THE DETERMINATION OF THE ARSENAL LOCATION IN AN EFFORT TO INCREASE THE CARRYING CAPACITY OF THE SEA FORCES IN CRITICAL AREAS OF THE NORTH NATUNA SEA

Kornia Adhi[1], Budisantoso[2], I Made Jiwa[3],Atiq Alfiansyah[4]
[1,3] Indonesian Naval Technology College, [2] Sepuluh Nopember Institute of Technology,
Bumimoro-Morokrembangan, Surabaya 60187, Indonesia
adhinepus @yahoo.co.id

ABSTRACT

The dynamics of the strategic environment in the North Natuna Sea area raises potential threat spots to the territory of the Republic of Indonesia where the Indonesian Navy needs to determine a marine security strategy where one of the things that must be prepared is the distribution of logistics in the form of musicians and weapons through the construction of the Arsenal warehouse. Through this research, an alternative strategic location as an Arsenal warehouse was determined as a storage place for ammunition supplies used to support KRI in carrying out operational tasks. Alternative locations for the construction of Arsenal are Lanal Bintan, Lanal Ranai Lanal Bangka Belitung and Lantamal IV Pontianak. Based on Perkasal No. 17 of 2008, the criteria used and are absolute requirements in determining the location are security, transportation access and supporting facilities. The data collection of this research was carried out using the questionnaire distribution method and conducting interviews with *experts*. The Delphi method is used in this research to determine and agree on relevant and valid criteria and sub-criteria to be researched to the next stage. Furthermore, the *Analytic Network Process* (ANP) method is used to determine the best alternative by processingdata using *Super Decision Software*. The results of this study were obtained The priority of the alternative location of the Arsenal warehouse is Lanal Bintan with a weight value of 0.536308.

***Keywords*:** Arsenal, Arsenal location selection, Delphi, ANP *(Process Analytics Network).*

1.   Introduction.

The development of strategic environmental issues in the North Natuna Sea has raised potential threats to the territory of the Republic of Indonesia where the government needs to determine a national marine security strategy. One of the strategies is through the role of weapons and ammunition logistics support from Arsenal (arsenal and ammunition) in meeting the operational needs of KRI. Arsenal is a technical implementing element (UPT) of the Dissenlekal which is in charge of carrying out material support for weapons, ammunition and special weapons to all elements/units using the Indonesian Navy. (Kep Kasal number kep/31/VII/1997, 1997).

Currently, there is only one main Arsenal warehouse located in Lanal Batuporon Mako Koarmada II Surabaya. This is considered very ineffective in the event of a national conflict, especially in the critical area of the North Natuna Sea where the threat position is very far from Arsenal's main warehouse. This disadvantageous position is very vulnerable to threats if a conflict occurs, with one main *warehouse* it will be very easy to destroy and paralyze logistics lines, especially in ammunition.

In responding to these problems, it is necessary to add an Arsenal Warehouse in the northern Natuna Sea area (Theodora C. T., I W. G. Gunawan, 2019). If considered in light of the current threat, the placement of the Arsenal Warehouse location must be considered based on a critical area in the waters of the North Natuna Sea to facilitate the distribution of ammunition in anticipation of conflict. The addition of this location is expected to be able to overcome the problems that are currently occurring at Arsenal where the storage location will be wider and able to accommodate a larger amount of ammunition. Distribution time and *Loading* ammunition and missiles will also be shorter and faster and be able to accommodate many ships that will carry out *Loading* ammunition and missiles at the same time. In addition, the addition of this location is expected to be able to support the need for KRI ammunition and missiles in carrying out sea operations in an effort to anticipate the possibility of threats to critical areas in the future.

2. Methodology

2.1 Theoretical Basis

Ammunition is one part of the class V supply of the TNI Navy weapon system, so it needs to be prepared as optimally as possible in order to achieve a timely level of speed in the provision of class V supplies and operational effectiveness (Sudaryanto et al., 2020).

Location theory is a science that investigates the spatial layout of economic activities, or a science that investigates the geographical allocation of potential sources, as well as their relationship with or influence on the existence of various other kinds of businesses/activities, both economic and social. (Tarigan & Van De Geer, 2006).

2.2 Multi Criteria Decision Making (MCDM)

In daily life, humans are often faced with various problems and challenges. One of the challenges that is commonly faced is how to make the right decision in the midst of many options (alternatives) and criteria (attributes) that must be considered (Muanley et al., 2022). Humans are always looking for the best way or solution to solve this problem, and as a result, various methods and solutions have been developed. One of the methods that is often used to overcome this decision-making challenge is the Decision-Making Method with Multiple Criteria *(Multiple Criteria Decision Making -* MCDM) (Purnomo et al., 2020)*.* This method helps humans to detail and understand in various factors that need to be considered when facing complex decisions. With MCDM, we can conduct a better and more informed analysis to choose the alternative that best suits our goals and needs (Ardielli, 2020).

2.3 Delphi Method

The Delphi method is by definition defined as a decision-making process in a group that involves interaction between researchers and a group of experts related to a certain

topic, which is usually carried out through the help of questionnaires. According to Scheele (1975), it describes the Delphi process with six stages as follows:

1) Identify the members of the group whose consensus is needed. The composition in the group must be able to represent various points of view proportionally.

2) The first questionnaire was conducted to ask each member to write down goals, considerations, or issues related to the expected consensus goals. Furthermore, the information that has been obtained is compiled so that it is easy to understand between group members. Next, prepare a second questionnaire with a more structured format so that assessments can be carried out.

3) In the second case, each group member is asked to give an assessment of the results of the information preparation in the first step.

4) Furthermore, the third questionnaire will show the results of the second questionnaire in the third questionnaire, including the consensus results of each section, and which parts are different from the group. In the third questionnaire, each panelist gave reasons and a brief explanation of their opinions.

5) In the fourth questionnaire, the results of the third questionnaire were displayed in the fourth questionnaire, including changes from the first consensus result, and each panelist was asked to give a third assessment and ranking which was the final assessment stage, as well as give reasons for deciding to be in a different position from the group.

6) The results of the fourth questionnaire were tabulated and presented as the results of the group consensus.

2.4 *Process Analytics Network (ANP)*

The *Analytic Network Process* (ANP) method is a development of the *Analytical Hierarchy Process* (AHP) method. The ANP method is able to correct structural differences in AHP in the form of the ability to accommodate the relationship between criteria or alternatives. There are two types of linkages in the ANP method, namely the linkage in a set of elements (*inner dependence*) and the linkage between different elements (*outerdependence*). The existence of this association makes the ANP method more complex than the AHP method (Saaty, 1998)

The *Analytic Network Process* (ANP) method in the decision-making process has stages or steps in making ANP. The following are the steps to make an ANP according to Saaty (1999):

a. Step One: Model construction and problem structuring. The construction of the model is made based on the existing problem, so it is necessary to clearly describe the problem, and form it into a network.

b.   Step Two: A paired comparison matrix showing the linkages. The pairwise comparison of ANP was carried out by comparing the level of importance of each element to its control criteria.

c.   Step Three: Calculate the weight of the element (Eigenvector Value). After the paired comparison matrix is carried out, the eigenvalue of the matrix is then determined. The eigenvector calculation is by summing the values of each column from the matrix then dividing each column cell value by the total column and summing the values from each row and dividing by n.

e.   Step Four: Calculate the Consistency Ratio. After getting the eigen, then check the consistency ratio, the consistency ratio is a ratio that states whether the assessment given by the experts is consistent or not.

f.   Fifth Step: Super matrix formation. A super matrix is a matrix consisting of sub-sub-matrices that are composed of a set of relationships between two levels contained in the model.

After obtaining the value of each element in the limit matrix, the next step is to perform a calculation on the value of these elements according to the ANP model created. The alternative with the highest global priority is the best alternative.

2.5   Methodology

This research uses a qualitative approach where in its implementation the data is taken from the measurement results and based on existing variables. The source of data from this study is sourced from primary data of all relevant officials who are still serving in the Arsenal Environment. Secondary data from this study is sourced from data that has been obtained or has been previously collected by other researchers from literature, articles, journals and sites on the internet related to the research being conducted.

The research began with the method used, the Delphi method as a tool to identify research criteria. The next step is to do weighting and ranking using the ANP method.

The subject of the study refers to an individual or group of people who are actively involved in the research, acting as a resource person, and providing data. The subject of the research is an agency or organization that is directly involved in the research. The objects in this study are KRI, Arsenal, and the Indonesian Navy Base in the area around the North Natuna Sea.

3.   Results and Discussion

3.1   Identify Criteria

Table 4. 1 Table of Sub-Criteria

CRITERION	SUB-CRITERIA	REFERENCE
Security	Amana from enemy attacks	Kep Kasal No.17 of 2008

CRITERION	SUB-CRITERIA	REFERENCE
	Safe from border conflicts	Kep Kasal No.17 of 2008
	Safe from social conflicts	Kep Kasal No.17 of 2008
	Safe from natural disasters	Kep Kasal No.17 of 2008
	Safe from Illegal Activities	Interview, Turgut, et all, 2011
	Safe From Shipping Accidents	Interview, Turgut, et all, 2011
	Safe from the shipping lane	Interview, Turgut, et all, 2011
Transportation Access	Military Port Available	Kep Kasal No.17 of 2008
	Public Port Available	Kep Kasal No.17 of 2008
	Public Airports Available	Kep Kasal No.17 of 2008
	Pilot/Guide Available	Interview, Turgut, et all, 2011
	Public Transportation Available	Interview, Turgut, et all, 2011
	Tugboat Available	Interview, Turgut, et all, 2011
Supporting Facilities	Communication facilities available	Kep Kasal No.17 of 2008
	Electrical Facilities Available	Kep Kasal No.17 of 2008
	Water facilities available	Kep Kasal No.17 of 2008
	Transportation facilities available	Kep Kasal No.17 of 2008
	Available Fasharkan	Kep Kasal No.17 of 2008
	Heavy Equipment Available	Interview, Turgut, et all, 2011
	Public Workshop Available	Interview, Turgut, et all, 2011
	Shipyard Available	Interview, Turgut, et all, 2011
	Available Land	Interview, Turgut, et all, 2011

(Source: Author data processing)

In the last round of surveys, the opinions of the Experts led to compromised answers, showing that there was an *Accept for* several criteria. The average value obtained from the responses of these experts is extracted from the data. The results of this survey formulate the best 12 criteria out of 22 criteria based on the respondents' views/preferences. The statistical analysis of the implementation of this methodology as well as the opinion of the weights of importance for each criterion can be illustrated in the results of the Delphi method analysis conducted on the coesioner in Table 4.3 as follows:

Table 4. 2 Results of Data Processing of the 3-Stage Delphi Method

No	Dimension	Item	Round 1			Round 2			Round 3		
			Mean	CVI	Result	Mean	CVI	Result	Mean	CVI	Result
1	Keamanan	Aman Dari Serangan Musuh	4,14	0,86	Acceptep	15,10	1,00	Acceptep	4,14	0,86	Acceptep
2		Aman Dari Konflik Perbatasan	3,86	0,86	Acceptep	13,52	1,00	Acceptep	4,00	1,00	Acceptep
3		Aman Dari Konflik Sosial	4,43	0,86	Acceptep	14,98	1,00	Acceptep	4,43	0,86	Acceptep
4		Aman Dari Bencana	4,71	1,00	Acceptep	16,05	1,00	Acceptep	4,71	1,00	Acceptep
5		Aman Dari Kegiatan Ilegal	3,14	0,43	Rejected						
6		Aman Dari kecelakaan Pelayaran	4,29	0,86	Acceptep	3,14	0,57	Rejected			
7		Aman Dari Alur Pelayaran	3,14	0,57	Rejected						
8	Akses Transportasi	Tersedia Pelabuhan Militer	3,86	0,86	Acceptep	4,14	1,00	Acceptep	4,00	1,00	Acceptep
9		Tersedia Pelabuhan Umum	4,43	1,00	Acceptep	4,43	1,00	Acceptep	4,43	1,00	Acceptep
10		Tersedia Bandara Udara	4,43	0,86	Acceptep	4,43	1,00	Acceptep	4,43	1,00	Acceptep
11		Tersedia Pandu/Pilot	2,86	0,29	Rejected						
12		Tersedia Transportasi Umum	3,86	0,86	Acceptep	3,00	0,43	Rejected			
13		Tersedia Kapal Tunda	4,29	0,86	Acceptep	3,14	0,43	Rejected			
14	Sarana Pendukung	Tersedia Fasilitas Komunikasi	4,43	1,00	Acceptep	4,43	1,00	Acceptep	4,43	1,000	Acceptep
15		Tersedia Fasilitas Listrik	4,43	1,00	Acceptep	4,43	1,00	Acceptep	4,43	1,000	Acceptep
16		Tersedia Fasilitas Air	4,29	1,00	Acceptep	4,29	1,00	Acceptep	4,29	1,000	Acceptep
17		Tersedia Fasilitas Angkutan	4,29	1,00	Acceptep	4,29	1,00	Acceptep	4,29	1,000	Acceptep
18		Tersedia Fasharkan	4,57	1,00	Acceptep	4,57	1,00	Acceptep	4,57	1,000	Acceptep
19		Tersedia Alat Berat	4,00	0,86	Acceptep	3,14	0,43	Rejected			
20		Tersedia Bengkel Umum	3,14	0,57	Rejected						
21		Tersedia Galangan	4,14	0,86	Acceptep	3,14	0,57	Rejected			
22		Tersedia Lahan	3,00	0,43	Rejected						

(Source: Author data processing)

Table 4.3 above shows the criteria for the results of data analysis processing using the Delphi method from the Criteria for Perception of Security, Access to Transportation and Supporting Facilities. 12 (eight) criteria were obtained that are feasible to be developed in the next research analysis. The twelve sub-criteria are as follows:

a. Safe from enemy attacks
b. Safe from border conflicts
c. Safe from Social Conflict
d. Safe from disasters
e. Military Port Available
f. Public Port Available
g. Public Airport Available
h. Communication Facilities Available
i. Electrical Facilities Available
j. Water Facilities Available
k. Transportation Facilities Available
l. Available Fasharkan

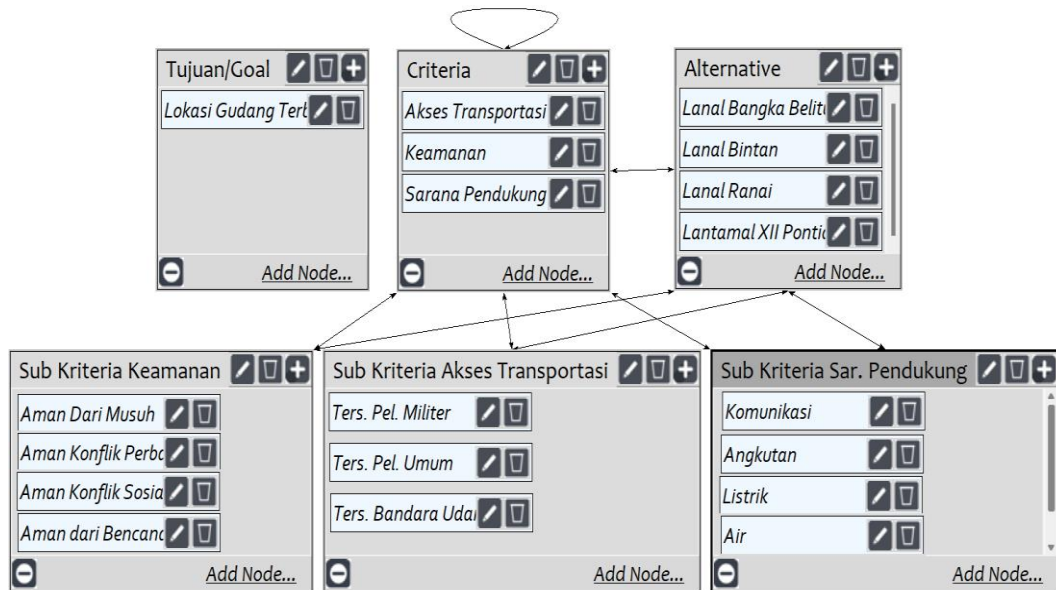## 3.2 Process Analytics Network (ANP) Relationship Structure.

Figure 4. 1 ANP Model in *Softwere Super Decisions*

The author has carried out a model validation through expert validation carried out by experts in their fields, in this case the officials of the Batuporon Arsenal and the Headquarters Base Facilities Service in this case are represented by the Head of the Planning Section who is competent in the study of Arsenal Warehouse Standardization.

3.3 Geomatrix Mean Calculation

After the results of the questionnaire test from each *expert* are tested for consistency, then the results of filling in are worthy of being unified through the geometric average of each of these questions.

Table 4. 3 Results of Comparison of Values Between Criteria and Geomaen Values

No.	Security - Alternatives	E1	E2	E3	E4	E5	E6	E7	Geomaen
1	Lanal Bangka - Lanal Bintan	3	3	2	3	3	4	4	3
2	Lanal Bangka - Lanal Ranai	2	3	4	3	5	4	3	3
3	Lanal Bangka - Pontianak	3	3	2	2	3	2	2	2
4	Lanal Bintan - Ranai	3	4	3	3	4	3	4	3
5	Lanal Bintan - Pontianak	2	4	3	3	5	4	4	3
6	Lanal Ranai - Pontianak	5	5	5	3	4	4	3	4

3.4 Pairwise Comparation Value between Criteria and Sub-criteria

The *Pairwise comparison score* for each category was obtained from a questionnaire of experts in determining the Arsenal Warehouse. After obtaining one *pairwise comparison value* for each relationship, the local priority weight calculation is carried out. The local priority weighting that must be considered is that the value of

inconsistency cannot exceed the value of 0.1 The ANP questionnaire is processed using *super decision software version 3.2.0.* The output of the final calculation is in the form of the priority weight value of each alternative, as seen in Figure 4.6.

Figure 4. 2 Comparison of Security criteria with Alternatives
(Source: data processed with Super Decision)

From the comparison table of pairing between criteria and Alternatives in the Security criterion, the *inconsistency index* is 0.09088. Where the value is still below 10% or 0.1 which means that this shows that from all the answers given to the respondents in this research questionnaire are consistent.

Table 4. 4 The results of normalization weighting using *Software Super Decision*
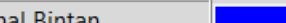

Inconsistency: 0.09088	
Lanal Ban~	0.17038
Lanal Bin~	0.48056
Lanal Ran~	0.08711
Lantamal ~	0.26194

3.5   Alternative Priority Determination of Arsenal Warehouse Location

After obtaining the results of the priority weights of the criteria, then from the results of processing the data in the form of questionnaires, as well as checking *the inconsistency* index of all criteria and subcriteria on the local priority weights, the software will work on all stages of the ANP method by running *Synthesize*, then it will obtain the criteria weights as exemplified in figure 4.9 below.

Table 4. 5 Alternative Weights

Name	Graphic	Ideals	Normals	Raw
Lanal Bangka Belitung		0.287890	0.154398	0.064794
Lanal Bintan		1.000000	0.536308	0.225064
Lanal Ranai		0.245919	0.131888	0.055347
Lantamal XII Pontianak		0.330789	0.177405	0.074449

After the results of the geometric average value are input or fully entered into the matrix format in the *Super Decision software*, and check the *inconsistency index* of all criteria and all sub-criteria on the local priority weights, the software will automatically perform or do data processing for all stages in the ANP method process, then the weight values from all criteria can be obtained by running *Computations*, as exemplified in table 4.7 below.

Table 4. 6 Criterion Weight Value on Alternative

	Transportation Access	Security	Supporting Facilities
Lanal Bangka Belitung	0,094248	0,110880	0,088213
Lanal Bintan	0,301525	0,312739	0,387505
Lanal Ranai	0,049930	0,056689	0,229600
Lantamal XII Pontianak	0,164622	0,170466	0,044500

From Table 4.8, the order of alternative priority is obtained based on the amount of weight value of each alternative as follows:

a.   Priority 1 is an alternative to Lanal Bintan with a weight value of 0.536308.
b.   Priority 2 is an alternative to Lantamal XII Pontianak with a weight value of 0.177405.
c.Priority 3 is an alternative to Lanal Bangka Belitung with a weight value of 0.154398.
d.   Priority 4 is the Lanal Ranai alternative with a weight value of 0.131888.

4.   Conclusion

From the results of data collection and processing, as well as the analysis and interpretation of the data processing results that have been carried out, the conclusions that can be drawn in this final project are:

a.   The main criteria that are considered in determining the Arsenal Warehouse alternative are the Security criterion with a weight value of 0.43917,

then the second priority is the Transportation Access criterion with a weight value of 0.28482 and the third priority is the Supporting Facilities Criterion with a weight value of 0.27601.

b.   The chosen alternative in determining the location of the Arsenal Warehouse from this article is Lanal Bintan with a weight of 0.536308. The bintan lanal is located in Bintan Regency within the working area of Lantamal IV Batam. Meanwhile, the second to fourth alternatives in a row are Lantamal XII Pontianak (weight 0177405), Lanal Bangka Belitung (weight 0.154398) and Lanal Ranai (weight 0.131888).

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