea; increased North Korean nuclear weapons and missile development activities; Rohingya humanitarian crisis; changes in the international political map that have led to new problems such as Middle East refugees, conflicts in Iraq, Syria, Yemen, Somalia and Nigeria; the more pressing and unsafe the position of ISIS in Syria and Iraq, however, they formulated a power base in various countries through acts of terror including Southeast Asia by establishing the Southeast Asian Islamic State in Sulu, Philippines; increasing disease outbreaks, natural disasters and environmental damage; the struggle for energy sources, conflicts of interest, developments in information and communication technology present cyber threats; and other prominent non-traditional security issues, such as efforts to disarm weapons of mass destruction which are placed as one of the crucial issues in global security issues. The development of this strategic environment has an impact on Indonesia's geostrategy and geopolitics in the region. The various problems faced today have implications for shifting the dimensions of threats, both physically and non-physically.

The dimensions of physical threats are military, non-military, and hybrid threats which are categorized as real and not yet real threats. Real threats are threats that are being and must be faced, such as: terrorism and radicalism; separatism and armed uprising; natural and environmental disasters; border territorial violation; piracy and theft of natural resources; epidemic of a disease; cyber and intelligence; distribution and abuse of narcotics; as well as other threats that can interfere with national interests. Meanwhile, the threat is not yet real, namely open conflict (conventional warfare) which is unlikely to occur in the next few years, but still needs to be watched out for in order to prepare national defense early. Meanwhile, the non-physical threat dimension is in the form of ideological threats in terms of communism, socialism, liberalism and radicalism.

Faced with the development of the strategic environment that has occurred in the South China Sea, Natuna Waters, Karimata Strait and land and sea border areas, it is deemed necessary to optimize the title of strength of the marine dimension in the region.

Operations to secure border areas in accordance with the guidebook for the implementation of security operations for border areas (Perpang TNI number: Perpang / 173 // XII / 2011), are all efforts and activities to ensure the enforcement of the country's territorial sovereignty in land, sea and air borders with other countries, from all forms of threats and violations, including survey and mapping activities. The objective is to maintain integrity and prevent and eliminate all forms of threats that may arise in the land, sea and air border areas between the Republic of Indonesia and other countries. While the objectives of the operation relating to the maritime border area are as follows:

a. The maintenance of the integrity of the sea area at the border of the Republic of Indonesia with other countries.

b. The creation of security stability along the maritime borders of the Republic of Indonesia and other countries.

c. Prevention of all illegal activities and / or use for illegal activities in the maritime border area between the Republic of Indonesia.

d. Implementing law enforcement in the maritime border area between the Republic of Indonesia and other countries.

Based on the above, the Indonesian Navy in this case Koarmada I as the operational executing command with the main task of carrying out force projections to carry out marine operations which include marine combat operations and amphibious operations both to support sea control and to achieve strategic objectives in the context of enforcing sovereignty and law at sea. The limited capacity of the KRI and the budget provided by the state as well as demands for securing the territorial waters of the Republic of Indonesia for the assignment of ships in the sectors of the maritime border area security operations in the waters of the Natuna Sea have resulted in the need for a demand for ideas about the deployment of the Indonesian Navy, in this case the KRI to the Aju base and in the operational sector to secure the maritime border area in the Natuna Sea waters.

Marine security patrols are presence operations at sea that have strategic value for the existence of national sovereignty and maritime security in the Indonesian national jurisdiction. Security disturbances and crimes at sea in the form of illegal fishing, illegal logging, violations of Indonesia's territorial territory and theft of other natural resources require the presence of patrol boats, to safeguard the entire Indonesian archipelago from threats both from within and from abroad.

The following table is data on violations that occurred in the waters of the Natuna Sea.

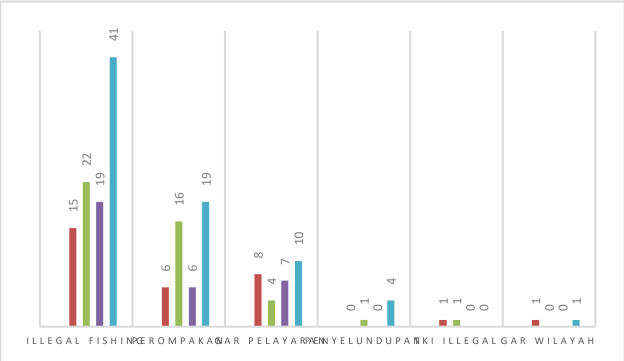

Figure 1. Graph of marine safety violations data 2015-2019

The graph above shows the success of the Indonesian Navy patrol boats in catching criminals at sea. The graph also shows that the type of illegal fishing crime is in the top rank and is increasing every year followed by piracy and shipping violations.

The limited capacity of KRI owned by Koarmada I and the budget provided by the state as well as demands for securing the Indonesian marine area on the assignment of ships in marine security operations sectors in Natuna waters resulted in the need for thinking demands on the optimal distribution of patrol boat assignments, so that the type and type number of supports in safeguards in the operating sectors.

The assignment of elements of the Indonesian Navy in carrying out security operations in border areas is also closely related to logistical support. And one of the logistical functions of the Indonesian Navy is support for base facilities directed to meet the needs of operational units consisting of rebase facilities, maintenance and repair facilities, replenishment facilities, personnel care facilities (rest / recreation).), and base development facilities. The Indonesian Navy base as an integral component of the SSAT is one of the spearheads in carrying out support for border area security operations, so that the Indonesian Navy base will play a very significant role in the success of supporting the Indonesian Navy operations title. In the current operation tactic as a policy of efficiency in the operation title, the tactic of waiting with the base as the waiting point for Indonesian Navy ships is carried out. So that according to its function and position, the base is a strategic component in carrying out the maintenance and maintenance functions of materials and personnel and can provide support for the reaction speed of the action element, namely the ship to the position of the incident at sea.

This research was conducted to optimize the criteria associated with the implementation of border area security operations, these criteria are: coverage area and operating costs. Looking for interdependent relationships or influencing each other between one criterion and another, then calculating the weight of each of these criteria. This study also aims to find the target value of each objective function in accordance with the existing constraints, as well as to find the importance weight of the objective function. The objective function of this study are: maximizing the KRI coverage area and minimizing operating costs.

With the presence of multi criteria in the implementation of border security operations in the waters of the Natuna Sea, this study uses the Multi Criteria Decision Making (MCDM) method. The MCDM method used is the Competitive Profile Matrix (CPM). The Competitive Profile Matrix (CPM) method approach is used to determine the relative weight of criteria or objectives in the implementation of border security operations in the waters of the Natuna Sea, where the relationship between the criteria is dependence or interrelated. The weight assessment in the CPM method is carried out based on the results of a questionnaire to experts / experts so that alternative priority weights will be obtained in relation to the implementation of border security operations in the Natuna Sea waters.

The transshipment method in this study is used to describe the KRI assignment flow, that KRI moves from the main base before heading to the operations sector, the KRI will go through the transshipment point / intermediate point in this case the aju base. Goal Programming method in this research is used to find optimization, in the form of effectiveness and efficiency of the target value of each objective function, namely: maximizing the coverage area and minimizing operating costs.

Goal Programming aims to drink the distance between or deviation (deviation) from the goals, targets or targets that have been set with efforts that can be taken to achieve these targets or objectives satisfactorily in accordance with the existing constraints, in the form of: KRI allocation in the operational sector, capability coverage area (KRI radar), mileage, fuel consumption, operating costs, KRI endurance. While the Weighted Goal Programming method is used to align the value of the weighted goal / goal with the achievement of the weighted goal / goal, resulting in a solution that is more representative of the preferences of decision makers on the goals / goals. Where all the decision variables, objective functions, constraints of the three optimization methods (transshipment, goal programming, weighted goal programming) are resolved silmutaneously in a syntax using optimization software, resulting in an optimization model for compromising decision-making (compromise solution) in implementation. operations to secure maritime borders in Natuna Sea waters.

1.2. Problem Formulation

Based on the background and research gap above, the problems that can be formulated in this study are as follows:

a. How to optimize the criteria related to the implementation of security operations in border areas in order to be effective and efficient?

b. How to develop an optimization model for border area security operations by Koarmada I in the waters of the Natuna Sea?

c. How to implement a combination of CPM, Transshipment, Goal Programming and Weighted Goal Programming methods to find a compromise solution of the objective function?

1.3 Limitations and Assumptions

Considering some limitations from limited data sources and time, this study is limited to:

- Territorial violation (garwil) is a violation of territorial borders committed by ships of foreign countries.
- Does not discuss base operational costs.
- Alert implemented in maritime security operations is standby III (peacetime)
- Did not discuss the patrol boat weaponry.

Assumptions :

- Everything related to research and its results related to threats that exist from countries around the North Natuna Sea Region, can be facilitated by their needs.
- All patrol boats operating in a ready condition (not being repaired and maintained).

2. LITERATURE REVIEW

2.1. Previous research

Literature reviews are conducted to support problem solving and to deepen theoretical knowledge that will be used in solving problems in this study. As for some references to research studies that have been carried out previously which have similarities in object, problem formulation and method are as follows:

Ming and Yang (2007) examined the allocation of resources in a transportation infrastructure project in Thaicung City, Taiwan using the ANP method and Goal Programming. Selection of a transportation infrastructure project is a process of identifying several project alternatives with the aim of maximizing organizational profits and allocating resources according to the limitations contained in the resources themselves, namely: planning and design should not be more than 24 days, construction time should not exceed 35 months, the budget costs no more than $ 320, and the administration fee is not more than $ 42. This study uses ANP and Zero-One Goal Programming (ZOGP) methods. The ANP method is used to select project alternatives based on the relationship between the criteria and the weight of these criteria according to the assessment of experts in the selection of transportation infrastructure projects that have been determined through group discussions, namely: land use, planning and design, definition of management and maintenance infrastructure, travel requests, financial analysis, proposals and promotions. Alternative projects are: special express bus lane (P1), traffic signal control system (P2), and parking structure (P3). After going through the weighting process using AHP, the weight of each project (P) is obtained, as follows: (P1, P2, P3) = (0.342,0.484, 0174). Meanwhile, ZOGP is used to calculate the achievement of the objective function of the project according to the limits specified above. From the application of the two methods above, it is found that P2 and P3 are the chosen alternatives, with a total cost of $ 300, planning and design for 24 days, construction work for 34 months, and administration costs of $ 42.

Singgih S (2007), examines the selection of suppliers using the Integrated Fuzzy AHP method and Weighted Fuzzy Goal Programming Approach. The purpose of this study is to accommodate the preferences of decision makers by giving weight to fuzzy goals, so the method developed is called weighted fuzzy goal programming. This method is to solve the problem of international supplier selection. The objective functions developed are minimizing the percentage of defects, minimizing late delivery, minimizing purchase prices, and maximizing business relationships. The constraint functions include total demand, supplier's maximum supply capacity, owner estimate purchase price, and minimum order quantity. This method produces a solution that is more representative of the preferences of decision makers on international supplier selection when compared to the FGP method where the preferences of the decision makers are expressed in weighted values. The value assigned to goals can show a harmonious relationship between the value of the weighted goal and the achievement of the aspirations of the weighted goal. The greater the value of the weighted goal, the higher the achievement of the aspirations for the weighted goals. As a result, suppliers with a better value for weighted goals will get increasingly higher returns.

Suhirwan (2007). Researching the comparative study of the capability and allocation of the Indonesian Navy KRI, as well as the allocation of its bases in order to secure the sea area of western Indonesia using the Set Covering Problem method This study intends to compare the ability of KRI to determine the allocation and location of the patrol sector, which is associated with endurance in operating in the patrol sectors that must be secured. Solving the solution using a mathematical model in the form of Integer Linear Programming and Set Covering with the decision variables used is the assignment of KRI from an initial base in carrying out operations to the patrol sector then returning to the initial base, using a range of ranges according to operational limits and considering area, threats existence and the existence of vital objects that must be secured. The calculation process uses Lingo software. The conclusion is to compare the ability of the five types of KRI to produce one optimal solution and four non-optimal solutions, where the optimal solution is obtained by the KRI KKP class as many as 21 KRI KKP Class to secure the sea area of western Indonesia. Meanwhile, for the allocation of bases of the 20 candidate bases, through the optimization process, there are 13 bases that are suitable to become Indonesian Navy bases.

Okol (2008) examines the Fleet Placement Optimization Model (Case Study of Indonesian Navy Patrol Boats in Eastern Indonesia). In this research, it explains about the optimization of the placement of the Navy patrol boat assignments to the eastern operational sectors and the determination of their placement to support bases, so that the type and number and operational costs are right in security. To optimize these problems the authors apply the optimization method by combining the Linear Integer Programing (ILP) method and the Problem Set Covering method. From the optimization results in the form of the composition of the assignment of 21 patrol boats to 7 Armatim Kamla operation sectors. The maximum coverage area of patrol boats reached is 1,668,765 miles2 with an under deviation of 2.58% of the coverage area or 43,494 miles which has not been covered from the entire operational sector I to. VII (1,668,765 mil2). The optimization result also shows that the minimum operating cost that is achieved for one assignment is Rp. 4,531,018,000, - and does not exceed the operational budget / budget for one assignment (IDR 5,000,000,000).

Chang, et al (2009) examined a historic transportation revitalization strategy project in Alishan using ANP and Zero-One Goal Programming (ZOGP). The method is used to maximize net benefits to society and allocate resources most efficiently. In this study, it was explained that in a project many criteria must be selected and must be considered. This is because the proposed projects have not considered the related criteria, both tangible and intangible. The criteria that must be considered are: benefit, cost, opportunity, risk. Then the interdependence of these criteria must be known through group discussions, then through the experts the criteria are weighted. The integration of the ANP and GP methods for the decision-making process in the railway transport revitalization strategy project in the city of Alishan where the project is multi-criteria, interdependent so that it requires selection and evaluation in its decision making. Where ANP provides a systematic approach to setting the priority of multi criteria and trade offs of objective functions. Then the results of the ANP are used to formulate Goal Programming. With Goal Programming, the deviation from the achievement of each predetermined goal will be sought according to the constraints that have been set, then with the Zero-One Goal Programming formulation, which projects will be selected in accordance with the achievement of the targets of each function will be selected. aim. Through this optimization, 4 (four) projects were selected from the 7 (seven) proposed projects.

Hozairi (2011) optimizes the placement of Indonesian Navy fleets in eastern Indonesia using the Genetic Algorithm (AG) method. This study resulted in an optimization in the form of the composition of the assignment of 27 patrol boats to 7 Kamla Armatim operating sectors, by maximizing the coverage area and minimizing operational costs. The results of the AG technique are not global optimum but are not easily trapped in the local optimum. The result is an acceptable optimum, that is, a result that has a fair and acceptable optimization. The research resulted in a coverage area of 1,942,929 square miles and an operational cost of IDR 2,853,447,000, thus this optimization model was able to save the state budget by around 48% of the IDR 5,000,000,000 budget.

Iskandar (2015) discusses planning on optimizing the assignment of the Navy Patrol Elements (ships and aircraft) in maritime security operations in the eastern Fleet region and determining their placement to support bases. This study seeks to combine the operational and logistical interests of the Navy Patrol Elements with budget constraints, technical capabilities and maintenance schedules for Indonesian Navy maritime patrol and maritime patrol aircraft, operational sector area, sector vulnerability level and base capability. This optimization study identifies the related decision variables, then determines the objective function and constraints as an optimization model to be developed. Problem solving uses the Integer Linear Programming and Covering Set approach and the calculation uses a tool in the form of a Solver.

2.2 Role of the Indonesian Navy

According to Ken Booth (Marsetio, 2014), the Navy universally has three roles in carrying out its duties, namely: Military role, carrying out state defense in order to uphold state sovereignty at sea, guarding maritime borders with neighboring countries. The role of Diplomacy (Diplomacy Role), to provide support for government foreign policies designed to influence the leadership of other countries in peaceful or hostile situations. The role of the Naval Police (Constabulary Role), enforcing laws at sea, protecting national marine resources and assets, maintaining security at sea.

While the duties of the Navy are in accordance with Law Number 34 of 2004 concerning the TNI, the duties of the Navy are as follows:

a. Carrying out the duties of the Navy in the defense sector;
b. Upholding the law and maintaining security in the marine area of national jurisdiction in accordance with the provisions of national law and international law that has been ratified;
c. Carry out naval diplomacy in the context of supporting foreign policy stipulated by the government;
d. Carry out TNI duties in the development and development of the strength of the marine dimension; and
e. Implementing the empowerment of marine defense areas.

The Indonesian Navy as an integral part of the TNI carries out the duties of Military Operations for War (OMP) in the form of mobilizing and using Indonesian Navy forces to fight against military forces of other countries that carry out aggression against Indonesia, and / or in armed conflict with another country or more, which is preceded by the declaration of war and subject to international war laws. In its implementation, the deployment and use of Indonesian Navy forces are still guided by the Integrated Tri Matra, where the Indonesian Navy's strength is an integral part of the TNI's strength in fighting the military forces of other countries.

2.3 Security of Indonesian Waters

The implementation of safeguarding Indonesian waters is ensuring the integrity of all waters of Indonesia's national jurisdiction and the security of national interests in and or by sea. In the implementation of safeguarding Indonesian waters, it is carried out by :

a. Preventive deployment, namely preparing and placing Indonesian Navy combat forces in vulnerable waters, approaching roads for deterrence, observation and enforcement of sovereignty and the law at sea.
b. Reactive deployment, namely preparing and placing Indonesian Navy combat forces in certain waters to overcome crises in the form of sea control.

Meanwhile, the pattern for the implementation of safeguarding Indonesian waters is carried out using the following operating pattern:

a. Presence operations at sea. It is the presence of a number of Navy forces in collaboration with other components of Defense and Security, in the form of a preventive and reactive deployment of force, for strategic deterrence and naval diplomacy, in order to protect national interests at and or by sea.

b. Maritime Security Operations. Is an operation carried out to prevent and overcome every form of maritime security disturbance by the forces of the Navy and non-Indonesian Navy in order to enforce law at sea and to carry out the form of assistance activities for Domestic Security operations in order to protect national interests at and or by sea.

A ship that moves from one point to another during its endurance has a variable radar capability and speed. For the calculation of ship coverage area and cruising range, it is described and formulated in Figure 2.1 as follows: (Marine Security Operations Manual, Asops Kasal, 2004).

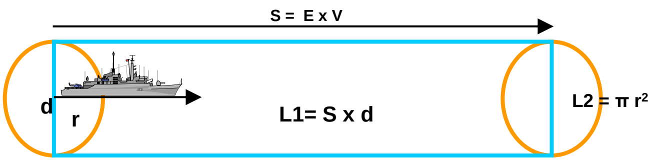

Figure 2. KRI's Coverage Area (Source: Iskandar, 2015)

$S = E \times V$ .... (2.1)

$L_1 = S \times d$ .... (2.2)

$L_2 = \pi r^2$ .... (2.3)

Information :

S = Range per Endurance (miles)

E = Endurance (hours)

V = speed of the ship (miles / hour)

L1 = Area of rectangle (mil2)

L2 = area of circle (mil2)

d = Radar range (miles)

r = Radius of radar coverage circle (miles)

KRI coverage area is the area of the rectangle (L1) plus the area of the circle (L2)

Coverage Area = (L1 + L2) x Probability of radar detection

Coverage Area = (L1 + L2) x 0.9 (mil2) .... (2.4)

Patrol boat max cruising distance = Cruising distance per day x Endurance

S = E x V (mil) .... (2.5)

Information :

S = the maximum cruising range of the patrol boat

E = Endurance, is the number of days the ship is able to sail without re-provision.

The presence of KRI in the area of operation was also inseparable from the support from the base. The Indonesian Navy bases consist of: main bases, aju bases, operations bases, intermediate bases and floating bases. According to the Indonesian Navy Base Standardization Administration Manual (PUM-703) states that the Indonesian Navy Base as an integral part of the Integrated Fleet Weapon System (SSAT) is the spearhead in supporting the success of the tasks of the Indonesian Navy operational units both in peacetime and during war. . In a logistical sense, the base functions as a support point for the provision, repair and protection of the fleet, while in the sense that the base strategy functions to ensure that the presence of the fleet along vital sea lines of communication is maintained continuously.

2.4 Planning and Logistics Costs

Hadi Firmanto (2006), Logistics planning is a process of strategy in managing a procurement, transfer and storage, final inventory through organizations and channels of civil and military companies / agencies, so that current and future profits can be maximized through cost effectiveness. Logistics management provides many ways to increase efficiency and productivity with a significant contribution to lowering unit costs.

The goal of logistics cost planning is to achieve the target at the lowest cost, with a mission to plan and coordinate all important activities in the implementation of operations. Logistics is a command function which means from the planning stage to the implementation of each situation and development

Logistical positions and movements must be authorized by the Commander. So a Commander must know the level of his logistical capability to support the concept of his operation. And vice versa

Logisticians must be prepared to make suggestions to leaders so that operations do not exceed their logistical capabilities.

The logistics costs for KRI and Indonesian Navy aircrafts are broadly divided into two, namely liquid logistics costs and personnel logistics. Included in the liquid logistics costs are the costs of fuel, lubricating oil and fresh water, while personnel logistics costs include the cost of meals during operation, screen and non-screen allowances as well as leader's allowances, flight allowances, pocket money and maintenance costs for operating ships / Harkapops. . (Kasal, Indonesian Navy Strength Development 2005-2024, Jakarta, 2005).

2.5 Multiple Criteria Decision Making (MCDM)

According to Ciptomulyono (2010), multiple criteria decision making is a method of selecting an alternative process to obtain optimal solutions from several alternative decisions by taking into account more than one criterion or object in conflicting situations. For this reason, the MCDM method provides an alternative to take advantage of objective and subjective considerations as a basis for decision making. Hwang and Yoon (1981) divided the scientific taxonomy of multicriteria decision making into 2 different approaches, namely: Multiple Objective Decision Making (MODM) and Multiple Adjective Decision Making (MADM).

The MODM approach deals with the completion of an optimization model that has multiple objectives and conflicts with each other. The existence of an "optimal" solution for this multiple objective will differentiate it from the classic single objective optimal approach such as linear programming. While the MADM approach is a multicriteria solution technique for selection or selection problems, it does not require a classical mathematical model approach. The decision variable is considered as a finite discrete variable. This approach is only intended as a decision aid so that they can study and understand the problems faced, determine priorities, values, objectively through the exploration of the decision components so that it will make it easier for decision makers later to identify which is the best choice they like (Ciptomulyono U, 2010).

2.6 Competitive Profile Matrix (CPM)

Researchers have proposed several strategic techniques that are useful for analyzing industrial competition scenarios. Coman & Ronen (2009) states that the SWOT (Strengths-Weaknesses-Opportunities-Threats) analysis is one of the most useful tools for defining a company's strategic actions by analyzing the company's internal capabilities and the external environment to identify appropriate opportunities and threats. However, the problem with SWOT analysis is that it does not prioritize or consider the internal or external factors identified (Hill & Westbrook, 1997) whereas the CPM method includes weights of all identified CSFs to analyze competitive advantage. Porter (2000) identifies another popular tool known as the five forces model for analyzing a firm's industrial attractiveness.

On the basis of analyzing these factors, Porter argues that organizations can develop generic competitive strategies of differentiation or cost leadership, capable of delivering superior performance through proper configuration and coordination of value chain activities. This model not only offers a valuable starting point for strategic analysis, it also has several limitations.

According to Porter (2000), this model helps companies assess the profitability potential of a particular industry but Rumelt (1991) argues that profitability does not depend on overall industry factors; Company-specific factors such as unique endowments, individual competencies, and strategy are more important to business profitability. Porter's model also shows that the five forces apply equally to all firms in an industry but in reality the strengths of these forces can vary from business to business in terms of brand name size or strength (Stonehouse & Snowdon, 2007, p. 258).

The Competitive Profile Matrix is a simple but powerful tool for providing information on the competitive scenario of an industry and helping managers develop the right strategy for the company. Managers need competitive information to understand the industry and its competitors and to identify areas where competitors are weak and to evaluate the impact of strategic actions on competitors (David, 2011). Using this model enables them to outperform competitors by the design and implementation of an effective strategic plan. Academics have to go a long way with this model in this area. They can push this model from a theoretical framework to the practical arena and encourage industrial firms to use it in the competitive analysis of their own firms and their competitors. Students in a variety of scientific disciplines will benefit from a corporate assessment and the competitive environment of their industry.

2.7 Transshipment Model

The transshipment model (Candra, 2013) is an extension of the transportation problem. The transshipment model is a transportation model that allows the delivery of goods (commodities) indirectly, where goods from one source can be at another source or other destination before reaching their final destination, so a source can simultaneously act as a destination and vice versa a destination can also play a role. as a source. This model has the additional feature of allowing delivery to occur between three types of nodes, namely origin or source nodes, transshipment or intermediary nodes, destination nodes. This allows the delivery of commodities from all sources through intermediate nodes before reaching their final destination. In this model, each source or destination is seen as potential points for demand and supply. Therefore, to ensure that each potential point is able to accommodate the total product in addition to the product that already exists at these points, it is necessary to add to the points the quantity of demand and supply of each is large B. The quantity B is usually referred to as a buffer, a sizeable value. Mathematically, the transshipment problem can be modeled as follows:

$$B \geq \sum_{i=1}^{m} ai + \sum_{j=1}^{n} ti \dots\dots\dots\dots\dots\dots\dots\dots . (2.6)$$

Where:

ai = Capacity (supply) of goods at the place of origin i

ti = Request for destination j

2.8 Goal Programming

Goal Programming was first introduced by Charmes and Cooper (Sunarta, 2015), which is a mathematical approach that seeks the optimal value of a set of variables in situations involving conflicting goals (goals). The goal programming model seeks to minimize the deviation between the various objectives or targets that have been determined as targets, meaning that the value of the left side of the constraint equation is as close to the value of the right side as possible.

Ignizio (in Ciptomulyono, 2011) makes a formulation for mathematically conventional optimization with a single objective, linear programming becomes a goal in the goal programming framework by adding a new variable called the negative deviation variable (n) and reducing the positive deviation variable (p) on the linear programming constrain model.

3. RESEARCH METHODOLOGY

3.1 Research Methods

The method used in this research is to use a qualitative approach and a quantitative approach. With a qualitative approach, this research is expected to be able to achieve the achievement of the target function objectives of the border area security operations in the waters of the Natuna Sea which are faced with boundaries / constraints. Meanwhile, through a quantitative approach in this research, it is hoped that the value weight will be obtained in a series of determining the objectives of a border area security operation in the waters of the Natuna Sea.

3.2 Research Flowchart

This chapter describes the stages of research methods arranged in a research flow chart. The research flow diagram is arranged in order to make it easier for researchers to carry out all research activities that will be carried out so that the research process runs systematically, structured and directed. The research methodology consists of the stages of the research process or the steps that the researcher must take in carrying out the research in accordance with Figure 3.1. This study has the following research methodology:

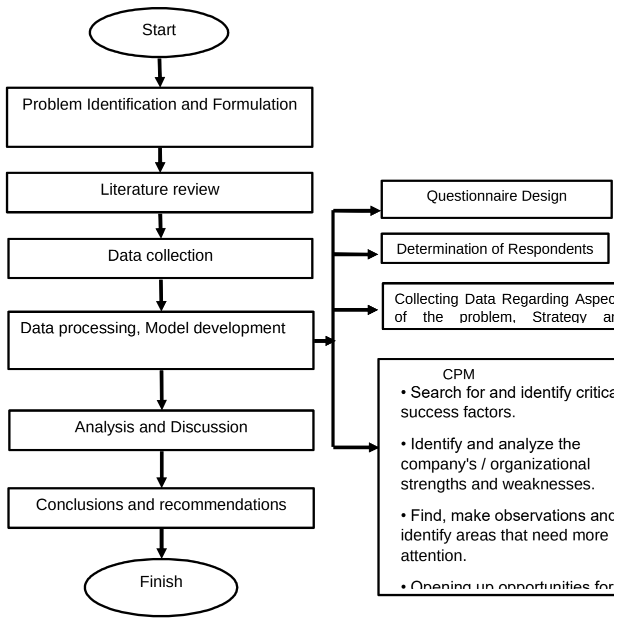

Figure 3. Research Flowchart

4. DISCUSSION

The decision-making model to be developed is the Competitive Prifile Matrix (CPM) model. At this stage, the determination of criteria was carried out preceded by conducting consultations with experts in the operational staff of Koarmada I, related to the implementation of security operations in border areas in the waters of the Natuna Sea. Then consultations were carried out by means of discussions either carried out with an expert or discussion with several experts in the operational field related to the implementation of security operations in border areas in the waters of the Natuna Sea.

The criteria developed are related to the factors that influence the decision to carry out a maritime border security operation that will be considered to support the implementation of border area confinement operations in the Natuna Sea waters. Taking into account the opinions of various sources both from experts and existing literature, this study developed 2 (two) criteria, namely: (1) KRI coverage area, (2) KRI operating costs. KRI Coverage Area Criteria, namely the extent of the area that can be covered by the elements / KRI that are in the area / sector of operation according to their radar capabilities. The sub-criteria are listed in table 1 as follows:

Table 1. Sub Criteria for Coverage Area

Code	Sub criteria	Description
K1	Sewaco capability (Sensor Weapon and Commnad)	Is the KRI capability which includes: sensor capability (radar, sonar), armament capability, against various threats (air, surface, subsurface) in the operations sector
K2	*Endurance* KRI	Is the sailing resistance of each KRI according to the capacity of fuel, fresh water, freshroom, and weather resistance.
K3	KRI speed	Is the time used by KRI to cover a certain distance.

K4	Mileage	Is the distance that can be reached to a stop by KRI with a certain amount of fuel.

Operation Cost Criteria, namely the costs used to support KRI operations. The sub-criteria are listed in table 2 as follows:

Table 2. Sub Criteria for Operating Costs

Code	Sub criteria	Description
K5	Liquid logistics costs	This is the cost of fuel, lubricating oil and fresh water required by KRI.
K6	Personnel logistics costs	These are the cost of meals during surgery, capital costs, tactical costs and prophylactic costs.
K7	Harkapops Fee.	Is the cost of maintaining the ship that carries out the operation

The optimization model in this research is the transshipment model, the goal programming model and the weighted goal programming model. Where the algorithms of the three models are integrated silmutaneously so as to produce an optimal solution related to the operation of securing border areas in the waters of the Natuna Sea. The transshipment model in this research is the KRI which will be assigned to the border area security operations sectors in the Natuna Sea waters, departing from the main base of Koarmada I, Jakarta as the point of origin / source, then moving to aju bases as a transshipment point / intermediary. then occupy to the operating sector as the destination / operating sector.

The goal programming model is used to determine the achievement and deviation from the objective function. While the weghted goal programming model is used to determine the level of importance of the objective function, where the weight value is obtained from the CPM model. Meanwhile, the decision variable in this model is the placement of the KRI from the main base to the Aju base, then the assignment of the KRI to the operations sector. The form of the decision variable (decision variable) is an integer and 0-1 (zero-one). Where:

Kijk = 1, meaning that KRI i is assigned to the initial base j and assigned to the k operation sector

Kijk = 0, meaning that KRI i is not assigned to the initial base j and is not assigned to the k operation sector. The decision variable can be seen in table 3.

Table 3. Variables of KRI Placement and Assignment Decisions

KRI (i)	Initial Base			Operating Sector			
	a	b	c	I	II	III	IV
1	k1,a	k1,b	k1,c	k1a,I	k1,a,II	k1,a,III	k1,a,IV
.							.
.							.
.							.
N	ki,j	.	.	.	.	.	ki,j,k

Matrix description:

- k1, a, I = 1st KRI assigned to base starting a and to sector I operations
- ki, j, k = the i-th KRI is assigned to the j-initial base and to the k-th operation sector

The data needed are primary data and secondary data. Primary data were obtained directly from parties related to border area security operations in Natuna Sea waters by filling out questionnaires and face-to-face interviews. Judgment value of the direct interrelation between criteria or aspects of related parties is used to determine the relationship between criteria. In addition, judgment pairwise comparisons are also needed on the criteria or aspects and alternatives of border security operations in the Natuna Sea. Meanwhile, secondary data is data obtained through literature studies both from documents and reference books related to border security operations in Natuna Sea Waters.

The data that has been collected will be processed using methods that have been studied by researchers, namely the CPM, Transshipment, Goal Programming and Weighted Goal Programming methods. These methods will be used to determine the optimization of border area security operations in the Natuna Sea which will be carried out by Koarmada I. The data processing includes:

a. Calculating the priority weight value of the criteria, Ops Pamwiltas alternatives by means of pairwise comparison based on the CPM method.
b. Assigning KRI by means of the transshipment method.
c. Calculating the achievement and deviation from the target / objective function with the Goal Programming method.
d. Aligning the value of the weighted goal / goal with the achievement of the weighted goal / goal using the Weighted Goal Programming method.

Where the whole algorithm will be processed silmutaneously, together with the help of optimization software Lingo 11, while for weighting on CPM using superdecission software.

After the required data is collected and processed, interpretation and analysis are then carried out on the results of data processing on the model that has been developed. Interpretation is carried out to answer the problems as formulated and their relation to meeting the research objectives.

The next step after the model output is obtained is to carry out data analysis. In this study, there are 2 (two) data analyzes, namely: scenario analysis and sensitivity analysis. The scenario analysis referred to in this study is to make changes or change the decision variables in the model related to the composition of KRI. This aims to determine any changes in the value of the objective function. Meanwhile, the sensitivity analysis in this research is carried out by changing the weight of the criteria, if the weight is changed to the criteria, a different solution will be obtained. Sensitivity analysis is needed to provide an evaluation of the stability of the solution obtained from the model. This analysis is carried out by providing variations in changes in various existing parameters and their effects on changes in the results of the model. In this study, the sensitivity analysis was carried out by changing the weights of the criteria or subcriteria. If we change one of the criteria or sub-criteria weights, especially those that have a large weight or are very influential on the final model solution, then we will get a different model solution. However, if what we change is the weights of the criteria or subcriteria that are of small value, changes to the weights of these criteria do not necessarily result in changes to the resulting best solution. If this can be carried out well, it can be concluded that the model that has been created is working well. In addition to conducting a sensitivity analysis by changing the weight of the criteria, sensitivity analysis can also be carried out by making changes to the composition of the KRI assigned, changes to the number of KRIs assigned and changes to the constraint function. Changes in the constraint function represent changes in existing resources or changes in policies taken in the decision-making process.

5. CONCLUSIONS

5.1 Model Algorithm Results

5.1.1. Results of the CPM Model (Competitive Profile Matrix)

Using the Super Decision software produces the following relative weights:

Figure 4. Super Decision Software Processed Results from the CPM Model.

Table 4. Weight of Sub Criteria and Criteria for Coverage Area

No	Sub Kriteria dari Kriteria *Coverage Area*	Bobot
1	*Endurance* KRI	0,206834
2	Jarak tempuh KRI	0,244417
3	Kecepatan KRI	0,277762
4	Kemampuan Sewaco	0,014213
	Total Bobot *Coverage area*	0,743226

Table 5. Weights of Sub Criteria and Criteria for Operating Costs

No	Sub Kriteria dari Kriteria Biaya operasi	Bobot
1	Biaya harkapops	0,032289
2	Biaya logistik cair	0,200443
3	Biaya logistik personel	0,024042
	Total Bobot Biaya operasi	0,256774

By using Lingo 11 software, optimization results were obtained for the five KRIs in the implementation of security operations in the border areas waters, namely: the deployment of forces (placement and assignment of KRI) including the length of operation, effectiveness of KRI's coverage area in the operating sector, efficiency of KRI's operating costs. These results can be seen in the following table :

Table 6. Variables for Placement and Assignment Decisions of KRI

No	KRI Class (i)	Initial Base			Operating Sector				Operation Time (Daysi)
		I	II	II	P	Q	R	S	
1	A	0	0	1	0	0	0	1	3,2
2	B	1	0	0	0	1	0	0	2,2
3	C	0	1	0	0	0	1	0	1,6
4	D	1	0	0	1	0	0	0	2,7
5	E	1	0	0	1	0	0	0	0,9

Table 7. Coverage Area Effectiveness Results

No	Operational Sector	Type of KRI Assigned	Sector Area (mil²)	Covergae area (mil²)	
				Covered	Uncovered
1	P	D,E	1367	171924	-
2	Q	B	1731	99124	-
3	R	C	2789	71415	-
4	S	A	2042	108450	-

5.2 Model Analysis

Model analasis is performed on the optimization model, consisting of scenarios of analysis and sensitivity analysis.

5.2.1 Analysis Scenarios

First Analysis Scenario In the first analasis scenario, the optimization model is used to model the needs of KRI in the joint marine operations in the waters of Natuna, obtained the following optimization results:

Table 8. Coverage Area Effectiveness Results in First Analysis Scenario

No	Operational Sector	Type of KRI Assigned	Sector Area (mil²)	Covergae area (mil²)	
				Covered	Uncovered
1	P	A2,B1,D1,D2,D3,D4,D5,D6,E3,E4,E5,E6	1367	944030	-
2	Q	B2,E1	1731	171560	-
3	R	E2	2789	69341	-
4	S	A1,	2042	108450	-
	Total		7929	1293381	

Second Analysis Scenario In the second analasis scenario, the optimization model is used to model kri's needs as a veil element for one Marine BTP, obtained by optimization as follows:

Table 9. Coverage Area Effectiveness Results in The Second Analysis Scenario

No	Operational Sector	Type of KRI Assigned	Sector Area (mil²)	Covergae area (mil²)	
				Covered	Uncovered
1	Q	A2,A3,B1,B2,B3,C1,C2,D1,D2	1731	171560	-
2	R	A1	2789	69341	-
	Total		7929	1293381.	

5.3 Conclusion

From a series of data processing and analysis carried out in this research / thesis, the following conclusions can be drawn:

a. Optimization of border area security operations in the waters of the Natuna Sea can be modeled with a combination of the Competitive Profile Matrix (CPM), Transshipment, Goal Programming and Weighted Goal Programming methods to produce a compromise solution in implementing operations to secure maritime border areas in the Natuna Sea waters.

b. The decision-making method in the form of the Competitive Profile Matrix (CPM) model produces the relative weight of the objective function of the border area security operation in the Natuna Sea, namely maximizing the coverage area and minimizing operating costs.

c. The optimization method is in the form of the Transshipment model, the Goal Programming model and the Weighted Goal Programming model, where the three models are run silmutaneously, together using the Lingo 11 software produces an optimization solution in the form of a decision variable in the form of a zero-one matrix assigning 5 (five) KRIs from main base to base aju and to the operating sector, length of operation in the operating sector, achievement or deviation from the objective function in the border area security operation in the Natuna Sea waters. Where it is obtained the average coverage area achieved is 450,913 miles, which means it has exceeded the target coverage area of the operating sector area of 7929 miles2, and the average operating cost efficiency is 40% of the set budget.

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