POLICY SCENARIOS TO ACHIEVE MINIMUM ESSENTIAL FORCE / *MEF TARGET :* CASE STUDY OF INDONESIA NAVY

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ABSTRACT

The Indonesian Navy's policy regarding to development of Minimum Essential Force / MEF is a real manifestation of the Navy main task's demands, which is essentially to preserve, to protect and to defend the territorial integrity of Indonesian sea. MEF Development of Navy is realized gradually in three strategic plans, namely: the period 2010-2014, the period 2015-2019, and the period 2020-2024. The Programs and development activities MEF on first period has reached an average of 42%. In the field of principal equipments of weapon system development (Alutsista), especially in procurement of KRI (Republic of Indonesia Ship), the 1st period of MEF (2010-2014), the Navy planned procurement of 39 units of KRI. However until the end of 2014, the Navy has completed physically of 20 units of KRI, while the others are still under construction and they are estimated to be completed physically between 2017 until 2018. By considering the physical realization of KRI procurement on 1st period (2010-2014), which have not fulfilled on time as planned, it will certainly effect on the Navy MEF development process on 2nd period (2015-2019), so this research aims to predict the target achievement of Navy MEF development on 2nd period by analyzing the factors that influence and inter-relationship between variables in executing this policy and its effect in supporting of the Navy main tasks, especially in procurement of KRI. The methods are applied in this research : survey research method is used to determine variables affect the achievement of MEF, literature studies method is used to collect data , questionnaire method and interviewing experts are used to achieve the research objectives, then system dynamics method is used to predict, analyze and simulate in order to determine appropriate alternative scenario so that the MEF target of KRI procurement on 2nd period (2015-2019) and 3th period (20120-2024) can be accomplished.

Keywords : the Navy MEF policy, prediction target achievement, system dynamics approach, appropriate alternative scenario.

1. Introduction

The total area of Indonesia is about 7.7 million km ², two-thirds of the area, namely 5.8 million km ² is composed of the ocean, while the remaining area of 1.9 million km ² are mainland, that's why Indonesia is referred to as the largest archipelago in the world (Ditjen Strahan Kemhan, 2003). To maintain the integrity of Indonesia's marine area, it is absolutely needed a naval defense and security force has the means of combat and supporting facilities are qualified. The Indonesian Navy (TNI AL) as an integral part of the Indonesian armed force (TNI), is assigned to carry out TNI naval task in the field of defense, enforcing the law and maintaining security in the sea areas of national jurisdiction in accordance with the national laws and international laws that have been ratified, implementing diplomatic mission of the Navy, in order to support foreign policy set by the Indonesian government, carrying out TNI tasks in the construction and development of naval force, and implement empowerment sea defense area. the successful implementation of the Navy tasks will be very depend on the realization of abilities and powers in accordance with the posture of the Indonesian Navy. (Mabesal, 2011).

Therefore, the forming of the Navy force posture directed to achieve Minimum Essential Force. MEF is the amount of strength and ability to be built and owned by the Navy that in its calculations also consider internal and external factors as well as using the approach to the task. MEF development of the Navy realized gradually in three strategic plans, namely: the period 2010-2014, the period 2015-2019, the period 2020-2024. Navy as an integral part of the TNI has implemented the first phase of the development policy MEF years 2010 - 2014 as listed in table 1.1

Table 1.1 Planning and physical realization of KRI Procurement on period I (2010-2014)

NO	Initial condition		1st period planning (2010 - 2014)						1st period realization (2010 - 2014)					
	Type*	amount	procurement	disposal	*Down Grade*	Switching function		amount	procurement	disposal	*Down Grade* to	Switching function		amount
						to	from					from		
1	A	2	2					4						2
2	B	15						15	3					18
3	C	14	2					16						14
4	D	5	16			4		25	11			4		20
5	E	2						2						2
6	F	2						2						2
7	G	4				3		7				3		7
8	H	46	8	1	10		4	39	3	2	10		4	33
9	I	1						1						1
10	J	28	4	7				25	1					29
11	K	5	2					7	1					6
12	L	7		1				6		1				6
13	M	1				1		2				1		2
14	N	5	2				4	3	1				4	2
15	O	2		1				1		1				1
16	P	3	1	1				3						3
17	Q	2	1					3						2
18	R	1	1					2						1
19	S	4						4		1				3
total		149	39	11	10	8	8	167	20	5	10	8	8	154

(*) All type of KRI is confidential

MEF development programs and activities of the 1st period (2010 – 2014) include the development of capabilities and strengths in which there is modernization, defense equipment procurement and disposal of *Alutsista* as well as the development of the organization which today has reached an average of 42%. (Mabesal, 2014). Based on the Harmonisation Policy Evaluation and Development Basic Navy toward MEF (Minimum Essential Force) 2010-2024 explained that in the field of *Alutsista* development especially KRI procurement, the 1st period (2010-2014), the Navy will carry out procurement of 39 KRI.

However until the end of 2014, Navy has physically completed the procurement of 20 KRI, while the rest is still under construction estimated to be completed physically between 2017 until 2018. Although the state budget provided for the procurement of KRI has been absorbed well according to plan, but in actual physical realization Navy MEF 1st period have not been able to achieve the target set. If the above are not be evaluated, analyzed, predicted and anticipated by the leader of the Navy will most likely affect the next target achievement of MEF 2nd period (2015-2019).

The objectives of this research are: 1.) to predict the target achievement of MEF in KRI procurement for 2nd period (2015-2019) based on the behavior of Navy performance outcome of 1st period (2010-2014) and 2.) to analyze the successful achievement of development MEF TNI AL at the end of 2nd period in 2019, which is influenced by three things: (i) the results of MEF development in 1st period which already passed, (ii) considering situation and condition currently today, and (iii) calculate the potential threat that will be faced the future. The benefit of the

research are: 1) Providing information and suggestion to the Navy leader regarding picture of KRI's strength at the end of 2nd period in 2019 and 2) Giving consideration to the Navy leader to make decision and policy further to anticipate constraints and obstacles that will be faced forward in realizing the Navy MEF.

2. Literature Review

According to Iwan Sulistyo (2012) in his research on the Indonesian Defence Policy in 1998-2010 to response the Strategic Environmental Dynamics in Southeast Asia, explains that the policy of Indonesia defense posture development (land, sea and air) to response the military establishment of the countries in the region southeast in the period 1998-2010 is intended to achieve a deterrent force rather than build up the strength for offensive force. The policy was made because of there is perception that the countries in the Southeast Asian region has potential to threaten the security and sovereignty of Indonesia. Besides that, Indonesia's capability to build military strenght higher than deterrent level is very limited. Limited financial resources, political support and the weakness in analyzing of regional strategic environmental development causes this policy can not reach "deterrent" level and also can not reach "strategic stability" point.

According to Chiou-Guey Jan (2003) explains that government policy in building its defense posture aims to create at the independence of *Alutsista* in its production and development. It means that the government support the domestic defense industry has capability to create and build *Alutsista,* also to participate in research and development of defense technology. The policy is in line with the policy of Taiwan government as the newly industrialized countries in building the country's defense posture. This policy was taken because of competition among developed countries in the world that offer *Alutsista* with advanced technology but relatively low budget. If this condition is not prevented, it will hinder the progress of research and development (R&D) in Taiwan, even it is feared that would lead to dependence on supplier countries that harm the national defense. Hence, the Taiwan government apply the concept namely Defense Technology Development (DTD) policy, which is a network system that connect between state institutions with technology issues and make interaction between the political situation in Taiwan with the international defence market.

According Estu Prabowo E. (2013) in research on the Indonesian Defence Policy and Strategy (Case Study of Conflict In South China Sea) explain that the minimum essential force of TNI is prepared to face the development of strategic environment which is always changing dynamically and to anticipate the potential or actual threat from outside and inside of Indonesia. The China south sea conflict lately causes gap between strategic environmental development with defense policy and strategy of Indonesia: First, defense policy and strategy is not in line with the foreign policy of giving special attention to the dynamics of Southeast Asia, including China south sea. Second, the current defense policy and strategy does not give attention to the dynamics of the South China Sea conflict. Third, defense policy and strategy Indonesia still considers that the conflict in the South China Sea can be resolved through soft power and does not anticipate the use of hard power that will have implications on the national interests of Indonesia. To respond to such situations, it is recommended a number of solution. First, synchronization between defense policy and foreign policy so they can pay attention to developments issues in the China south sea. Second, reviewing of defense policy and strategy in accordance with the dynamics of the strategic environment. Third, replace the minimum essential force / MEF policy with essential force policy. Fourth, build and develop a home base defense forces at Natuna island, especially for Navy and Air Force. The fourth recommendation on a broader level would correlate well with the political and economic aspects of Indonesia.

To assess how far of MEF TNI has already implemented, there is a quantitative method using dynamic linear programming that can detail global problems into smaller sub-problems as certain stages and then completing these stages sequentially. Solutions of lower stage will be used as reference in making decision of higher stage. (Balibang Kemhan 2010)

3. Research Methodology

The methods are applied in this research : survey research method is used to determine variables affect the achievement of MEF, literature studies method is used to collect data , questionnaire method and interviewing experts are used to achieve the research objectives, then system dynamics method is used to predict, analyze and simulate.

System Dynamics modelling is based on a causal relationship. The causal is made of models based on experience, situation, source of data, conclusions, assumptions, and other information that can be obtained. The steps to implement system dynamics method (Sterman, 2000) are : a). problems articulation, b) dynamic hipotesis c) Formulation of a causal loop diagram is converted into stock and flow diagrams, d) validation testing, e). Scenarios and policy evaluation.

The system dynamics is a system analysis device which can be used to make the simulation of complex systems. Simulation means making a simple representation of reality. (Forrester, 1994). For system dynamics software, this research uses Power Simulation (Powersim) version 2.5.1 to formulate the model of component stock, flow, auxiliary and constanta.

4. Variable Identification and Model Conceptualization

Generally, there are five groups of variables that affect the performance of a system, those are: (1) desired output variable, which is determined base on the needs analysis, (2) a undesired output variable (3) controlled input variables, (4) uncontrolled input variables and (5) environmental input variables. After identifying those variables above, next step is quantifies the qualitative variables in order to determine its units and to get its initial data as listed in Table 4.1.

Table 4.1 Initial data of variables in stock and flow diagram

no	variable	type	initial	Period					unit
			2009	2010	2011	2012	2013	2014	
1	Strenght of KRI	level	29,1	29,6	29,3	28,3	29,3	36,4	Weighted Unit
2	Strength of other country*	level	28,5	29,8	30	30,8	31,8	33,5	Weighted Unit
3	KRI is not ready	level	6,3	6,7	6,5	6,6	6,2	9,3	Weighted Unit
4	Realization of KRI procurement	flow	0,5	0,7	0,7	0,8	0,2	8	Weighted unit / year
5	Rate of disposal	flow	0,2	0,2	0,5	1,6	0	0,5	Weighted unit / year
6	KRI under maintenance	flow	3,1	3,3	3,2	3,7	3,3	6,2	Weighted unit / year

7	Decreasing rate of KRI's technical condition	flow	4,5	1,1	11,1	3,7	5,5	10,4	Weighted unit / year
8	Defense budget of other country*	flow	31,9	32,148	33,310	42,040	54,357	63,467	(in trillion) Rupiah / year
9	APBN for defense	aux	30,5	34,35	47,41	50,92	64,95	80,95	(in trillion) Rupiah
10	APBN for TNI AL	aux	5,75	6,370	11,443	9,405	10,171	13,495	(in trillion) Rupiah
11	National Income	aux	988,54	1013,5	1194,9	1331,3	1426,9	1537,2	(in trillion) Rupiah
12	TNI AL budget for maintenance	aux	3,94	3,490	5,223	4,081	3,674	3,734	(in trillion) Rupiah
13	Lawlessness at sea	aux	17,15	16,15	19,88	23,89	22,19	13,22	Weighted case
14	TNI AL budget for procurement	aux	3,54	2,880	6,220	5,324	6,497	9,761	(in trillion) Rupiah
15	Coverage of KRI's operational	aux	42,5	44,12	45,10	45,10	47,06	45,10	percent
16	Planning of KRI procurement	aux	1,9	2,3	2,1	1,7	1,5	1,6	Weighted Unit
17	KRI relative strenght against other country ship*	Aux	0,6	-0,2	-0,7	-2,5	-2,5	2,9	Weighted Unit

18	Threat to other country*	aux	1,02	0,99	0,97	0,92	0,92	1,08	Not unitless
19	Price of KRI procurement	aux	15,96	12,11	13,02	11,84	49,5	1,35	Rupiah / weighted unit
20	MEF TNI AL	aux	29,8	31,1	31,2	30,3	30	30,1	Weighted Unit
21	Posture of TNI AL	aux	32	32,2	32,3	32,4	33,1	33,6	Weighted Unit
22	Potential threat	aux	50,54	58,24	76,15	103,24	80,65	42,57	percent
23	Percentage of APBN for TNI AL	const	18,85	18,54	24,14	18,47	15,66	16,67	percent
24	Percentage of KRI breakdown	const	20,21	19,14	18,57	18,86	17,71	26,57	percent
25	percentage of KRI disposal	const	1,03	0,675	1,706	5,654	0	1,374	percent
26	percentage of achievement 1st period	const	0	8,4	8,4	8,4	8,4	8,4	percent
27	Percentage of defense budget other country*	const	2,03	2,15	2,13	1,97	1,5	1,97	percent
28	Exchange rate to Rp	const	8950	9036	9113	9718	11600	12502	Rupiah (per 1 USD)

29	Cost of KRI maintenance	aux	0,08	0,0848	0,0912	0,0947	0.099	0,108	(in trilion) Rupiah
30	Percentage for Cost of KRI maintenance	const	20	20	20	20	20	20	percent

Annotation :
Other country = Malaysia ; KRI = Republic of Indonesia Ship ; APBN = State budget of Indonesia ; TNI = Indonesian armed force ; TNI AL = Indonesian Navy ; MEF = Minimum Essential Force ; Rp = Indonesian currency (Rupiah)*

Next Causal loop diagram is arranged based on variables that have been identified, it describe causal relationship into the images language, where every images of variable are connected with arrows, so they will form a causal diagram (causal loop), where upstream arrow reveals the causes and arrowheads revealed as a result. The positive and negative causal loop describes the types of consequences caused by the cause. If the relationship in the direction of the arrow is positive (+), but on the contrary if the relationship in opposite directions, the arrow is negative. as stated in gambarl 4.1.

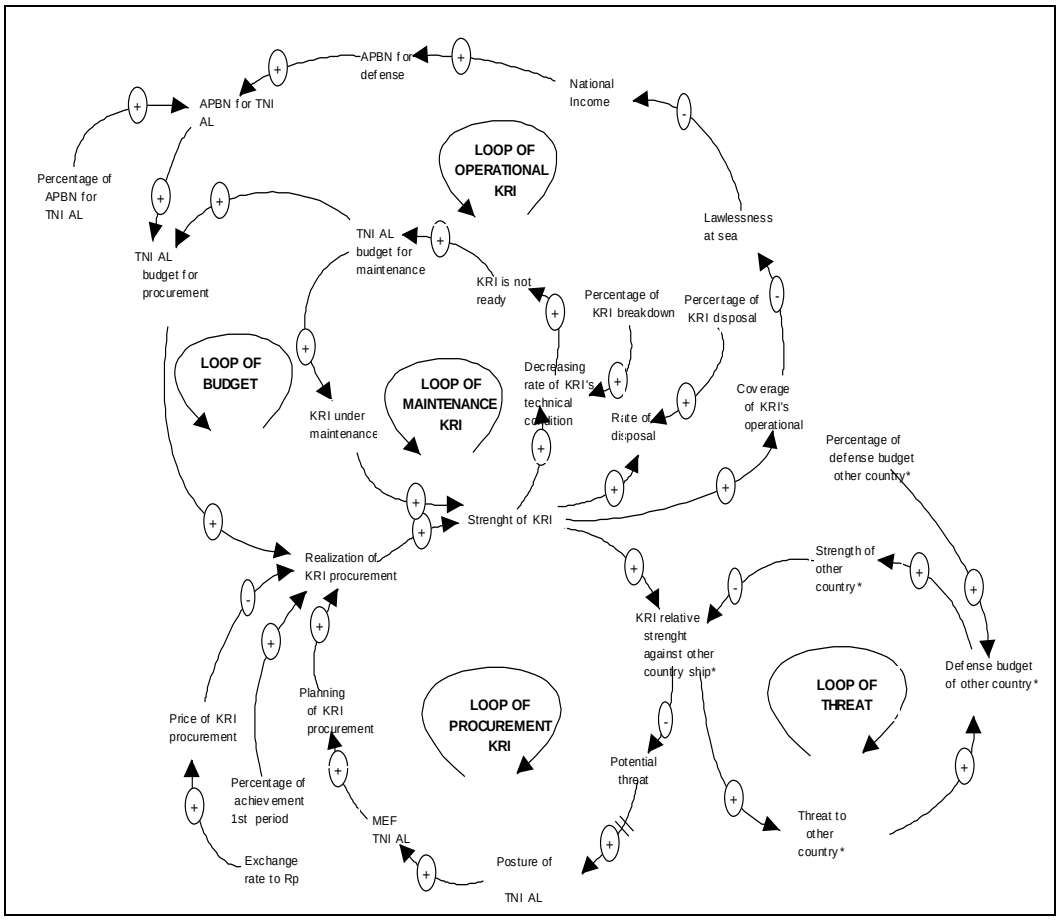

Figure 4.1. Causal Loop Diagram target achievement model

The data model builders obtained from the initial observation was later identified to obtain variables models and patterns of interaction between the variables in the real system. Data that have been identified in these variables are then compiled by patterns of interaction in a causal

diagram (causal loop diagram). Variables were included in the causal loop diagram is still a common variable is intact then be specified in accordance with the needs of the stock and flow diagram.

5. Building a System Dynamics Model

Based on the causal loop diagram above, next step is building a dynamics diagram model using Power Simulation software (Powersim) Studio version 2.5. In this research, the design of the model is done with a top-down approach, which is the main model was built first and then breakdown into sub-models. This top-down approach is done because the system dynamics main model is made by causal loop diagram which its variables are still a common variable and they have to breakdown first to get a model that can represent the real conditions to find relationship between variables of the system through the stock and flow diagrams, as presented in Figure 5.1. up to Figure 5.6 below.

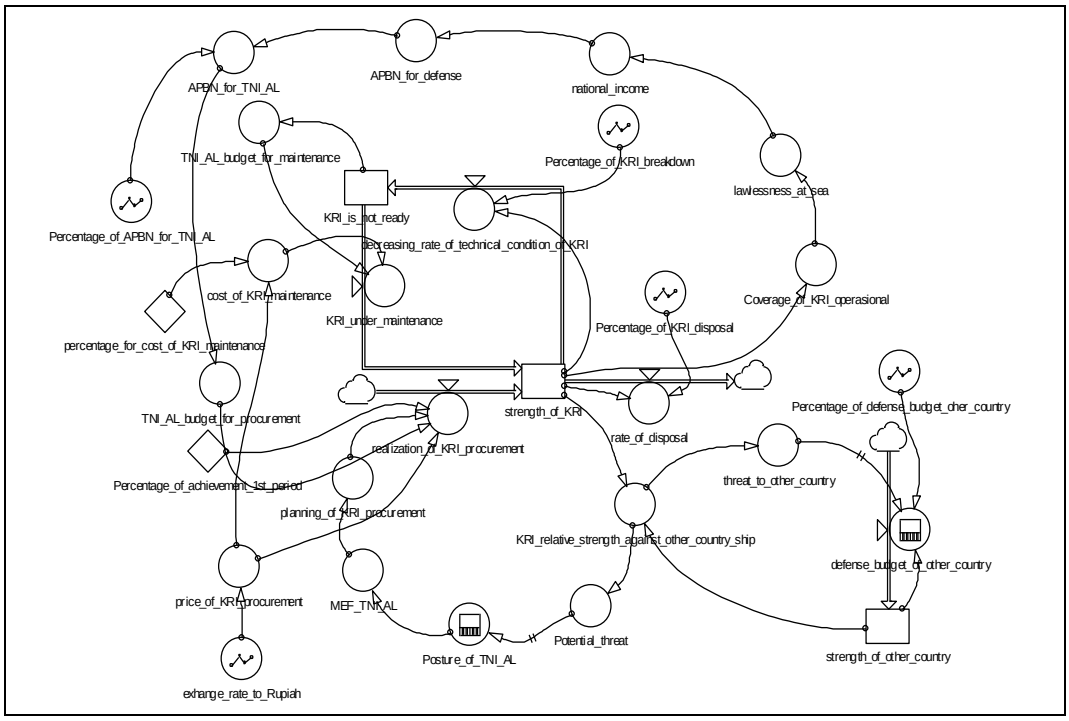

Figure 5.1. stock Flow Diagram model of target achievement

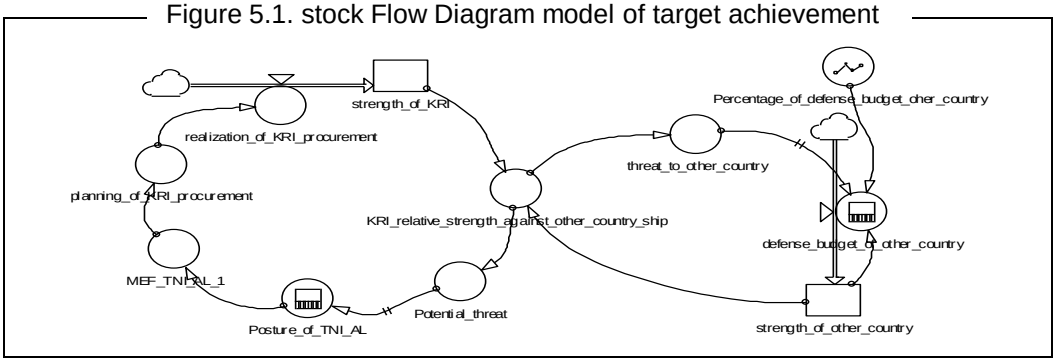

Figure 5.2. stock Flow Diagram submodel of threat

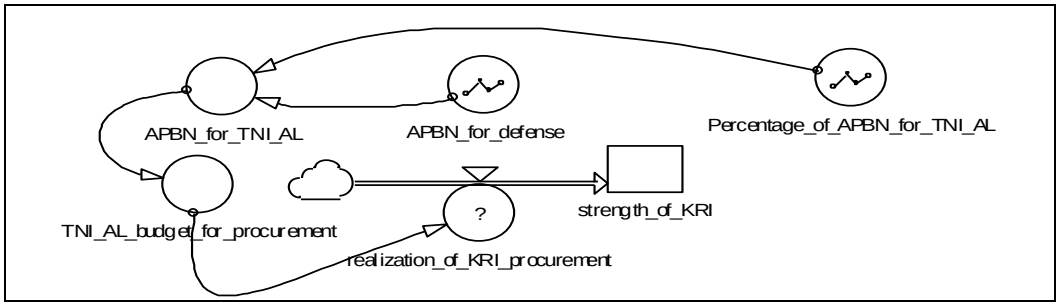

Figure 5.3. stock Flow Diagram submodel of Budget

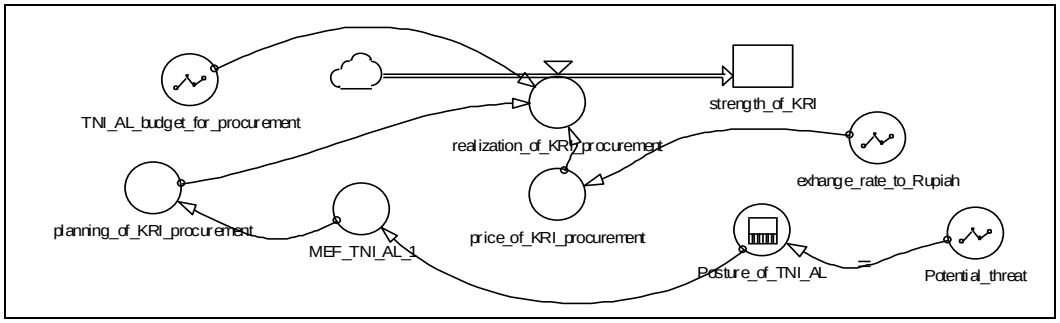

Figure 5.4. stock Flow Diagram submodel of KRI procurement

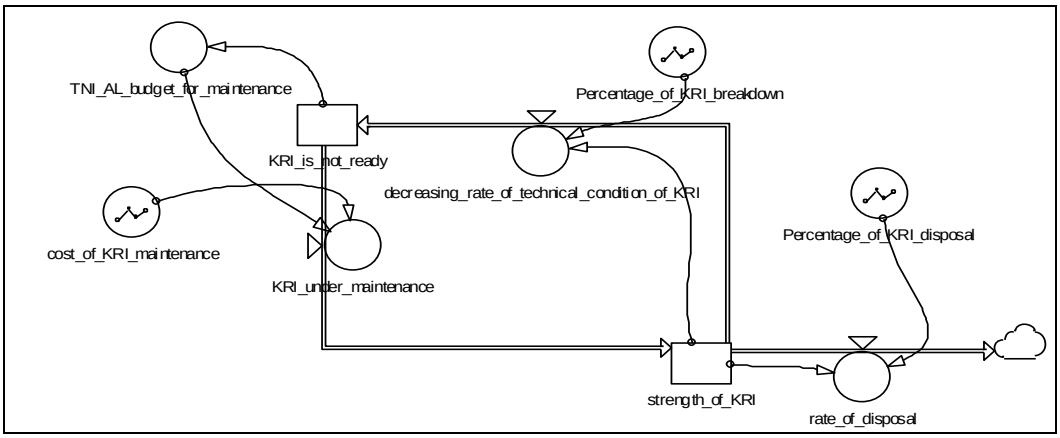

Figure 5.5. stock Flow Diagram submodel of KRI maintenance

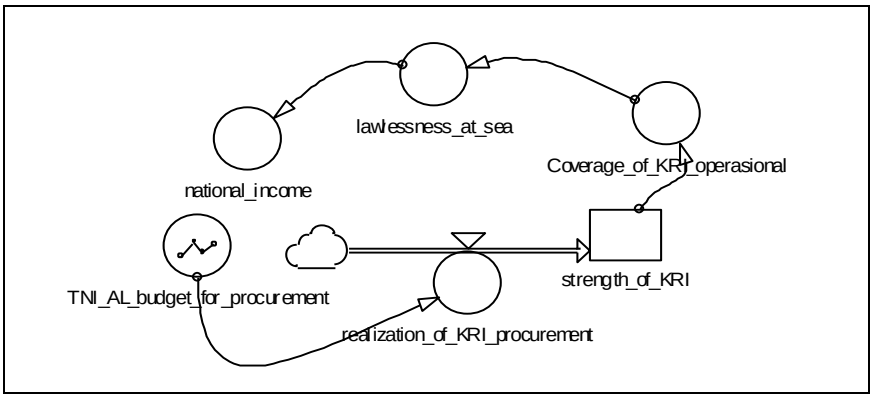

Figure 5.6. stock Flow Diagram submodel of operational KRI

6. Running a Verified and Valid System Dynamics Simulation Model

Before running the simulation, the models needed to be verified and validate. Verification of the model aims to examine the error and ensure that the model function in accordance with the logic of the research objects. Verification is done by examining the formulation (equations) as well as checking unit variable from the model. If there are no errors on the model or when running the model, it can be verified model as shown in Figure 6.1 and 6.2

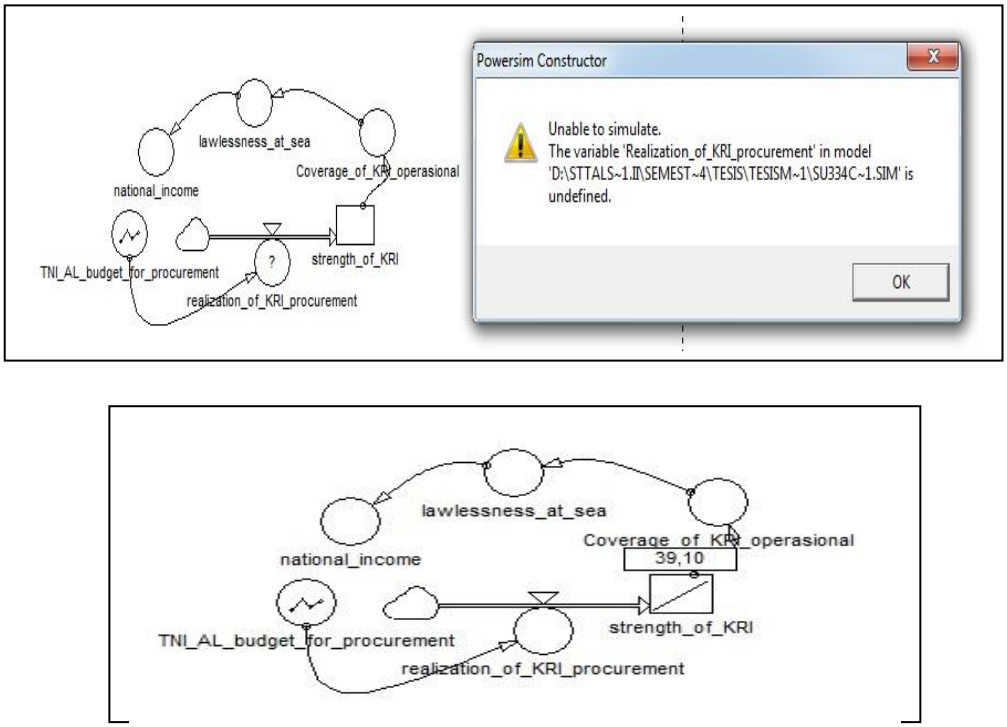

Figure 6.2 Running simulation of model is verified

While validation of the model to show how the model has been able to represent the real system. Validation methods used in this research was the model structure test, test parameters of the model, extreme conditions test, and model behavior test using black box method by and Mean Average Percentage Error / MAPE by Daalen dan Thissen as shown in Table 6.1 and 6.2

Table 6.1 Model behavior test for variabel *MEF* TNI AL

Year	Data Simulation (S) in weighted unit	Data actual (A) in weighted unit	S - A	E = |(S – A)/ A|
2009	30,22	29,8	0,4200	0,0141
2010	30,33	31,1	-0,7700	0,0248
2011	30,32	31,2	-0,8800	0,0282
2012	30,3	30,3	0,0000	0,0000
2013	30,27	30	0,2700	0,0090
2014	30,29	30,1	0,1900	0,0063
Average (black box method*)* If E<0,1 so model behavior test is valid				0,0137

Based on Table 6.1 indicates that by using the black box method is obtained an average error value (E) 0.0137, where the value is smaller than 0.1. Therefore, the variable in the model is said to be valid quantitatively

Table 6.2 Model behavior test for variabel Strength of KRI

Year	Data Simulation (Xm) in weighted unit	Data actual (Xd) in weighted unit	Xm - Xd	|Xm - Xd|	$\frac{\|Xm - Xd\|}{Xd}$
2009	29,1	29,1	0,0000	0,0000	0,0000
2010	30,29	29,6	0,6900	0,6900	0,0233
2011	31,89	29,3	2,5900	2,5900	0,0884
2012	33,83	28,3	5,5300	5,5300	0,1954
2013	33,7	29,3	4,4000	4,4000	0,1502
2014	31,62	36,4	-4,7800	4,7800	0,1313
$\frac{1}{6} \times \Sigma \left[\frac{\|Xm - Xd\|}{Xd} \right] \times 100\%$ *(MAPE* method*)*					9,8100
Accuracy criteria for the result: MAPE < 5% = very valid 5% < MAPE < 10% = valid MAPE > 10% = not valid					

Based on Table 6.2 appears that by using MAPE method is obtained 9,81% which included in the criteria valid for a value of 5% <MAPE <10%. Therefore, the variable in the model prediction is considered valid quantitatively.

7. Improvement Policy Scenarios

The improvement policy scenarios are designed to anticipate threats on three trouble spots, namely in the Natuna Sea-South China Sea, the Sea of Sulawesi and Papua as shown in Figure 7.1.

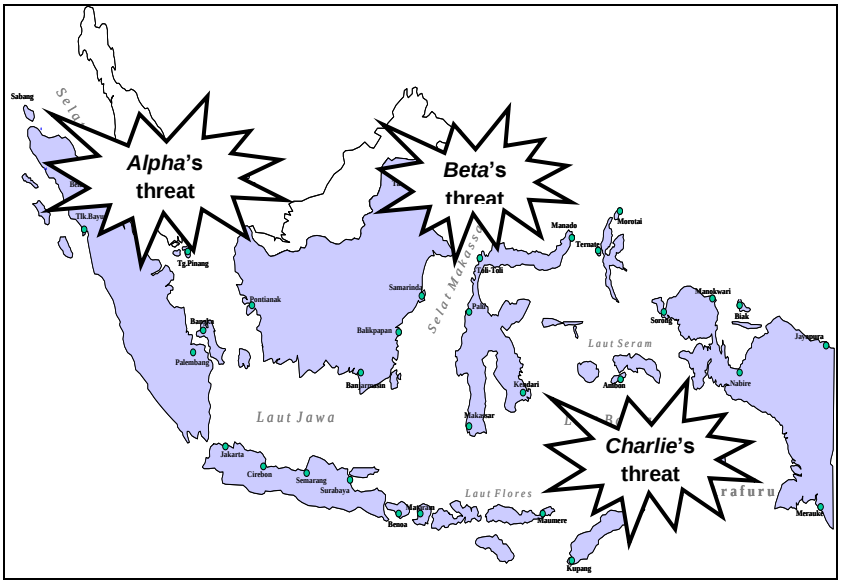

Figure 6.3 Potential threats at sea jurisdiction of Indonesia

Annotation : Alpha, Beta and Charlie are just a symbol, the real countries are confidential

Starting from the current conditions as defined in Table 4.1, in the submodel Threats section will be included mathematical formulation / *Powersim Equation* on each variables in accordance with the conditions in the country *Alpha*, *Beta* and *Charlie* in 2009-2014. Systematically scenarios can be seen in the following table:

Table 6.3 Variables in improvement scenario

No	Scenario	Variable	equation	unit
1	Alpha1 (2009-2014)	Strength of other country	130,8	Weighted unit
		Warship procurement of other country	(defence_budget_of_other_country*Percentage_of_other_country_defense_budget)/warship_average_price_of_other_country	Weighted unit
		Defence budget of other country	553+DELAYINF(threat_to_other_country, 1,1,0)	trilion Rupiah
		Percentage of other country defence budget	GRAPH(TIME,2009,1,[0.0125,0.013,0.0124,0.0124,0.0126,0.0127"Min:0;Max:3"])	x 100%
		Warship average price of other country	1.25	trilion Rupiah
2	Alpha2	There are certain treatments on the input variables for the Government and the Navy		
3	Alpha3	There are certain treatments on the input variables for the Government, the Navy and also supported by environmental influence from inside and outside		
4	Beta1 (2009-2014)	Strength of other country	28,5	Weighted unit
		Warship procurement of other country	(defence_budget_of_other_country*Percentage_of_other_country_defense_budget)/warship_average_price_of_other_country	Weighted unit
		Defence budget of other country	31,9+DELAYINF(threat_to_other_country, 1,1,0)	trilion Rupiah
		Percentage of other country defence budget	GRAPH(TIME,2009,1,[0.0203,0.0215,0.0213,0.0197,0.015,0.0197"Min:0;Max:3"])	x 100%
		Warship average price of other country	1.25	trilion Rupiah
5	Beta2	There are certain treatments on the input variables for the Government and the Navy		
6	Beta3	There are certain treatments on the input variables for the Government, the Navy and also supported by environmental influence from inside and outside		
7	Charlie1 (2009-2014)	Strength of other country	13,9	Weighted unit
		Warship procurement of other country	(defence_budget_of_other_country*Percentage_of_other_country_defense_budget)/warship_average_price_of_other_country	Weighted unit
		Defence budget of other country	221,23+DELAYINF(threat_to_other_country,1,1,0)	trilion Rupiah
		Percentage of other country defence budget	GRAPH(TIME,2009,1,[0.0198,0.0192,0.0171,0.0163,0.0166,0.0163"Min:0;Max:3"])	x 100%
		Warship average price of other country	1.25	trilion Rupiah
8	Charlie2	There are certain treatments on the input variables for the Government and the Navy		
9	Charlie3	There are certain treatments on the input variables for the Government, the Navy and also supported by environmental influence from inside and outside		

By comparing and analyzing the results of the simulation scenarios Alpha1, Alpha2 and Alpha3, it can be seen the initial number of Alpha1's warships (130.8 Weighted units) is far higher than target MEF development of the Navy (29.1 weighted units) on in 2009, therefore, if this policy is simulated until the end of 2024 strength of KRI will not be able to match the strength of Alpha1's warships as seen at Figure 6.4.

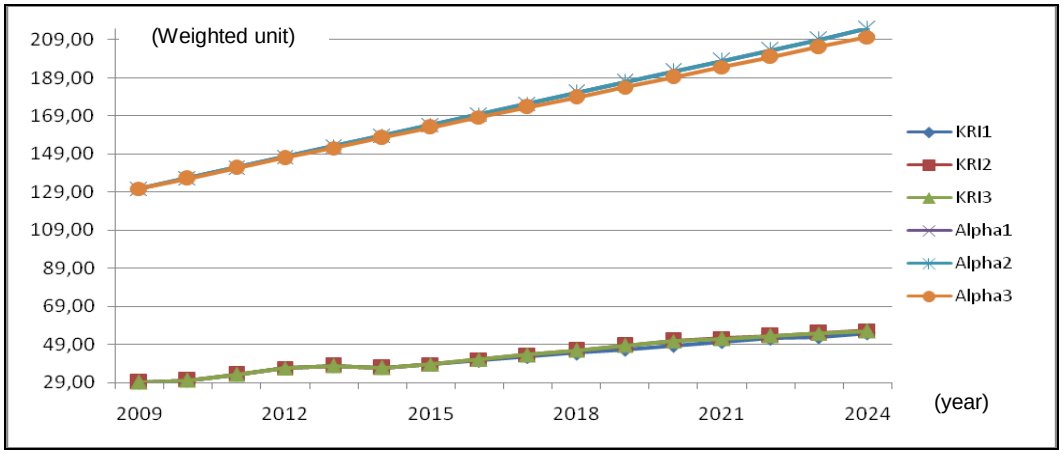

Figure 6.4 Graph of KRI strength and Alpha state scenario results

By comparing and analyzing the results of the simulation scenarios Beta1, Beta2 and Beta3, it is known that the early KRI strength until the end of 1st and 2nd period of MEF are superior to the power of Beta, but if the policy MEF were not evaluated properly then it could happen at the end 3rd period MEF does not reach the target (86,96%) and the strength of Beta will superior to the strength of KRI as shown at Figure 6.5.

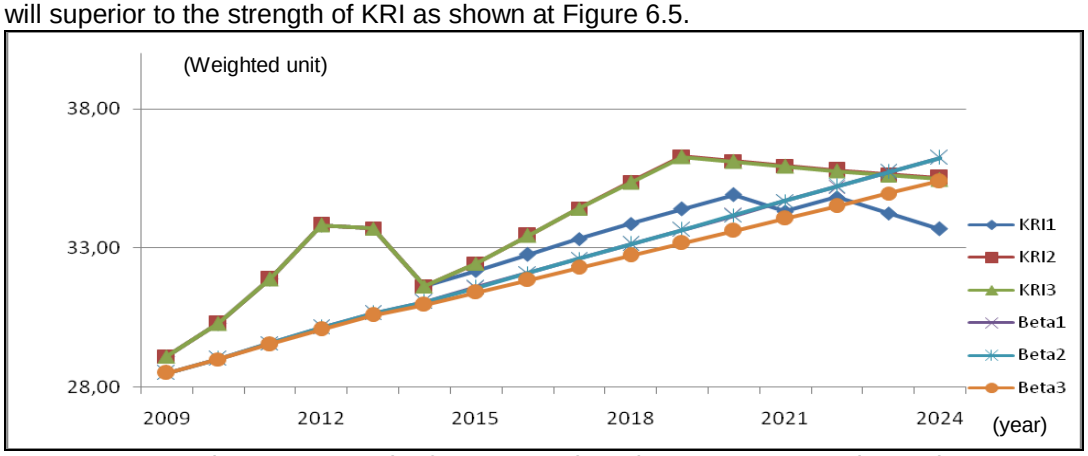

Figure 6.5 Graph of KRI strength and Beta state scenario results

By comparing and analyzing the results of the simulation scenarios Charlie1, Charlie2 and Charlie3, it is known that the early strength of KRI until the end of 1st and 2nd period MEF are superior to Charlie, but if the policy MEF were not evaluated properly then it could happen at the end 3rd period MEF does not reach the target (85,27%) and the strength of Charlie will superior to the strength of the KRI as shown at 6.6.

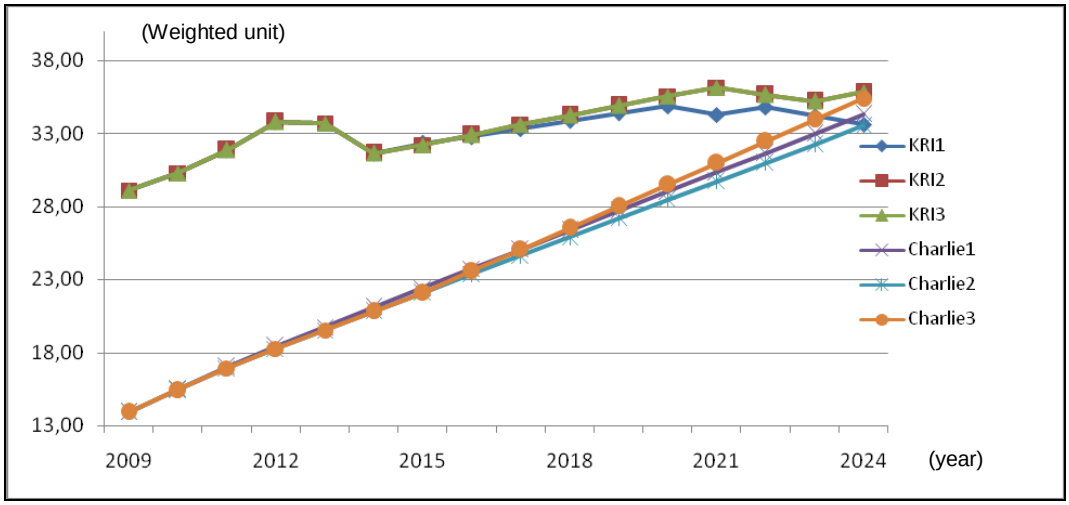

Figure 6.6 Graph of KRI strength and Charlie state scenario results

8. Determining the right improvement policy

For easy use of scenarios models, interface model is created in order to facilitate threat scenarios on three trouble spots to antisipate Alpha state in the Natuna Sea-South China Sea, Beta state in the Sulawesi Sea and Charlie state in the Papua sea. At the interface of this model, the research compares data of existing conditions to data of condition after scenario in order to analyze values of Percentage of target achievement, Strength of KRI, Strength of other country navy, coverage of operational KRI, and potential threats. The interface model can be seen at Figure 6.7 below.

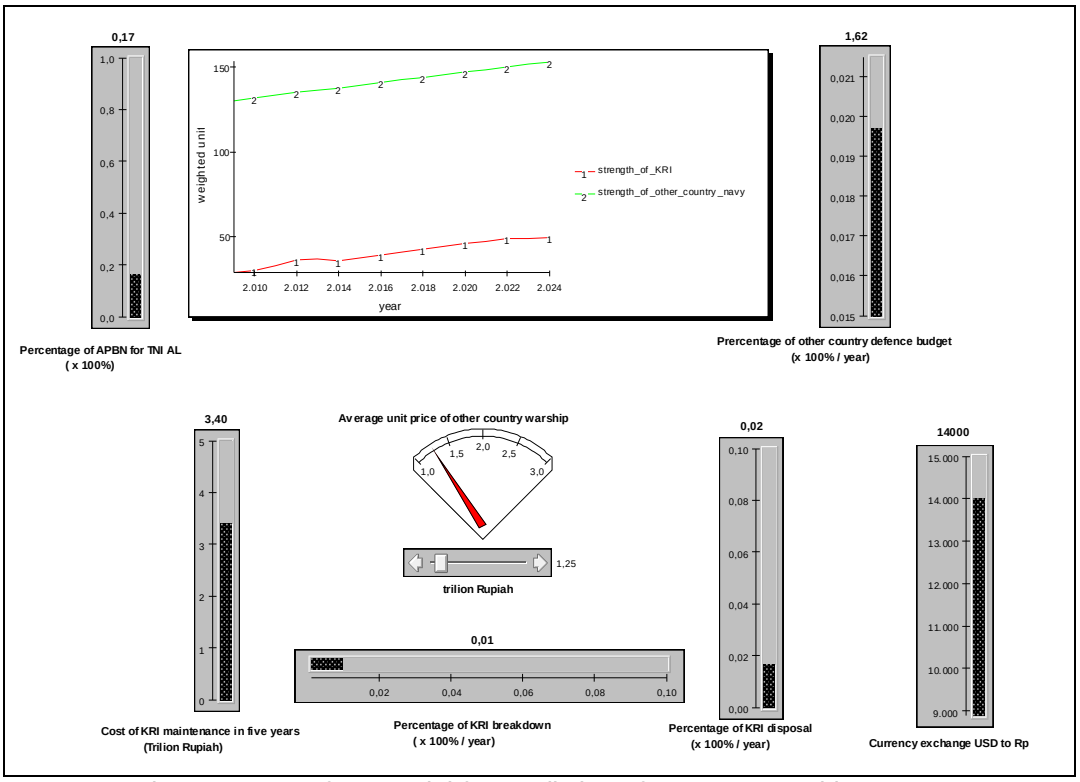

Figure 6.6 Interface model for predicting of target MEF achievement

Based on the results of running simmulation of 9 scenarios above, it will be analyzed which one more effective in achieving development targets MEF by the end of 2024 using *Cost Effectiveness Analysis (CEA)* with details calculation can be seen in Table 6.4.

Threat	Scenario	Budget for Navy (2009-2024) simulation results (trilion Rp)	output simulation target MEF 2024 (%)	output target achieved 2024 (3) x (4) trilion Rp	Output simulation excellence of KRI (weighted unit)	*Cost Effectiveness Ratio/* CER = (3) / (5)+(6)	Preference rank
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Alpha	Alpha1	111,64	196,033	218,85	-159,84	1,8918	**3**
	Alpha2	116,79	206,353	241,00	-158,46	1,4150	**2**
	Alpha3	116,80	205,663	240,21	-154,35	1,3603	**1**
Beta	Beta1	112,99	86,957	98,25	-2,57	1,1809	**3**
	Beta2	118,25	106,700	126,17	-0,73	0,9427	**2**
	Beta3	118,25	106,200	125,58	0,07	0,9411	**1**
Charlie	Charlie1	112,99	85,270	96,35	-0,68	1,1811	**3**
	Charlie2	118,30	107,233	126,86	2,3	0,9159	**1**
	Charlie3	118,30	107,293	126,93	0,42	0,9290	**2**

Overall preference rank based on smallest *CER* :
1. Scenario Charlie2
2. Scenario Charlie3
3. Scenario Beta3
4. Scenario Beta2
5. Scenario Beta1
6. Scenario charlie1
7. Scenario Alpha3
8. Scenario Alpha2
9. Scenario Alpha1

9. Conclusion and recommendation

As explained that this research is intended to: a) know how big a percentage of MEF Navy 2nd and 3rd period can be achieved based on the results that have been realized in 1st period, and b) determine what effects will be faced by the Navy to achieve of target in order to support main tasks of the Navy in future. From the results of simulation and analysis, it can be concluded as follows:

1. In this research designed predictive simulation model to describe behavior of development MEF policy on 1st period (2010-2014) with a case study in section of KRI procurement. The model was designed based on secondary data with modeling of system dynamics. After the model is valid, then it will be applied some certain scenarios based on real conditions that happened so will affect the achievement of Navy MEF target in future.
2. Based a conceptual model in causal loops diagrams, it is known that there are two important variables give effect to increase strength of KRI: the realization of KRI procurement and the rate of KRI which has already maintained and repaired. Otherwise there are two important variables give effect to decrease strength of KRI: the rate of KRI disposal and the decline rate of KRI technical condition.
3. Based on the scenario simulation model, it is known that if MEF policy on 2nd (2015-2019) and 3rd (2020-2024) period continued without adjustment and evaluation especially on the input of controlled variables and uncontrolled variables (environmental influences) will bring impacts those are on realization of MEF development will not reach target that have been planned. It will affect strength of KRI lose superior from strength of other countries. This condition will be a potential threat to Indonesia especially for the Navy and it can reduce the deterrence effect in the eyes of other countries.
4. Based on the scenario simulation, Navy MEF target on 2nd and 3rd period can be achieved 100% if supported by several improvements of policy: i) set the government policy to allocate a percentage of defense sector in APBN is average of 18% for the Navy, ii) maintain as much as possible the exchange rate of Rupiah currency does not exceed more than Rp.14.000 per 1 USD, iii) set the Navy policy in allocating maintenance costs for KRI can be pressed into an average of 3.5 trillion Rupiah per five years (each period MEF), and also iv) maintain as much as possible the rate percentage of KRI breakdown does not exceed 1% per year. Next the environmental influences from inside is considered: v) policy of the Navy to maintain an average percentage rate of KRI disposal at 1.7% per year, while the influence from the outside are: vi) the percentage of other country defense budget is an average of 1.24% of GDP (Gross Domestic Product) for Alpha state, then 1.75% of GDP for Beta state and 1.9% of GDP for Charlie state, and also vii) the price on the world market for new warship procurement which has similar specification with KRI is an average of 1.3 trillion rupiah per unit, so it can encourage domestic industry capability to build its own KRI with lower cost than the world market price.

This research used simulation modeling with system dynamics approach, where this method is suitable for simulating continuous systems such as socio-economic, political and defense policy because there is a flow of information, beliefs and so on. Therefore, the following are suggestions and recommendations can be given to sustainability following research:

1. In developing Navy MEF on next period is needed a good cooperation among stakeholders, especially between government and TNI leaders so that the role of government in controlling stability of exchange rate and consistency in setting of APBN percentage for the Navy will be supported by the Navy leaders policy in managing maintenance budget of KRI, so that finally the MEF target can be achieved.
2. The scope of this research discuss only in section of defense equipment,especially in KRI procurement, so it can encourage further research because Navy MEF Policy consist development in organization, personnel, defense equipment, facilities of naval base and special forces. This system dynamics model is very usefull for predicting another development target in military institution.

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