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# *SUSTAINABILITY OF OPERATION ELEMENT SECOND NAVAL COMMAND FLEET IN INDONESIAN WORD SHIPS DEGREES TO SUPPORT THE NAVAL TASK*

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***ABSTRACT***

*The sustainability degree of operation of the KRI elements in Koarmada II is determined by the interrelated influences and interactions between one aspect and another as a very complex system arrangement, so a comprehensive analysis is needed regarding the sustainability of the KRI operation title in terms of aspects of geography, politics of defense and security, the Financial/Budget aspect of the Indonesian Navy and the Physical/Technical aspect of the KRI. In order to be able to see the sustainability value of the KRI operation title, a dynamic model was developed that could determine the projected KRI operational title sustainability value with a time dimension of up to 40 years in the future. In this Thesis, the researcher developed a model with a system dynamic model approach which was integrated with the Analytical Hierarchy Process (AHP) method to obtain the sustainability value of the KRI operations title in this case the KRI Koarmaa II operation title based on aspects of Geography, Defense and Security Politics, Financial/Navy Budget aspects and KRI Physical/Technical aspects. From the results of the formulation and simulation of the model with the System Dynamic approach to the sustainability of the KRI Koarmada II element operations. After the model was run for 40 years, the value of the Geopolhankam aspect was at index 5.00, which means "Safe enough" (Alert), the value of the TNI's financial/budget aspect AL at index 4.80 which means "Medium" (Moderate), the value of the physical/technical aspects of KRI at index 5.*

***Keywords:*** *Sustainability Operations of KRI, System Dynamic, Analytic Hierarchy Process*

## 1. INTRODUCTION

The dynamics of the development of the situation and conditions of the current strategic environment have created a spectrum of threats that are increasingly complex and have implications for national security and defense.(Ministry of Defense, 2021). The economic crisis resulting from a prolonged pandemic has become a scourge for the nation's economic conditions and political stability. The complexity of the issues and the ambiguity over the situation that developed had an influence on the process of preparing the title of elements of the security and defense forces. KRI is a representation of the strength and ability of the Indonesian Navy in maintaining state sovereignty in the national jurisdiction area. In facing various threats to the security of the Koarmada II area, the sovereignty and integrity of the state require the readiness of the KRI. This sea area security activity is realized through the implementation of the Sea Defense Operation (Opshanla) and the Sea Security Operation (Opskamla) using the KRI.

Rear Admiral TNI Dr. Marsetio, (2016) Koarmada II as the main component of the strength of the Indonesian Navy in carrying out the national defense and state security at sea has an obligation to guarantee the safety and security of shipping for

all sea users, especially those crossing the Indonesian national jurisdiction waters which are the sector responsible for the work area. Koarmada II, in accordance with the rights and obligations that exist in the UN law of the sea. Collins English Dictionary, (1998) defines sustainability as an effort to maintain a business/behavior in a stable condition without weakening the ability of other resources (resources) or causing severe ecological damage. This view helped shape the broader definition of sustainability used by (Brundtland, 1987) as a business that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainability of the title of KRI element operations in Koarmada II in supporting the duties of the Indonesian Navy can be interpreted as a sea operation title that must be carried out by elements of KRI Koarmada II on an ongoing basis in carrying out the duties of the Indonesian Navy in the form of Opshanla and Opskamla with the aim of realizing stability of defense/security at sea by carrying out a series of other TNI operations in the framework of deterring and taking action against all forms of threats to defense/security at sea in accordance with

applicable laws and regulations, and protecting national interests at sea,

Referring to the background of this research, an analysis is needed regarding the sustainability of the KRI elemental operations degree at Koarmada II in supporting the duties of the Indonesian Navy in order to obtain an optimal solution. Referring to the above issues, the researcher developed a dynamic model that can determine the sustainability of the KRI elemental operations degree in Koarmada II with the interaction relationship between the influential aspects in it so that an understanding of the magnitude of the influence of these aspects is obtained to obtain the sustainability value of the KRI elemental operation degree in the Regional Military Command. II.

## 2. MATERIALS AND METHODS

### 2.1 Dynamic System Models

The dynamic system model is a combination of theory, method, and philosophy that aims to analyze the behavior of a dynamic system by building and forming a general model by identifying symptoms to produce problems for simulation evaluation/policy analysis in making decisions, both for evaluating steps -strategic steps that have been taken in producing system performance, as well as for evaluating/analyzing alternative steps that need to be taken in achieving the desired goals going forward (Forester, 1994). The decision can take the form of various aspects, including "allocation, location and distribution", "regulation and deregulation", "stimulation and response" whose essence is the sustainability of the system.

Simulation is imitation of the behavior of a symptom or process. Simulation is intended as an understanding of these phenomena or processes, analyzing and predicting the behavior of these symptoms or processes in the future. The simulation was carried out in several stages, namely drafting the concept, modeling, simulating, and validating the simulation results. (Suharyo, 2017).

### 2.2 Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process(AHP) has many advantages in explaining the decision-making process, this is in line with Kusrini's opinion in a book entitled Concepts and Applications of Decision Support Systems where it is stated that AHP has many advantages in explaining the decision-making process, one of which is that it can be described graphically so that it is easy to use. understood by all parties involved in decision making. Furthermore, in the Journal of Mhd. Sandi Rais entitled Decision Support System for Housing Site Selection Using the Analytical Hierarchy Process (AHP) stated that in solving problems with AHP there are several principles that must be understood(Siagian, 2017), among others are:

a. Create a hierarchy.

Complex systems can be understood by breaking them down into supporting elements, arranging the elements hierarchically, and combining them or synthesizing them.

b. Assessment criteria and alternatives

The assessment of criteria and alternatives was carried out by pairwise comparisons. The value and definition of qualitative opinion from the Saaty comparison scale can be measured using an analysis table as shown in the table below:

**Table 1.** Criteria and Alternative Assessment

| score | Information |
|---|---|
| 1 | The vertical factor is as important as the horizontal factor |
| 3 | The vertical factor is more important than the horizontal factor |
| 5 | The vertical factor is clearly more important than the horizontal factor |
| 7 | The vertical factor is clearly more important than the horizontal factor |
| 9 | The absolute vertical factor is more important than the horizontal factor |
| 2,4,6,8 | When in doubt between two adjacent element values |
| opposite | Opposite of indigo description 2-9 |

*c.* Determining priority (synthesis of priority*)*

For each criterion and alternative, it is necessary to do a pairwise comparison. The relative comparison values of all alternative criteria can be adjusted according to a predetermined decision to produce weights and priorities. Weights and priorities are calculated by manipulating matrices or by solving mathematical equations.

d. logical consistency

Consistency has two meanings: first, similar objects can be grouped according to uniformity and relevance. Second, it concerns the level of relationship between objects based on certain criteria.

**Table 2.** Ratio Index (RI)

| N | 1 ; 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RI | 0.0 | 0.58 | 0.9 | 1.12 | 1.24 | 1.32 | 1.41 | 1.45 | 1.49 | 1.51 | 1.48 | 1.56 | 1.57 |

Determination of Questionnaires According to Saaty, there are three principles in solving problems with AHP, namely the principle of compiling a hierarchy (decomposition), the principle of determining priorities (comparative judgment), and the principle of logical consistency (logical consistency). The hierarchy in question is a hierarchy of problems to be solved to consider the criteria or components that support the achievement of goals(Hussain et al., 2015). In the process of determining goals and the hierarchy of objectives, it is necessary to consider whether the set of objectives and the relevant criteria are appropriate for the problem at hand.

### 2.3 Maritime Defense and Security Operations

The Maritime Defense and Security Operation is the operation of the presence of KRI elements at sea where this operation has strategic value for the existence of national sovereignty and maritime security in Indonesia's national jurisdiction. Marine Defense and Security Operations are carried out by KRI from the ranks of the Indonesian Navy. The aim of the Maritime Defense and Security

Operation is to secure the Indonesian national jurisdiction sea from violations and crimes at sea in the form of violations of the territory of the Republic of Indonesia, piracy, timber theft, illegal fishing by foreign vessels and other marine natural resources. Maritime defense and security operations carried out by the Indonesian Fleet Command are manifested in the form of:

a. War Military Operations (OMP), carried out by the Indonesian Navy's Operations Command in an integrated manner with the area of operation, timing and objectives of war operations at sea;

b. Military Operations Other Than War (OMSP) carried out by the Indonesian Navy's Operations Command in an integrated manner and in coordination with other government agencies in terms of operations other than war, such as handling national disasters and social assistance.

### 2.4 Research methodology

This research was carried out in four stages, namely the preliminary stage, data collection, data processing, analysis and the last stage is the conclusion and suggestion stage. Shown in the flowchart as follows:

The initial stage is Problem Identification and Formulation. At this stage, the process of identifying existing problems is carried out. Deficiencies that occur in the field, possible solutions that can be carried out, approaches from a theoretical and field perspective, as well as various other possibilities that can be realized in a study. The next stage is the Determination of Research Objectives and Benefits, Literature Study and Field Observations, Data Collection and Model Development.Broadly speaking, the model formulation in this study is to construct a dynamic model using the System Dynamic method which is integrated with the methodAHP. After obtaining data from interviews, questionnaires and observations, the next step is to recapitulate the results and perform data processing. Data processing is carried out using System Dynamic modeling which is integrated withAHP methodand validation. The next stage is analysis and discussion as well as conclusions and suggestions.

## 3. 3. RESULTS AND DISCUSSION.

### 3.1 Aspect Assessment Stage and Supporting Variables

Analytical Hierarchy Process(AHP) has many advantages in explaining the decision-making process, in solving problems with AHP there are several principles that must be understood. Complex systems can be understood by breaking them down into supporting elements, arranging the elements hierarchically, and combining them or synthesizing them

| NO | SUB CRITERIA | WEIGHT VALUE |
|---|---|---|
| 1 | Foreign Policy Conditions | 0.13575 |
| 2 | foreign policy | 0.13498 |
| 3 | Domestic Political Conditions | 0.42390 |
| 4 | Crime at sea | 0.30537 |

| NO | SUB CRITERIA | WEIGHT VALUE |
|---|---|---|

| | | |
|---|---|---|
| 1 | POLITICAL ASPECTS OF DEFENSE | 0.16920 |
| 2 | FINANCIAL A | 8737 |
| 3 | PHYSICAL/T | 4343 |

**Table 3.** Weighting Value of Main

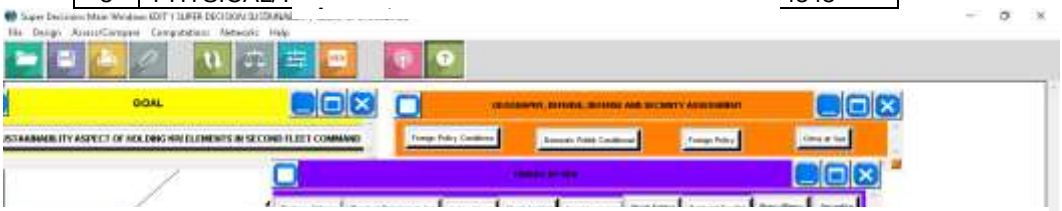

**Table 4.** The Weighting Value of the Geographical Aspects of Defense and Security Politics

**Figure 2.** Hierarchical Diagram Using Super Decision Software 2.10

In this study, the Analytical Hierarchy Process (AHP) is used as a tool in analyzing data to generate a hierarchy or priority scale for the factors that affect the sustainability of the KRI Second Fleet Command element in supporting the Navy's tasks.

**Table 5.** Weighted Value of Crime Criteria at Sea

| NO | SUB CRITERIA | WEIGHT VALUE |
|---|---|---|
| 1 | Territory Offenses | 0.15518 |
| 2 | Threat of Terrorism at sea | 0.05809 |
| 3 | Illegal fishing | 0.13691 |
| 4 | Illegal logging | 0.13955 |
| 5 | Piracy and piracy | 0.10471 |
| 6 | Smuggling | 0.12587 |
| 7 | Territorial conflict | 0.16398 |
| 8 | Illegal Immigrants | 0.06208 |
| 9 | Cyber Attack | 0.05364 |

**Table 6.** Weighting Value of the Indonesian Navy's Financial Aspects/Budget

| NO | SUB CRITERIA | WEIGHT VALUE |
|---|---|---|
| 1 | Emergency budget | 0.11576 |
| 2 | TNI Headquarters Budget | 0.06946 |
| 3 | Indonesian Navy Headquarters Budget | 0.08190 |
| 4 | Research and education budget | 0.12706 |
| 5 | Maritime potential development budget | 0.09664 |
| 6 | Budget for increasing professionalism and welfare of soldiers | 0.16325 |
| 7 | Budget for carrying out the duties of the Navy | 0.19437 |
| 8 | Budget for the modernization and improvement of the Alutsista program | 0.15156 |

**Table 7.** Weighting Value of KRI Physical/Technical Aspects

| NO | SUB CRITERIA | WEIGHT VALUE |
|---|---|---|
| 1. | KRI age | 0.08165 |
| 2. | KRI Eligibility Level | 0.18292 |
| 3. | KRI Soldier Professionalism | 0.27580 |
| 4. | KRI Damage Level | 0.13988 |
| 5. | KRI Capability Degradation | 0.11877 |
| 6. | Crew personnel (ABK KRI) | 0.07277 |
| 7. | KRI Certification | 0.12822 |
| 8. | KRI Operation Pattern | |

| | | |
|---|---|---|
| | a. Opshanla | 0.15221 |
| | b. Opskamla | 0.13671 |
| | c. BKO | 0.08138 |
| 10. | KRI Intensity Supports Indonesian Navy Operations | |
| | a. KRI type | |
| | 1) Strike Force | 0.15798 |
| | 2) Patrol Forces | 0.11533 |
| | 3) Supporting Forces | 0.10973 |
| | b. Number of KRI | |
| | 1). KRI Ready for Ops | 0.09146 |
| | 2). KRI Harkan | 0.10944 |
| | 3). KRI PUS Process | 0.04577 |
| 11. | KRI Repair Pattern | |
| | a. Third parties | |
| | 1) Third Party Regulations | 0.19703 |
| | 2) Repair Price | 0.31453 |
| | 3) Third Party Qualification | 0.19062 |
| | b. Parts | |
| | 1) Local spare parts | 0.14306 |
| | 2) Indent spare parts | 0.15476 |

### 3.2 Development of The Dynamic System Model Stage

The preparation of the model for the sustainability aspect of the title of the elements of KRI Koarmada II is represented in the form of a stock and flow diagram on the basis of a causal loop that has been compiled. Stock and flow diagrams are a detailed elaboration of the model compiled with a clausal loop diagram because in this diagram the effect of time on the interrelationships between variables is taken into account, so that each variable in the model is able to show the accumulated results for the level/stock variable and the variable which is the rate of system activity each time period or called rate/flow.

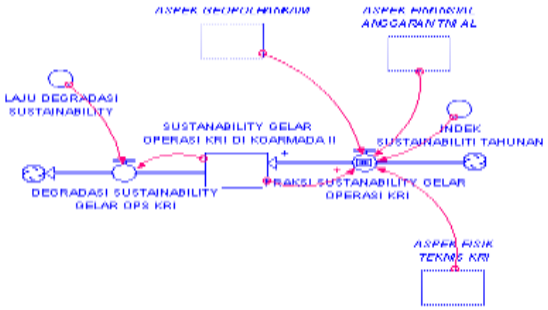


**Figure 3.** the main aspect of sustainability of the KRI's operating elements

The relationship between the interactions between the variable aspects of the political geography of defense & security into a model of the interaction relationship is shown in the following figure

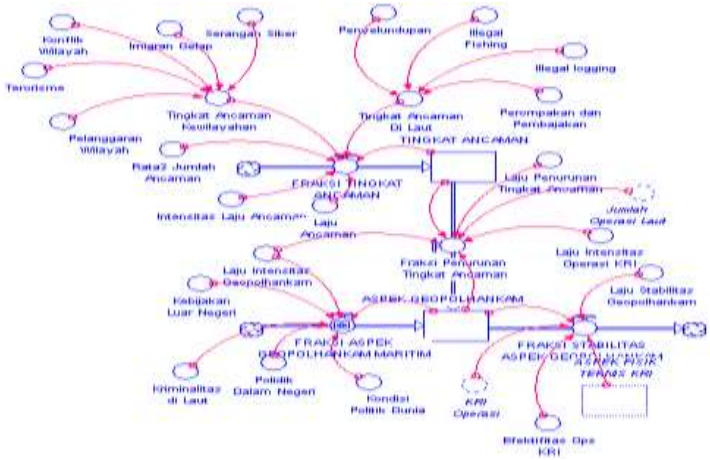


**Figure 4.** Image of the Geopolhankam Sutainability aspect of the KRI operation title

*The relationship between the interactions between the variables of the Indonesian Navy's Financial/Budget aspect of the variables can be projected into a model of interaction relationships in the figure as follows:*

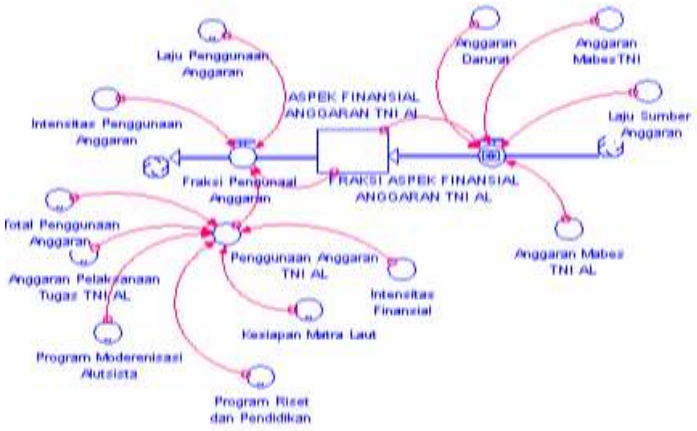


**Figure 5.** Stock and flow aspects of the final/budget of the Indonesian Navy

Relationships between interactions between variables Physical/Technical Aspects of KRI from variables can be projected into a model of interaction relationships in the figure as follows:

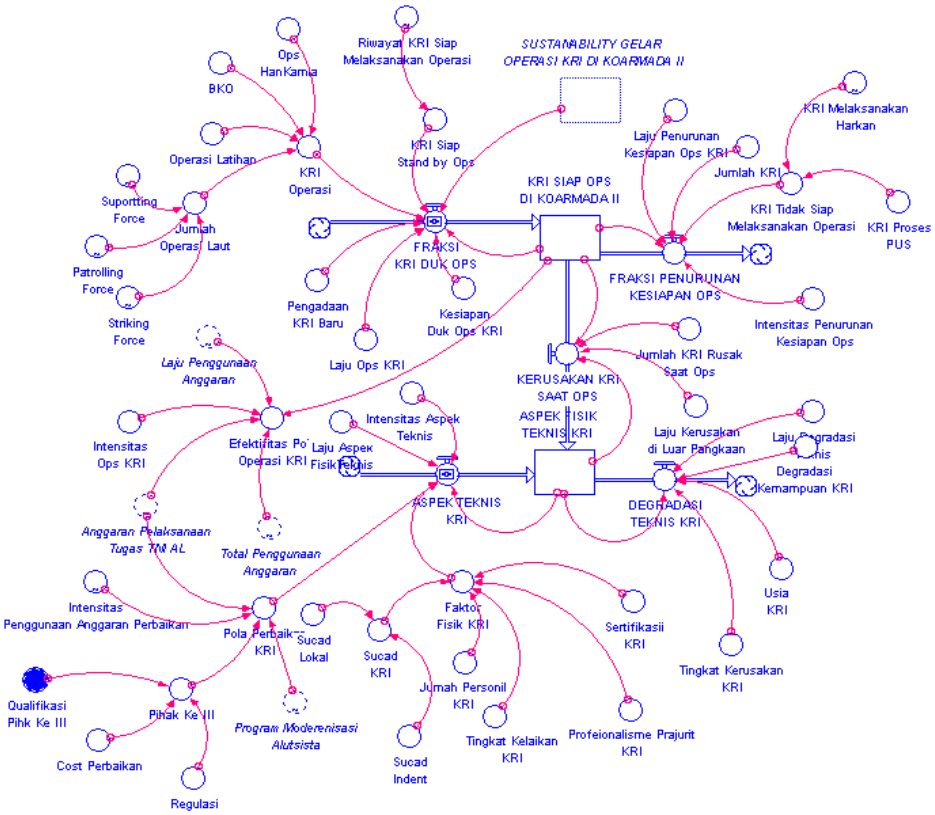


**Figure 6.** Stock flow physical/technical aspects of KRI sustainability, KRI operation title

### 3.3 Model Verification and Validation

Model verification is a step used to determine whether the simulation model reflects the conceptual model that has been made (Harel et al, 2003). In this case the verification of the model to check for errors in the model, check the model formulation, check the units and ensure the model is realistic and logical. Based on the model simulation results, the program on the main aspects of sustainability of the KRI Koarmada II operations is running well with a projection of the

next 40 years without errors in units or formulations (equations) which can be seen as follows:

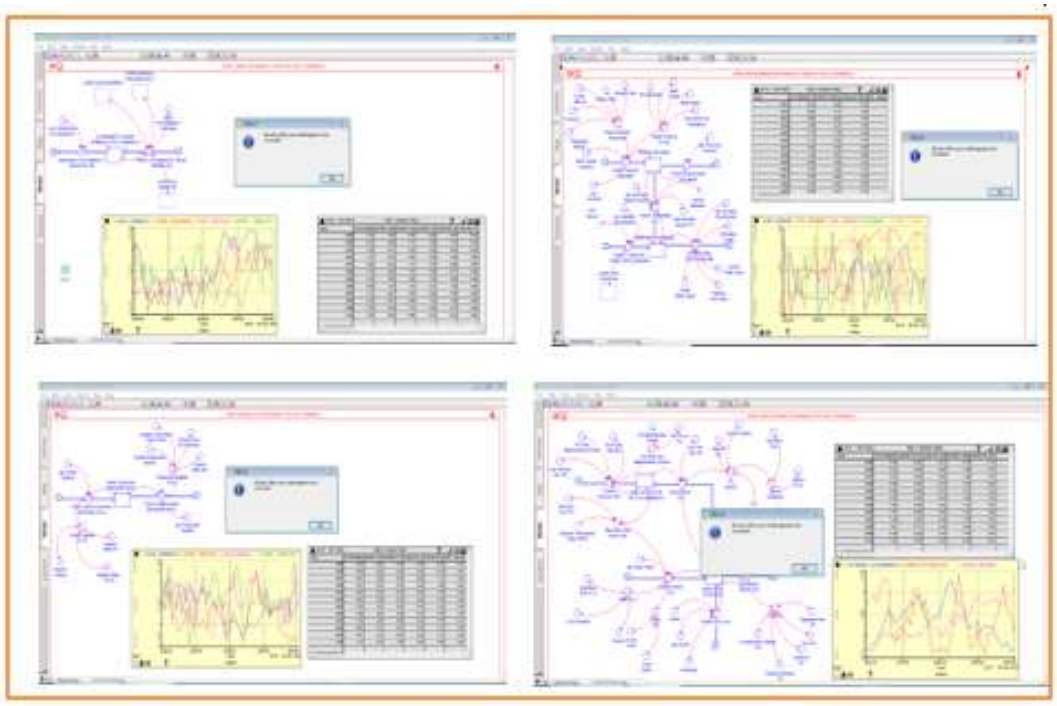

**Figure 7.** Model Validation Test

### *3.4* Sustainability Analysis Assessment of KRI Operations

The initial data used in the simulation of the KRI elemental operations degree at Koarmada II were obtained based on questionnaire data and processed using the Analytical Hierarchy Process (AHP) method to obtain the intensity weight of each variable. Based on the data that has been collected and processed, it is then put into the model formulation which finally gets a value that changes according to the dynamics of the system on the aspects of strength development variables. Based on the formulation of the sustainability aspect, the title of KRI elements in Koarmada II in the period of up to 40 years in the future as shown in the picture.

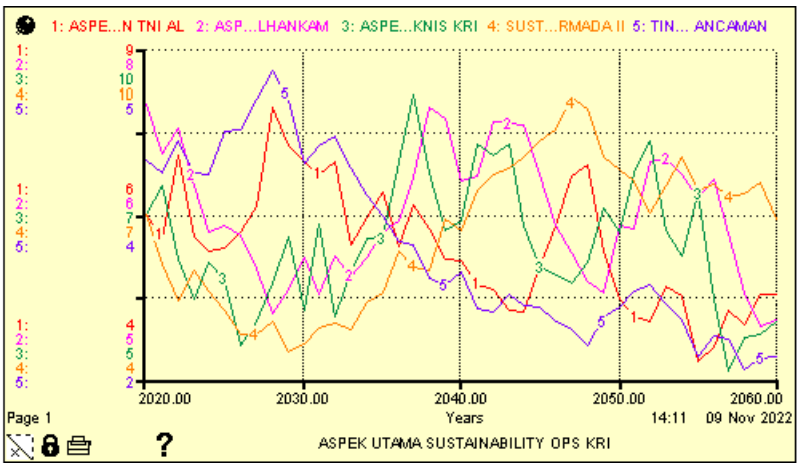


**Figure 8.** Results of the Sistainability Chart of KRI Operations

**Table 8.** Table of Sustainability Results for KRI Operations

| Year | Aspect Value | | | | | Year | Aspect Value | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | sustain abilities | Geopolh ankam | Financial | KRI techni cal | Thre at level | | Sustaina bility | Geopolh ankam | Financial | KRI tech nical | Threat level |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2020 | 7.00 | 7.00 | 6.00 | 7.00 | 4.00 | 2041 | 7.42 | 6.30 | 4.90 | 8.10 | 2.60 |
| 2021 | 6.09 | 6.50 | 5.60 | 7.40 | 3.90 | 2042 | 7.72 | 6.80 | 4.80 | 7.90 | 2.60 |
| 2022 | 5.40 | 6.80 | 6.90 | 6.30 | 4.20 | 2043 | 7.85 | 6.80 | 4.50 | 8.10 | 2.80 |
| 2023 | 5.98 | 6.30 | 5.70 | 5.70 | 3.90 | 2044 | 8.06 | 6.80 | 4.50 | 6.80 | 2.70 |
| 2024 | 5.59 | 5.80 | 5.40 | 6.30 | 3.90 | 2045 | 8.35 | 6.40 | 5.20 | 6.20 | 2.60 |
| 2025 | 5.23 | 5.90 | 5.50 | 6.00 | 4.30 | 2046 | 8.54 | 5.90 | 5.80 | 6.10 | 2.50 |
| 2026 | 4.81 | 5.80 | 5.70 | 5.00 | 4.30 | 2047 | 9.12 | 5.60 | 6.60 | 5.90 | 2.40 |
| 2027 | 4.81 | 5.50 | 6.10 | 5.40 | 4.50 | 2048 | 8.92 | 5.40 | 6.80 | 6.30 | 2.30 |
| 2028 | 5.03 | 5.10 | 7.60 | 6.00 | 4.80 | 2049 | 8.04 | 5.30 | 5.40 | 7.10 | 2.60 |
| 2029 | 4.47 | 5.30 | 7.00 | 6.70 | 4.50 | 2050 | 7.82 | 5.90 | 4.70 | 6.70 | 2.70 |
| 2030 | 4.61 | 5.60 | 6.80 | 5.50 | 4.00 | 2051 | 7.60 | 5.90 | 4.40 | 7.60 | 2.80 |
| 2031 | 4.93 | 5.30 | 6.60 | 6.80 | 4.10 | 2052 | 7.03 | 6.50 | 4.40 | 8.10 | 2.90 |
| 2032 | 5.01 | 5.60 | 6.80 | 5.40 | 4.20 | 2053 | 7.52 | 6.50 | 4.90 | 6.80 | 2.70 |
| 2033 | 4.88 | 5.40 | 5.50 | 6.10 | 3.90 | 2054 | 8.05 | 6.40 | 4.80 | 6.40 | 2.50 |
| 2034 | 5.39 | 5.60 | 6.00 | 6.60 | 3.70 | 2055 | 7.42 | 6.10 | 3.80 | 7.30 | 2.20 |
| 2035 | 5.56 | 5.80 | 6.30 | 6.60 | 3.50 | 2056 | 7.55 | 6.30 | 4.00 | 5.70 | 2.40 |
| 2036 | 6.31 | 5.90 | 5.50 | 7.80 | 3.20 | 2057 | 7.32 | 5.80 | 4.50 | 4.60 | 2.40 |
| 2037 | 6.04 | 6.30 | 6.10 | 8.80 | 3.20 | 2058 | 7.38 | 5.30 | 4.30 | 5.10 | 2.10 |
| 2038 | 5.96 | 7.00 | 5.80 | 7.60 | 2.90 | 2059 | 7.57 | 5.00 | 4.80 | 5.20 | 2.20 |
| 2039 | 6.91 | 6.90 | 5.30 | 6.70 | 2.90 | 2060 | 6.89 | 5.00 | 4.80 | 5.40 | 2.20 |
| 2040 | 6.70 | 6.30 | 5.30 | 6.90 | 3.00 | **FINISH** | | | | | |

The table above shows that there has been a change in the value of Geopolhankam and the financial/budget value of the Indonesian Navy which has an impact on the physical/technical value of the KRI. These three main aspects are important aspects that influence the value of the sustainability of the KRI operation title in Koarmada II. In a span of 40 years the value of the sustainability of the KRI operation title has experienced fluctuating dynamics. After the model has been run for 40 years, the value of the Geopolhankam aspect is at index 5.00, which means "Safe Enough" (Alert), the value of the financial/budget aspect of the TNI Al is at index 4.80 which means "Moderate" (Moderate) and the value of the physical aspect / technical KRI at index 5.40. which means "Moderate" (Moderate) and the index value of the sustainability index of the KRI operation degree in Koarmada II at index 6.89 which means the value of the sustainability index of the KRI operation title is in "High" (sustainability). This means that the sustainability of the operation stage in supporting the duties of the Indonesian Navy can immediately detect and implement countermeasures so that any potential threats that can cause conflict/war do not have the potential to cause conflict/war. The pattern of operation of the components of the maritime dimension of the defense force can carry out its functions properly supported by the strength, capability and pattern of its operations that can defend the sovereign territory of the Unitary State of the Republic of Indonesia.

## 4. CONCLUSION

From the simulation and analysis that has been carried out, several conclusions can be drawn as follows:

a. Variables on the main aspects that influence the sustainability model of the KRI Koarmada II elemental operations degree in supporting the duties of the Indonesian Navy are as follows:

1) On the Aspects of Geography, Politics of Defense and Security.
2) On the Financial/Budget Aspect of the Indonesian Navy.
3) On the Physical/Technical Aspect of KRI.

b. The Analytical Hierarchy Process (AHP) method is used to determine the weight/intensity of aspects and variables that affect the sustainability of the KRI element degree. Furthermore, using the system dynamic method (Stella 9.13 software) the data is used as input data which is used to obtain the sustainability value of the KRI operations degree in supporting the TNI AL's duties in research.With the formulation and simulation of the model with a system dynamic approach to the sustainability of the KRI Koarmada II element operation title in supporting the duties of the Indonesian Navy, it was obtainedvalue as follows:

**Table 9.** Final Scores

| No | Aspect | Score | Information |
|---|---|---|---|
| 1. | Sustainability KRI Operations Degree | 6.89 | High" (sustainability). |
| 2. | Geopolhankam | 5.00 | Enough Safe" (Alert), |

| No | Aspect | Score | Information |
|---|---|---|---|
| 3. | Financial/Budget Indonesian Navy | 4.80 | Moderate" (Moderate), |
| 4. | KRI Physical/ Technical | 5.40 | Moderate" (Moderate) |

This means that the sustainability of the operation in support of the TNI AL's duties can immediately detect and implement counter measures so that any potential threats do not have the potential to cause conflict /war. The components of the maritime dimension of the defense force can carry out their functions properly supported by the strength, capability and pattern of operations that can defend the sovereign territory of the Unitary State of the Republic of Indonesia.

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