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MODEL SELECTION OF KRI CHANGE OF DEVELOPMENT TO SUPPORT THE MAIN TASKS OF THIRD FLEET USING THE MCDM INTEGRATION METHOD

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ABSTRACT

Third Fleet is the Main Command of the Indonesian Navy as Operation City which is tasked with carrying out defense and security operations of the maritime dimension by securing the territorial waters of eastern Indonesia. The operation in these waters is faced with the vulnerability of frequent violations, geological conditions consisting of thousands of islands and shallow straits, extreme weather and also with limited state defense budget conditions. Therefore, it is very necessary to have a KRI that is right and ready to face these challenges and obstacles so that the goals of the organization can be achieved. The purpose of this study was to analyze the criteria and determine the type of KRI needed in accordance with the conditions in Third Fleet. This study uses an integration between the Delphi method and the AHP method. The results of this study are expected to be input and consideration for the leadership of the Indonesian Navy. The next 299 are fast boats with a weight value of 0.149 then Amfibious ships with a weight value of 0.154 then Bantu ships with a weight value of 0.131 then Mine ships with a weight value of 0.119 and Submarines with a value of 0.114. The results of this study are expected to be input and consideration for the leadership of the Indonesian Navy.

Keywords: Third Fleet, Delphi, AHP

1. INTRODUCTION

In accordance with the mandate of the Republic of Indonesia Law Number 34 of 2004 concerning the TNI, the Navy has the task of carrying out the duties of the Navy in the defense sector, upholding law and maintaining security in the marine area of national jurisdiction in accordance with the provisions of national law and international law that have been ratified carry out the diplomatic duties of the Navy in order to support the foreign policy stipulated by the government, carry out TNI duties in the development and development of the strength of the marine dimension, and carry out the empowerment of the marine defense area. In carrying out the duties of the TNI-AL, it is supported by the existence of an organization which includes: the leadership element, the leadership assistant element, the service element, the central executing agency, Kotama Bin.

Third Fleet is the main Guidance and Operations Command, which is directly under the Chief of Staff in the field of training and combat readiness of his unit command and is directly under the TNI Commander in the field of operations. Third Fleet has the main task of fostering the capabilities of the elements of the Fleet's forces, fostering maritime potentials to become a state defense and security force at sea, carrying out daily marine operations and sea combat operations for sea control and projection of power to land by sea in the context of enforcing sovereignty and law. at sea. In terms of geographical conditions and marine resources, the working area of Third Fleet is a vast area of water with a variety of abundant wealth. The condition of the area has resulted in vulnerabilities that can threaten Indonesia's security and sovereignty, including: Illegal, Unreported and Unregulated (IUU) Fishing, illegal surveys by foreigners which are packaged in the form of marine tourism activities, drug smuggling, firearm smuggling, marine pollution and Illegal use of ALKI rights of passage by civilian ships and military ships of foreign countries as well as other illegal activities. Therefore, sea operations are needed for sea control and power projection to land by sea in the context of enforcing sovereignty and law at sea.

In carrying out marine operations involving various Main Weapon System Tools (Alutsista) which are components of the Integrated Fleet Weapon System (SSAT) which consists of Ships of the Republic of Indonesia (KRI), Aircraft, Marines and Bases as supporters. So that the KRI as one of the components of SSAT is the foremost defense force to protect the maritime territory of the

Unitary State of the Republic of Indonesia. The KRI elements in the Indonesian Navy are grouped into 7 ship units, namely Satkor (Excorta ship unit), Satsel (submarine unit), Satfib (amphibious ship unit), Satkat (fast boat unit), Satran (mine ship unit), Satrol (unit patrol boat) and Satban (auxiliary ship unit). Therefore, it is necessary to choose the type and class of KRI in accordance with the existing conditions in Third Fleet, which is adapted to geographical conditions,

In carrying out the analysis of the selection of types and classes of KRI requires analysis of information and identification of various criteria. So that in this study the approach method used is the Delphi method to determine the criteria. The Multi Criteria Decision Making (MCDM) method integrates the Analityc Hierarchy Process (AHP) method, BORDA and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method to determine the criteria weights and determine alternative priorities.

2. MATERIALS AND METHODS

2.1 Delphi method

The Delphi method is a process carried out in groups to survey and collect opinions from experts on a particular topic. This method is useful for structuring the group communication process so that the process will run effectively, so that the group can solve problems. This method is used when expert opinion and judgment is required but other factors such as time or distance make it difficult for panel experts to sit down together.

In the process, this method involves the interaction between the researcher and a group of experts related to a particular topic, usually through the help of a questionnaire. This method is used to gain consensus on future projections using a systematic information gathering process. This method is useful when the opinions and judgments of experts and practitioners are needed in solving problems. The three main steps in this process are:

a. The first questionnaire was sent to the expert panelists to ask some of their opinions (from experience or just their judgment), some predictions and also their recommendations.

b. In the second round, a summary of the results of the first questionnaire was sent to each expert panelist to be able to re-evaluate their first assessment on the questionnaire using defined criteria.

c. In the third round, the questionnaire was returned with information regarding the panelists' assessment results and consensus results. The panelists were asked again to revise their opinion or explain the reasons for disagreeing with the group consensus.

Withdrawing opinions and measuring consensus and convergence are carried out using statistical analysis with the following approach:

a. Standard Deviation

The first measure of convergence or consensus assessment is when the answers or assessments of all informants have a standard deviation of <1.5. The Standard Deviation formula is as follows:

$$s = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}} \text{ atau } \sqrt{\frac{\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}}{n-1}}$$

Where:

x = response response A to the criteria / subcriteria n

$\bar{x}$ = average respondent's answer to the criteria / sub-criteria n

b. Interquartile Range

The second measure of convergence or consensus assessment is when the answers or assessments of all informants have an Interquartile Range <2.5. The interquartile range formula is:

IR = Q3 - Q1.

Where Q3 is the Upper Quartile and Q1 is the Lower Quartile. The above quartile formula is:

$$Q_1 = \frac{x_{\left(\frac{n-1}{4}\right)} + x_{\left(\frac{n+3}{4}\right)}}{2}$$

$$Q_2 = x_{\left(\frac{2(n+1)}{4}\right)}$$

$$Q_3 = \frac{x_{\left(\frac{3n+1}{4}\right)} + x_{\left(\frac{3n+5}{4}\right)}}{2}$$

Evaluation to express convergence or consensus on all criteria / subcriteria is, when the standard deviation <1.5 and the interquartile range <2.5. If either the standard deviation or the interquartile range is not <1.5 and <2.5, then the criteria / subcriteria are declared non-convergent or not agreed (consensus).

2.2 Analytic Hierarchy Process (AHP)

Thomas L Saaty developed Analytic Hierarchy Process (AHP) theory in 1970. AHP is an MCDM method as a structured technique to help people determine the priority of several

criteria by making pairwise comparisons of each criterion. Unlike other MCDM methods, AHP is a decision support system that decomposes a complex multi-factor problem into a hierarchy, where each level is formed from specific elements that are not related to each other. The main tool of AHP is a functional hierarchy with the main input being human perception. The existence of a hierarchy makes it possible to break down complex or unstructured problems into sub-problems, then arrange them into a hierarchical form. Three basic principles of the AHP process: (Saaty,1993).

a. Describing and describing a hierarchy is called arranging hierarchically, which is breaking down the problem into separate elements.

b. Differentiation of priorities and sitensis, the so-called priority setting, namely determining the level of an element according to its relative importance.

c. Logical Consistency, which ensures that all elements are grouped logically and ranked consistently according to a logical criterion.

2.2.1 Pairwise Comparison

Pairwise comparison based on the "judgment" of the decision maker by assessing the importance of an element compared to other elements. This comparison value is determined by the quantitative scale proposed by Saaty (1994). This scale starts from 1 to 9. Comparisons are made until a total judgment is obtained of nx [(n-1) / 2], where n is the number of elements being compared.

Table 1. Pairwise Comparison Scale

Intensity of Importance	Definition
1	Equally important
2	Between equally and moderately important
3	Moderately important
4	Between moderately and strongly important
5	Strongly important
6	Between strongly and very strongly important
7	Very strongly important
8	Between very strongly and extremely important
9	Extremely important

2.2.2 Consistency Ratio (CR)

Consistency deviation is expressed by the equation:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

where,

CI = Consistency Index

λmaks = the largest eigenvalues

AHP measures the entire consistency of the assessment using the Consistency Ratio (CR), which is formulated as follows:

$$CR = \frac{CI}{Random\ Consistency\ index}$$

Random Consistency Index this is abbreviated as RI, which is a certain level of consistency that is needed in determining priorities for achieving results legitimate. The CR value should be no more than 10%. If not, the judgments that have been made may be random and need revision.

Table 2. Random Consistency Index (RI)

n	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*

RI	*0.00*	*0.00*	*0.58*	*0.90*	*1.12*	*1.24*	*1.32*	*1.41*	*1.45*	*1.49*	*1.51*	*1.48*	*1.56*	*1.57*	*1.59*

3. RESULT AND DISCUSSION

3.1 Identification of Criteria and Subcriteria

This stage is carried out by means of brainstorming / interviews with the speakers. The resource persons consisted of experts from 1) Operations Staff; 2) Planning Staff and 3) Logistics Staff. The result of this stage is the identification of the initial criteria and sub-criteria in determining the KRI transfer of guidance to support the main tasks of Third Fleet, which are as follows:

a. Sea Operations.is a series of operational activities carried out by the Indonesian Navy units independently or jointly within a certain time tied to goals and plans to achieve strategic and tactical objectives.

Table 3. Sub-Criteria for Sea Operations

No.	Subcriteria	Description
1.	Opsgab Standby Purla	Marine combat alert operations carried out in the waters of the national jurisdiction of the Koarmada work area by presenting elements of the KRI and Pesud in order to anticipate any form of threat to sovereignty in the region national jurisdiction.
2.	Opsgab Pamtas	Operation securing the borders of the sea and air territories directly bordering with neighboring countries to free and defend against any attempts by foreign parties to carry out violations of sovereignty and law in Indonesia's maritime border areas with neighboring countries.
3.	Opsgab Pam ALKI	Regional security operations in the Indonesian Archipelago Shipping Lanes in the context of upholding state sovereignty and implementing regulations at ALKI in the sea and air area
4.	Patkor Ausindo	It is an OMSP with the aim of securing the border area to guarantee the upholding of state sovereignty in the maritime border area with other countries and the outer islands and remote islands from all forms of threats and violations, preventing the exploitation of natural resources and territorial violation by foreign parties in the territory sea border. In its implementation, it can be carried out in a coordinated manner with the Navy of neighboring countries in the form of coordinated patrols.

b. **Practice.** Is an activity that is repeated systematically in practice to acquire maximum proficiency and skills.

Table 4. Sub-Criteria for Exercise

No.	Subcriteria	Description
1.	Lat Matra	Implementation of training carried out by the Navy which includes inter-city, unit, Navy Balakpus or special training in the marine environment in order to improve and / or maintain readiness operational.
2.	Lat Together	Joint Training (Latma) of the Indonesian Navy is a form of collaborative training carried out by involving the Indonesian Navy together with one or more forces. sea of another country.
3.	Combined Lat	The TNI Joint Training (Latgab) is an exercise in the context of combat operations assisted by other operations as needed, is part of a defense operation pattern which is carried out pre-emptively, preventively or repressively by two or more forces in under a joint command.

c. **Base support**. Ability base to carry out its function in providing optimal support for the smooth operation of other SSAT components, whether ships, aircraft or Marines. The form of support referred to is in the form of both sea and air anchoring facilities, maintenance and repair facilities, provisioning facilities, personnel maintenance facilities and base development facilities.

Table 5. Sub-Criteria for Base Support

No.	Subcriteria	Description
1.	Labuh Fas	Base ability to deliver the dock to lean on the KRI
2.	Fas Harkan	Base capability to carry out maintenance and repair sewaco nor the platform
3.	Supply phase	Base capability to give support for class I to class X supplies to the type KRI

4.	Maintenance phase Personnel	The ability of the base to support personnel maintenance activities, including: mess facilities, health facilities / rumkit, sports and recreation facilities, worship facilities, training facilities for all types of KRI at least one cluster Duty
5.	Development phase Base	Base ability to deliver fasum, fasjasang and fashanlan

d. Special. Relates to special matters.

Table 6. Special Subcriteria

No.	Subcriteria	Description
1.	Detterence effect	The deterrence effect value for the current KRI presence carry out sea operations
2.	Geographical	This criterion relates to ability KRI connecting with condition geographic sea territory of Third Fleet.

3.2 Alternative Types of Warships

Alternative selection of the types of warships used in this study are the types of warships currently owned by Koarmada II, namely:

a. Combat Ships.
b. Amphibious Ship.
c. Fast ship.
d. Auxiliary Ship.
e. Mine Ship.
f. Submarine.

3.3 Determination of Criteria and Sub-criteria

Determination of criteria and sub-criteria that affect the selection of warships is carried out using the Delphi method. This study involved three experts. Obtaining expert consensus on the criteria and sub-criteria in this study was carried out in two rounds. Because the results of the 2nd round Delphi questionnaire are not much different from the results of the 1st round Delphi questionnaire because the experts tend not to change their assessments. In Table 7, the results of the assessment of the level of importance of the criteria and sub criteria in the second round are presented.

Table 7. Results of the 2nd round Delphi questionnaire

No.	Criteria	Sub Criteria	Expert				Avg.	Std. Dev	Mode	Q1	Q2	Q3	IR	Evaulation	
			I	II	III	IV								Std.Dev	IR
1	Operation Duty	Marine combat operations	5	5	4	3	4.25	0.957	5	3.8	4.5	5	1.25	Kon	Kon
		Limited Security Operations	4	5	5	3	4.25	0.957	5	3.8	4.5	5	1.25	Kon	Kon
		ALKI security operations	5	5	5	2	4.25	1.5	5	4.3	5	5	0.75	Kon	Kon
		Ausindo coordinating patrols	5	5	5	3	4.5	1	5	4.5	5	5	0.5	Kon	Kon
2	practice	Matra Exercise	5	5	5	4	4.75	0.5	5	4.8	5	5	0.25	Kon	Kon
		Bilateral Exercise	5	5	4	4	4.5	0.577	5	4	4.5	5	1	Kon	Kon

		Bilateral Exercise	5	5	5	4	4.75	0.5	5	4.8	5	5	0.25	Kon	Kon
3	Base Support	Berthing facilities	5	5	4	5	4.75	0.5	5	4.8	5	5	0.25	Kon	Kon
		Repairing facilities	5	5	5	5	5	0	5	5	5	5	0	Kon	Kon
		Provisioning Facilities	5	5	5	5	5	0	5	5	5	5	0	Kon	Kon
		Care personnel facilities	2	1	2	5	2.5	1,732	2	1.8	2	2.75	1	**Div**	Kon
		Base Developme nt	2	2	0	5	2.25	2,061	2	1.5	2	2.75	1.25	**Div**	Kon
4	Special	Deterence Effect	5	4	5	4	4.5	0.577	5	4	4.5	5	1	Kon	Kon
		Geography	5	5	5	3	4.5	1	5	4.5	5	5	0.5	Kon	Kon

Based on table 3.5 above, it can be seen that there are 4 consensus criteria and 12 sub-criteria. Only 2 sub-criteria were not consensus, namely Personnel care facilities and Base Development sub-criteria. Because the 2 sub-criteria have a standard deviation value> 1.5. So that the result of the second round of opinion withdrawal, which results from the evaulation of standard deviation and quartile coverage, is that the consensus will be used as the basis for building the AHP hierarchical structure in determining the type of warship.

3.4 Weight Assessment of Criteria and Subcriteria

3.4.1 Hierarchy Structure

The process of preparing a hierarchical structure is an important first step in the application of decision making through AHP. The hierarchical structure obtained is a structuring of the problem into the form of elements arranged hierarchically. Thus the hierarchy arrangement considers the objectives to be achieved, the factors that are the scope of the problem and the expected results. The analytical hierarchical process in research is applied in the problem of determining the type of KRI to support the task of Third Fleet, the goal is to determine the intensity of the criteria set and the potential priorities that allow it to be selected.

The hierarchical structure consists of several levels. The first level is the goal to be achieved in the research, namely choosing the type of KRI. The second level is the criteria which are the determining factors in the determination process. This study consisted of 4 (four) criteria: 1) Sea Operations 2) Exercises 3) Base support and 4) Special. The third level is sub-criteria and the fourth level is alternatives to be analyzed.

3.4.2 Pairwise Comparison

Pairwise comparisons were carried out on 12 sub-criteria in each of the criteria for operation, exercise, base support and special. Pairwise comparisons were carried out with the help of Exspert Choice V11 software. Furthermore, a pairwise comparison calculation process against the criteria and subcriteria is shown in the figure below.

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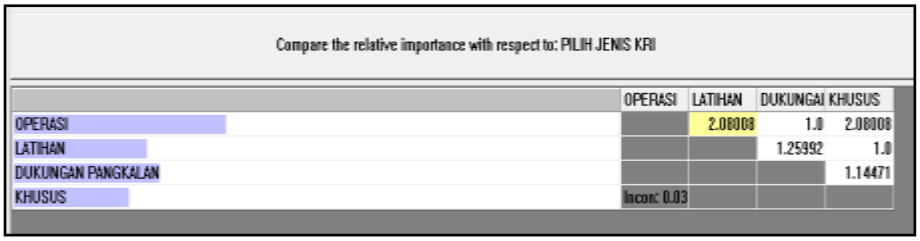

Figure 1. Pairwise Comparison Between Criteria

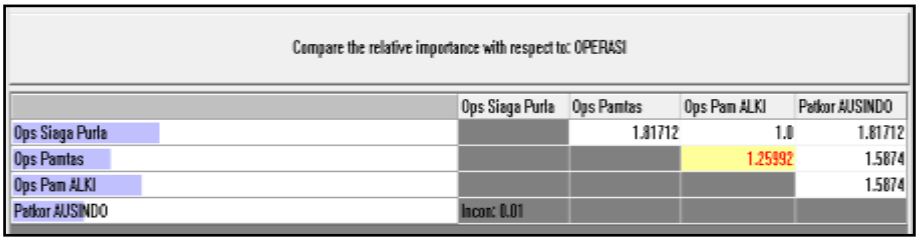

Figure 2. Pairwise Comparison of Subcriteria on Operating Criteria

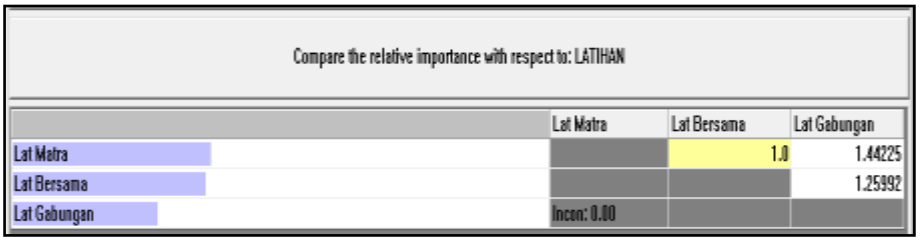

Figure 3. Pairwise Comparison of Sub-Criteria on Exercise Criteria

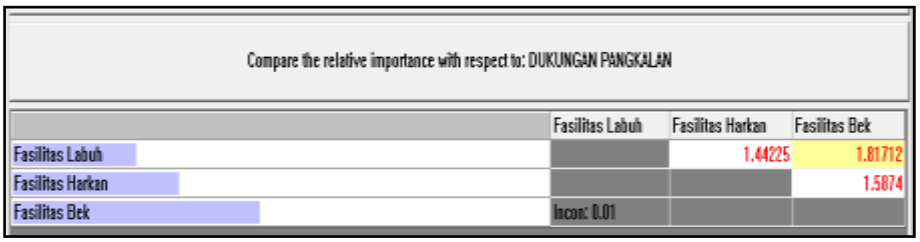

Figure 4. Pairwise Comparison of Subcriteria on Base Support Criteria

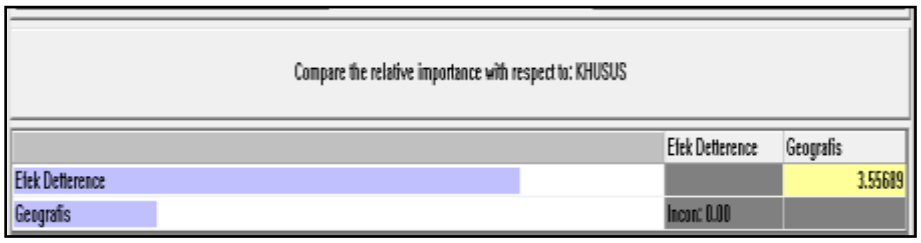

Figure 5. Pairwise Comparison of Subcriteria on Special Criteria

3.4.2 Consistency Ratio

With the Exspert Choice V11 software, the Consistency Ratio value can be seen when inputting pairwise comparison data. So that the inconsistency value can be found easily if there is a value that is more than 10%. Furthermore, one of the Consistency Ratio values is shown in the figure below.

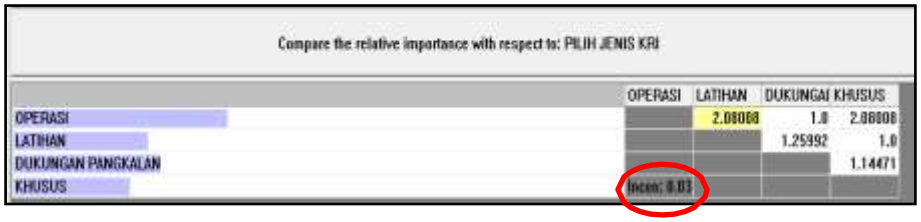

Figure 6. Inconsistency value

3.4.4 Weight Value of Criteria and Subcriteria

By using the AHP method, the weight value is obtained for each criterion and sub-criteria in selecting the type of warship. The results of the weighting of the criteria and sub criteria are shown below.

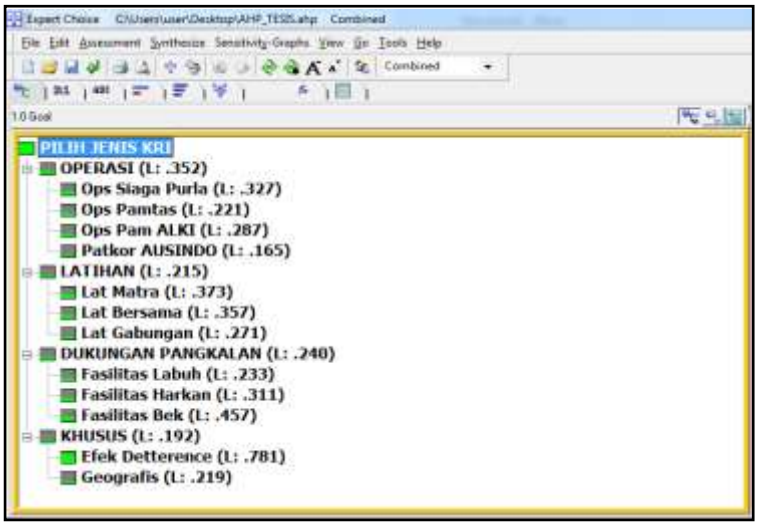

Figure 7. Weight Value of Criteria and Subcriteria

3.4.5 Alternative Prioritization

Data processing using Expert Choice software can facilitate network relationships that occur between criteria, between sub-criteria or between alternatives, giving the final calculation result in the form of a ranking value of the priority of each alternative in determining the type of warship.

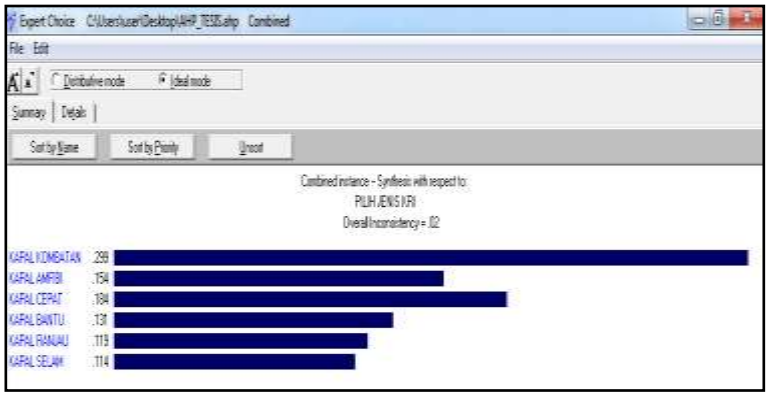

Figure 8. Synthesis of Processing Results

From the picture above, it can be seen that the alternative priority is based on the weight value of each criterion. The alternative priority ranking is in accordance with the table below.

Table 8. Priority Ranking of KRI Types

Rank	Type of KRI	Weight
1	Combat Ships	0.299
2	Fast ship	0.184
3	Amphibious Ship	0.154
4	Auxiliary Ship	0.131
5	Mine Ship	0.119
6	Submarine	0.114

3.4.6 Sensitivity Analysis

Sensitivity analysis is carried out in order to re-examine the results of the analysis of a problem. In this study, a sensitivity analysis will be conducted to changes in the weight of the sensitive criteria. Sensitivity analysis is carried out by changing the weight of the criteria in order to test the criteria whether to make the criterion weight absolute or not. Changes in the weight value of each criterion are carried out by decreasing or increasing the weight at each point that is randomly determined to see the trend in selecting each alternative based on changes in each factor. Trial of changing the weight at each point is either increased or decreased from the initial value of the weight, so that by changing the weight of the value for each factor, a change in the relative proximity value of each alternative will be obtained.

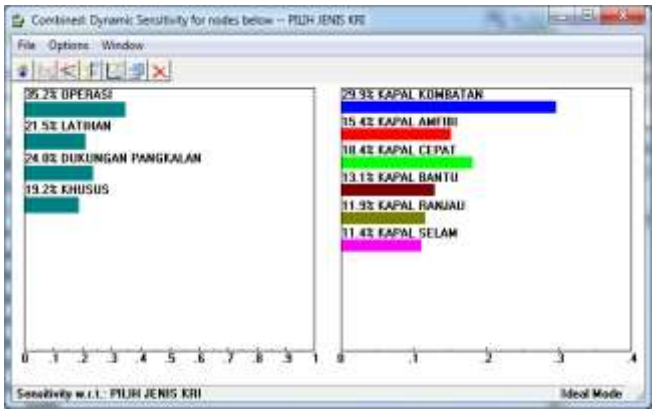

Figure 9. Initial Performance Criteria for Order of Priority

Figure 9. shows the performance / sensitivity for each of the factors considered in determining the priority of warships with an initial operating criterion weight of 35.2%, training criteria 21.5%, base support criteria 24.0% and special criteria 19.2%. In this study, the sensitivity analysis was carried out by adding and subtracting the weight of each criterion by 10%. The purpose of adding and subtracting weight to each criterion is to see whether there is a change in the order of the alternatives.

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Figure 10. Performance After Addition of Weight to Operating Criteria

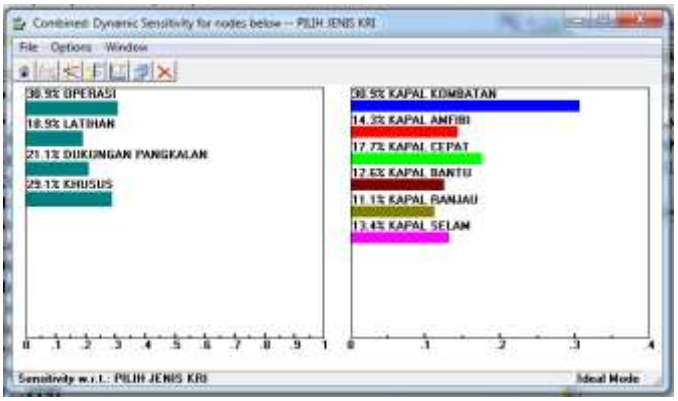

Figure 11. Performance After Weight Reduction in Operating Criteria

Figure 10. and Figure 11. show the performance after changing the weight on the operating criteria to 45.2% and 25.2%. The results of the weight change do not affect the order of priority type of battleship. Combat ships remain at the top of the list, followed by fast boats, amphibious ships, auxiliary ships, mines and finally submarines.

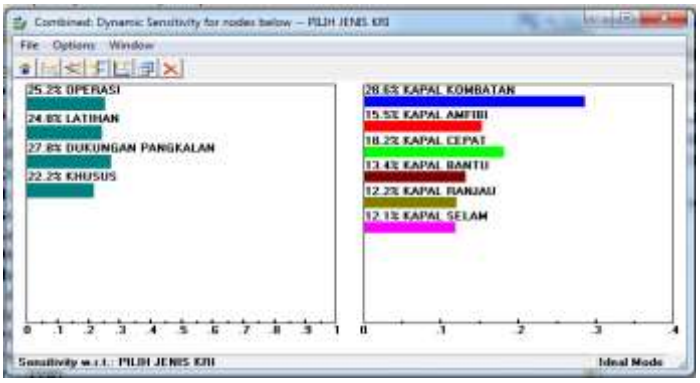

Figure 12. Performance After Increasing Weight on Special Criteria

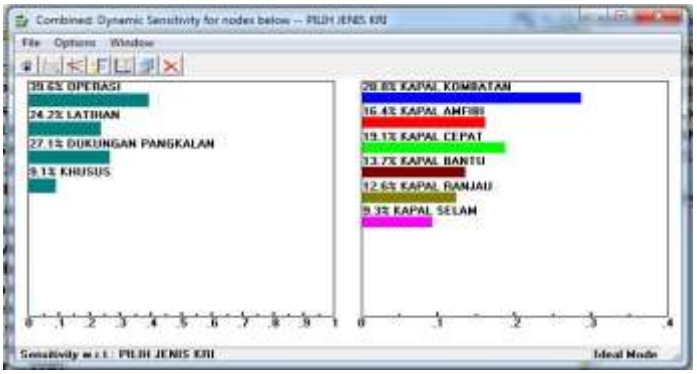

Figure 13. Performance After Weight Reduction Special Criteria

Figure 12 and Figure 13 show the performance after changing the weight on special criteria. When the weight is increased to 29.2%, there will be a change in the priority order of the types of warships, namely combat ships remain at the top of the list, followed by fast boats, amphibious ships, submarines, auxiliary ships and the last order of mines.

4. CONCLUSION

This study succeeded in obtaining a consensus of significant criteria and sub-criteria in the process of selecting the appropriate type of warship. A total of four criteria and 12 sub-criteria have been validated by the expert group to be used in making decisions on the selection of warships. These criteria are Operations (marine combat operations, limited security operations, sea line operations, coordination patrols), Exercises (training dimensions, joint exercises, joint exercises), Base support (anchoring facilities, repair facilities, provision facilities), Special (prevention, geographical). Operational criteria are the top priority in determining the type of warship, the next priorities are base support, training and special. Based on the AHP results, the type of combatant warship is recommended as the top priority.

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