The Impact of the Development of Maritime Sectors on Coarmada II Operational Activities and their Existence in Surabaya: A Dynamic System Approach

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Abstract:- With the national policy program that brings Sea Toll Concepts such as port development of new, improved fleet, empowerment of maritime resources and improvement of the maritime service industry, especially in the northern region of Surabaya, which is currently the region's maritime sector development Regional and National levels. Surely it would make an impact / significant influence to the operational activities of the Naval Fleet in this case Koarmada II as one important component of maritime defense which presence in Surabaya. Using system dynamic approach, connectivity models and maritime infrastructure in the region would be constructed to capture the dynamic, the feedback relationship, uncertainty and complex factors in the container port.

The model is tested using two sskenarios of new port development which include Terminal Teluk Lamong construction scenario and Terminal Manyar (JIIPE) construction scenario. The result showed that the Koarmada II should implement the strategy of KRI operation and mobility to take activity of the demand for port and ship visits the future in this region are increasing and dense so vulnerable to threats on its own base Koarmada II.

Keywords:- *Sea Toll Concept, Koarmada II Region, Dynamic System.*

I. INTRODUCTION

In the medium-term development period of 2015-2019, the Concept of Sea Toll Road was implemented for the purpose of increasing the performance of sea transportation through improving domestic and international shipping networks, decreasing dwelling time as the main obstacle to national port performance, and increasing the role of Indonesian sea transportation which has only reached 4 % of all Indonesian transportation, where the share is very small for an island country. Infrastructure development and maritime connectivity become important part in the context of accelerating economic growth and national equity. And of course it cannot be separated from the role of the Indonesian National Army (TNI) which contributes in the field of maritime defense.

East Java Province plays a strategic role in the maritime axis policy, namely as a chain of connectivity as well as distribution and logistics channels in the archipelago. East Java also has a large fishery potential and is currently being developed. The existence of port infrastructure is also built with adequate quality and quantity to support the development of the maritime and marine sector. Efforts to improve sea transportation infrastructure include expansion and improvement of Tanjung Perak port, improvement of shipping safety facilities, improvement / construction of navigation assistance facilities in Surabaya and construction of airport facilities. Increased Injasmar also plays an important role in supporting the maritime sector in this region, including the development of shipyards and docks in the ports of Surabaya and Gresik.

Tanjung Perak Port is a port that has an important role in East Java because most of the port-related activities are in the Port of Tanjung Perak. Plus the new port of Teluk Lamong in Perak and the development of the Java Integrated Industry and Port Estate (JIIPE) area in Gresik. These two industrial estates and ports will continue to grow and become the largest port in Indonesia.

With the development of maritime and maritime sector in East Java Province, of course it will have a significant impact on the activities and operations of Koarmada II in Surabaya. Because as it is known that the rise of the strategic defense industry (instrahan) has resulted in an increase in the number of TNI ALutsista in this case the KRI element in order to strengthen the strength of maritime defense. Thus, it can be ascertained that the operational activities of Koarmada II will be increasingly dense and complex. If faced with the development of the maritime sector, it is likely that the KRI's mobilization and maneuver will become more constrained even though the demands of the operation must move quickly and as soon as possible towards the target area of operation.

Therefore, in this study the impact of the development of the maritime sector on the operational activities of the Koarmada II in Surabaya will be studied. Policy analysis on the impact of the development of the maritime sector will be carried out with a dynamic system approach.

II. RESEARCH METHODS

A. Stages of Identifying Variables and Model Conceptualization

Stages of variable identification and conceptualization of the model are the stages of initial recognition of the entire system to be modeled. This stage is done to get the variables and parameters to be used in modeling. It starts with the identification of variables from the entire system related to the maritime area development system which influences the operation and existence of the Koarmada II in Surabaya, by making the input output diagram shown in Figure 1.

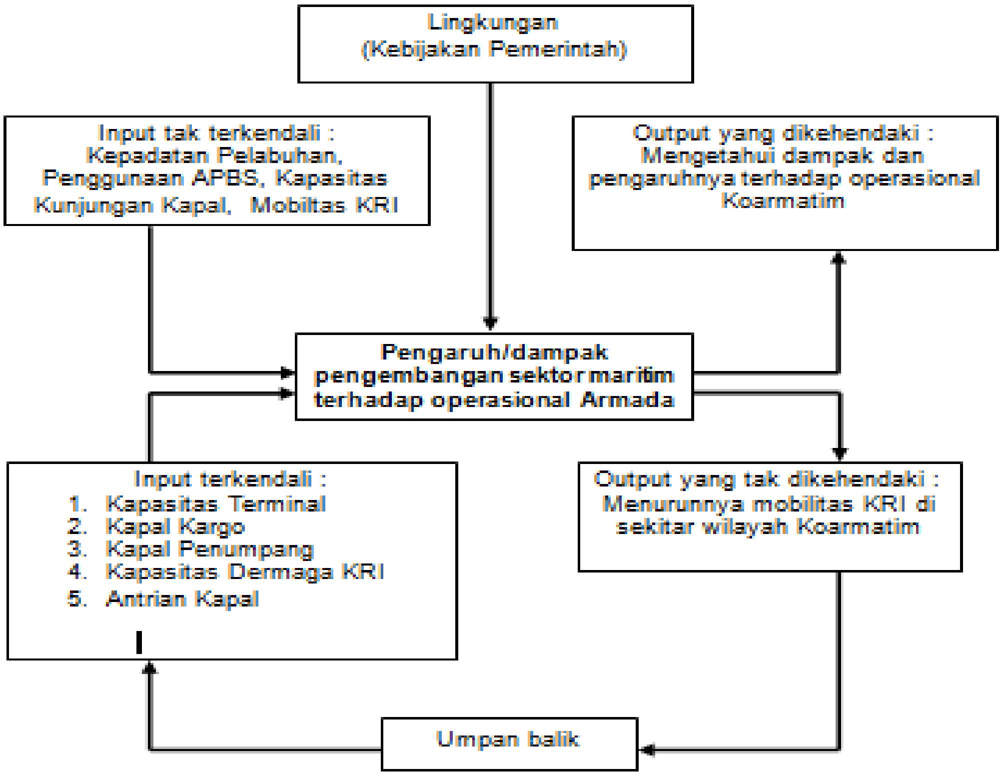

Fig 1:- Input Output Diagram

While the conceptualization of the model is done by making a causal loops diagram that shows the causal relationship and the relationship between variables, so that being able to represent the system identified, is shown in Figure 2.

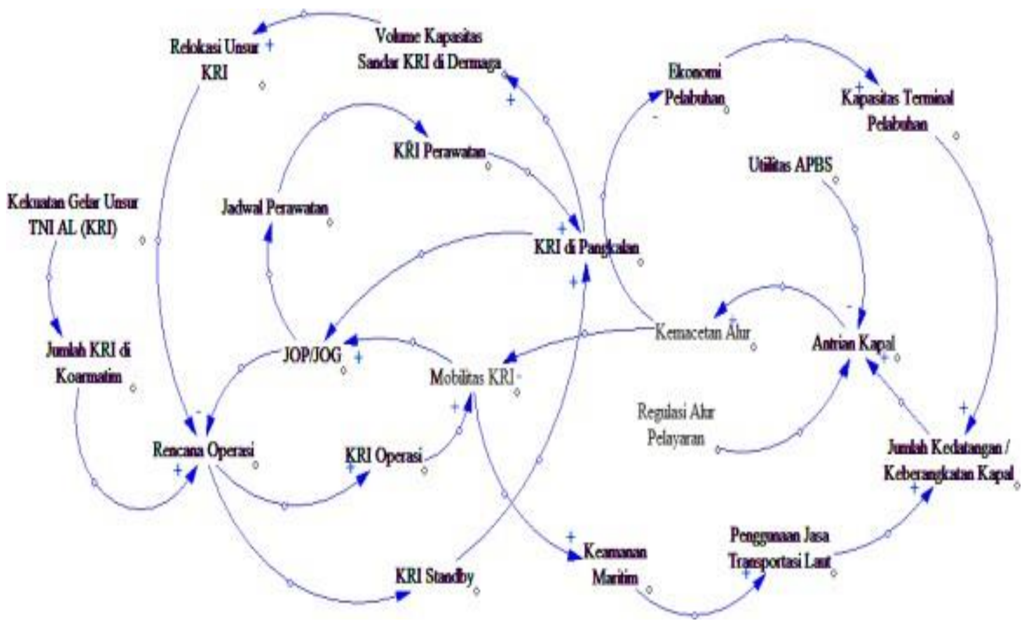

Fig 2:- Causal Loops Diagram

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B. Stages of Model Simulation

At this stage a model simulation is carried out with the simulation model formulation stages, running the initial model of the simulation and applying the scenario. The simulation model formulation is done based on the conceptualization of the model that has been made, then formulated mathematically the relationships between these variables according to stocks and flows (specification of the model structure and decision rules). In this formulation, parameters, feedback, and initial conditions are estimated from the existing system. The dynamic model formulation stage is the preparation of models in Vensim simulation software (Ventana Simulation). At this stage the model is also tested, there are 3 steps taken, namely model simulation, model verification and model validation. Running model is done by running the initial simulation model.

C. Stages of Policy Scenarios

At this stage, a scheme for taking policy scenarios will be carried out from the object under study. The implementation of policy scenarios was carried out with the aim of increasing the influence of the maritime sector on the operation and existence of warship fleets from the models made. At this stage it is done by changing the conditions, the time of application and / or development in the model so that the output will be different from the existing conditions. From the results of the model development simulation, then compared with the existing output and identified whether or not it has produced significant changes or not. In addition, a policy scenario analysis can also be carried out that focuses on a combination of selected and optimal scenarios.

D. Stages of Analysis and Withdrawal Conclusion

At this stage an analysis and interpretation of the model is carried out and the impact of the policy scenario is applied. The last stage is the analysis of the problems and the interpretation of the results of the modeling made, the critical variables defined, and the results of the running simulations performed. Analysis and interpretation are carried out in accordance with the research objectives. The final stage of this research is the compilation of conclusions from the entire study.

III. SYSTEM MODELING

A. Big Picture Mapping

Big Picture Mapping shows the relationship between related stakeholders in the maritime sector development system in the northern region of Surabaya, including the East Java Provincial Government, PT. Pelindo III, Port Authority and Port Authority, and Koarmada II. In addition, each stakeholder has an impact on its objectives which are interrelated with the goals of other stakeholders (Figure 3). PT Pelindo III's subsector has a goal of improving service, cargo traffic, and loading productivity. While the target of the regional government is to increase Gross Regional Domestic Product (GDP), per capita consumption and investment attractiveness index. On the other hand the Koarmada II object rests on improving the operation of the KRI and as a base for defense bases.

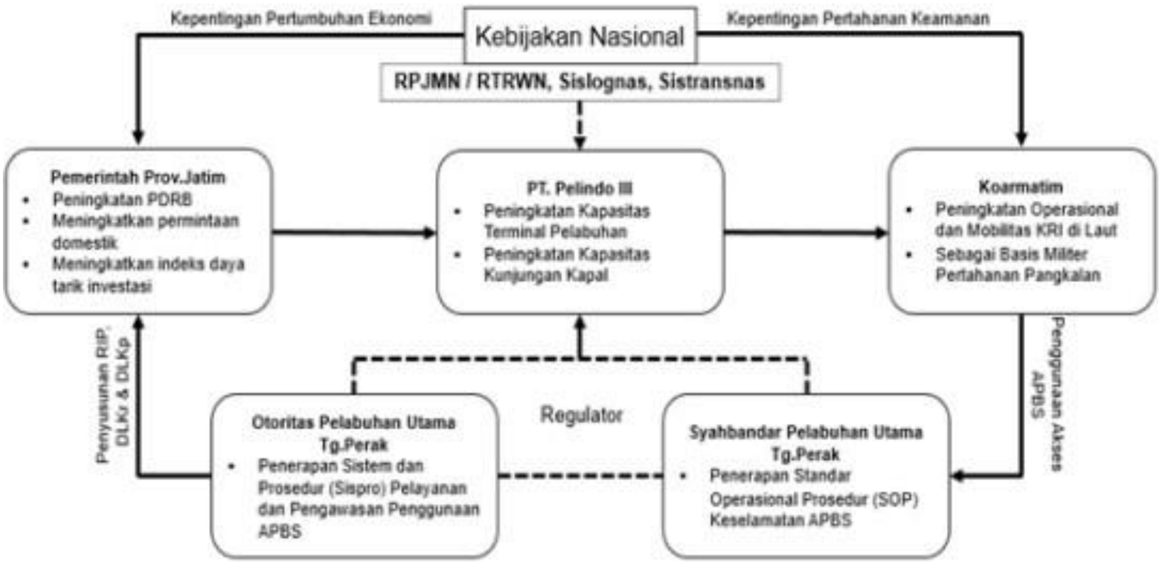

Fig 3:- Big Picture Mapping from Stakeholders

B. Stock and Flow Diagram

In the sub-section, stock and flow diagrams are depicted by simulation models of predetermined variables, while providing formulations for each variable. Each variable can show the accumulated results for Level variables, and variables in the system activity in a time period called Rate. This model is simulated to get results.

C. Main Model System

Basically, the relationship between variables has been explained at the causal loops diagram. The purpose of building a causal loops diagram is to describe the relationship between each variable, while the objectives of the main model system simplify and explain the relationship of stock and flow diagrams. So as to provide an overview of the great relationship of the system in a model.

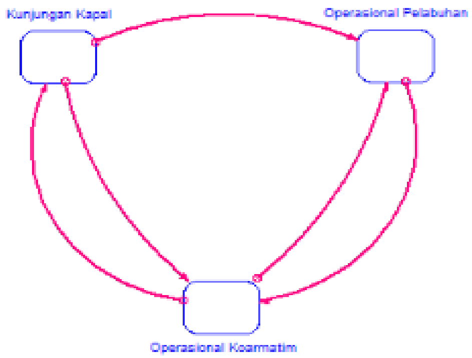

Fig 4:- Main Model of the System

The use of the APBS and shipping traffic in the port area is strongly influenced by the size of the arrival and departure of the ship. Furthermore, the influence of ship visits entering the DLKp and DLKr areas of Tanjung Perak Port and Gresik Port is the number of vessel requests as a means of sea transportation for certain purposes. Where ship demand adjusts to port service needs such as passenger ships and cargo ships / goods. In Figure 3.3, it shows the relationship of the variables that form the relationship between stock, flow and auxiliarry in the submodel of ship visits.

D. Ship Visit Submodel

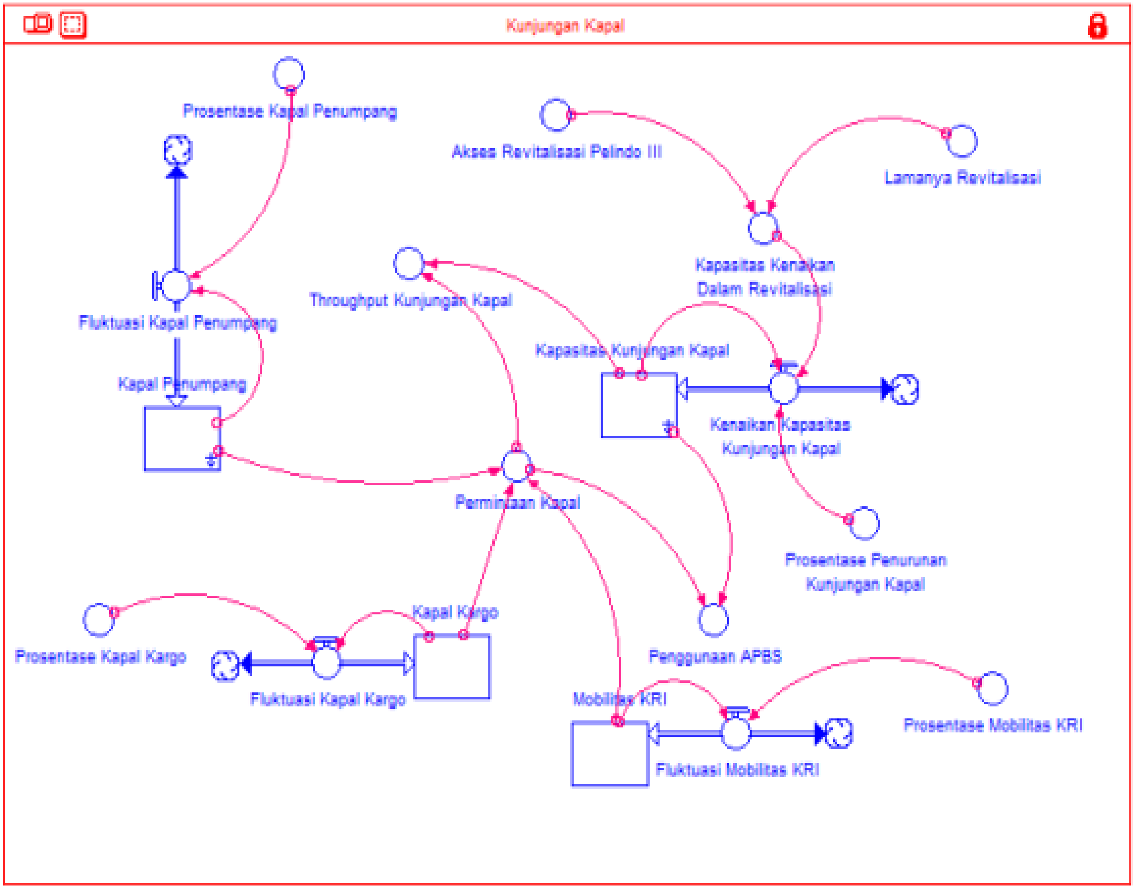

Fig 5:- Stock Flow Submodel Diagram of Ship Visits

E. Port Operations Submodel

Ports have an important function in accelerating regional economic development (Jung, 2011). Ports have many roles in the local economy such as cargo and handling passengers, providing services for ships such as bunkering and repairs, shelter for ships in the case of extreme sea conditions and storms, and terminals forming a part of the transport chain that connects sea and land. Many problems occur at ports that require detailed operational and handling techniques. Therefore, this model will discuss the prediction of port facilities that are affected by the services of the coming ships. The relationship of the stock and flow diagram is illustrated in Figure 6.

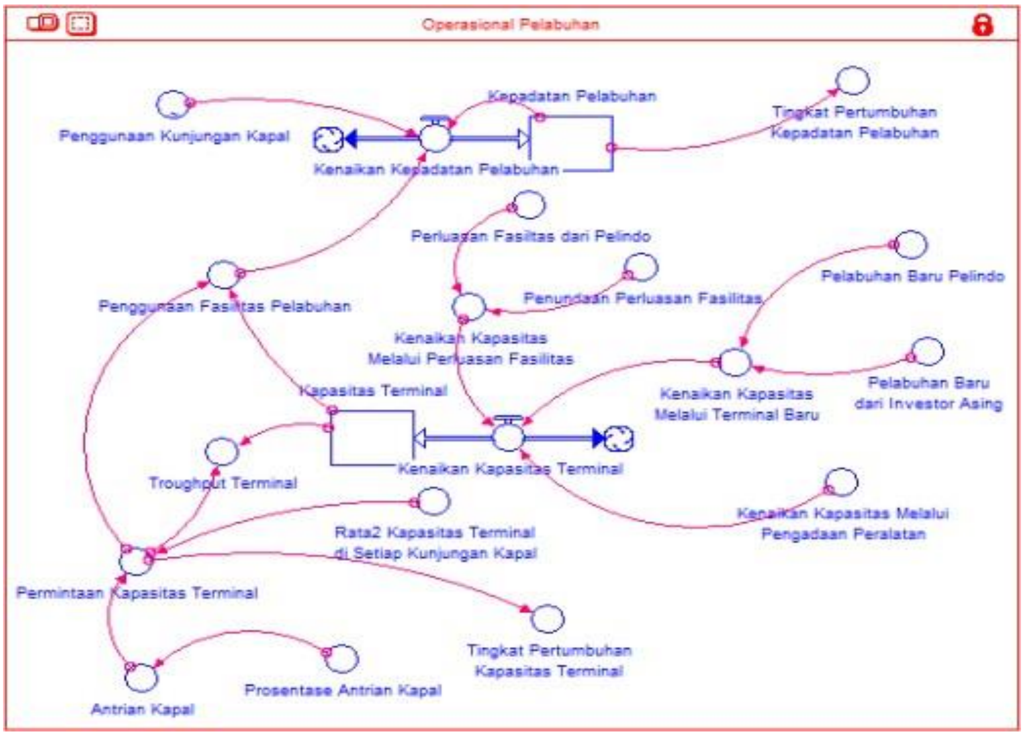

Fig 6:- Stock Flow Diagram of the Port Operations Submodel

F. Koarmada II Operational Submodel

In order to realize the gradual development of base facilities towards standardization of facilities including landing facilities, debriefing facilities, maintenance / repair facilities, the Koarmada II focused on development not only on facilities and infrastructure but on the operational development of KRI elements.

In general, the operation of the Koarmada II consists of an element of KRI operations, maintenance / maintenance and standby bases for defense and maintaining preparedness when needed in certain operations. So according to the policy of the leadership of the Koarmada II, based on the results of interviews with the Assistant Staff Officer of Operation Koarmada II, the KRI operation followed the formation of 1/3 KRI operations, 1/3 KRI care and 1/3 standby elements at the base.

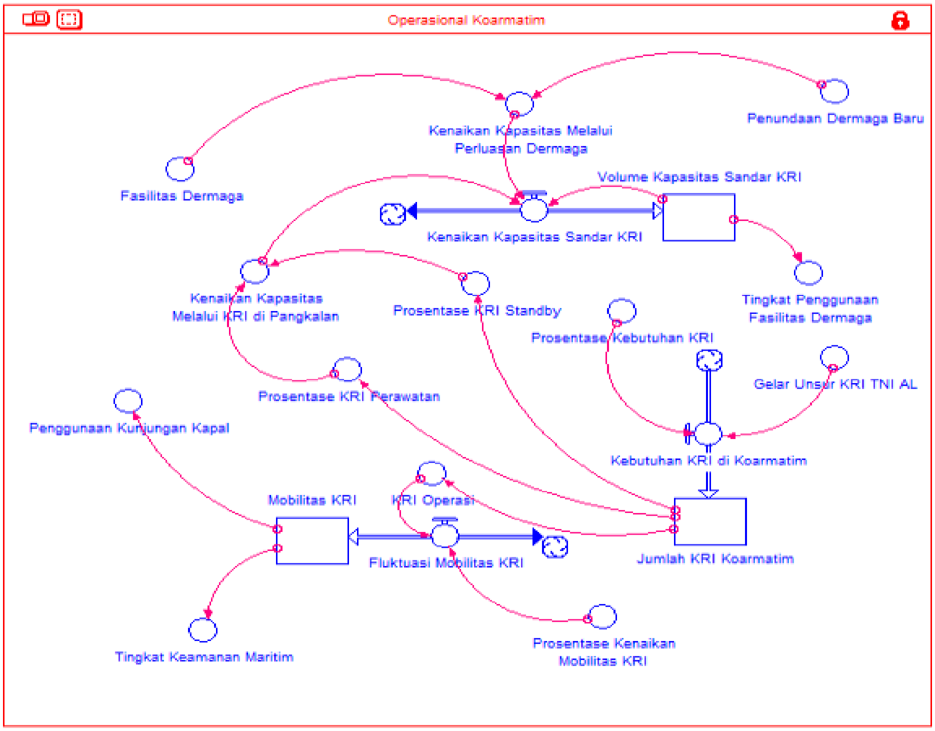

Fig 7:- Koarmada II Operational Stock Flow Diagram

G. Verification and Validation

After making a stock and flow diagram the next step is to do verification and validation. The verification and validation process is carried out aiming to test whether the model error or not, and to compare the structure of the model and its behavior with the real system structure, so that the model can approach the existing real system.

H. Model Simulation

Then the overall model simulation is carried out to get the results of the impact. The simulation is carried out for 20 years, which is the interval between 2016 and 2035. Complete results from the simulation can be seen in the Appendix. While in this section an analysis of the results obtained is carried out.

The simulation period is based on the Strategic Plan of the Ministry of Transportation, PT. Pelindo III and the Indonesian Navy. Simulations are carried out in annual terms because the area of measurement and performance evaluation is carried out every year and cannot be divided into units smaller than time.

I. Ship Visit Submodel Simulation

Figure 8 shows the use of APBS as a purple line. The blue line shows the ship visit demand variable and the orange line shows the variable capacity of the ship's visit. The vessel capacity graph decreases because it reduces the capacity to use the grooves every year. Finally, the number of uses of terminal facilities has increased which illustrates the relationship between ship visit demand and vessel visit capacity in the use of negative APBS.

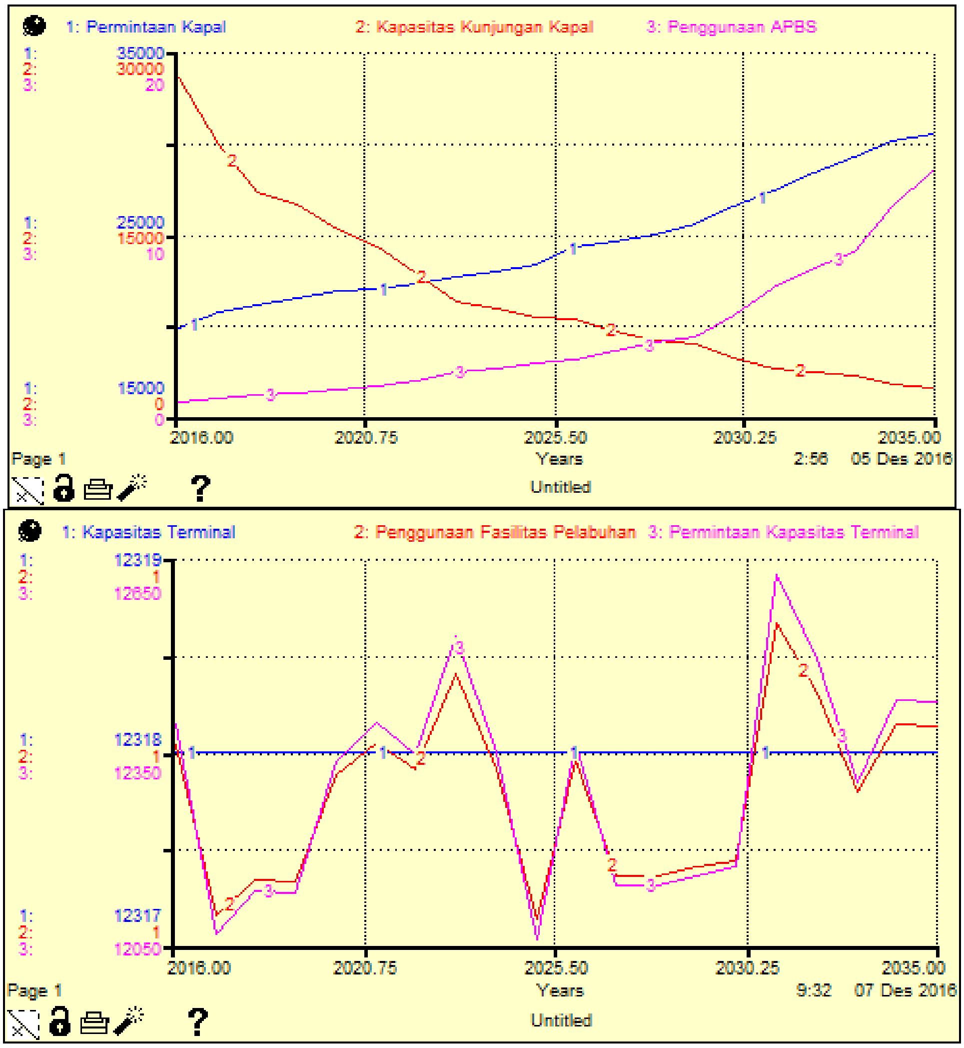

Fig 8:- Simulation of Ship Visits

J. Port Operational Submodel Simulation

Before the formulation is carried out, ship visit data and port characteristics are calculated based on the calculation of Berth Occupation Ratio (BOR) to see the capacity of the existing port capacity with the number of ship arrivals so that the capacity of the number of ships docked can be identified by the number of lego arrivals.

The equation is as follows:

$$BOR = \frac{\Sigma(P.kpl + 5)Jp)}{(PD.24.HK)} 100\%$$

Information:

P.pl: Length of Ship
HK: Calendar Day
5: Safety Factors
PD: Pier Length
JP: Number of Hours of Use of Pier

From the analysis of the above calculations, it can be seen that the capacity of the existing dock can only accommodate 60% of ship arrivals per year so that there are still 40% of ships carrying out lego or waiting for service lines at the port.

In Figure 8 shows the use of port facilities as a red line. The blue line shows the terminal capacity variable and the purple line shows the terminal capacity demand variable. The variable capacity terminal graph is constant while terminal facility requests vary during the simulation period. As a result, the use of port facilities also follows the demand for terminal capacity. Simulation data will follow a graph pattern according to input data history, despite the relationship between port facilities and terminal capacity in the use of port facilities that have a negative relationship.

K. Simulation of the Koarmada II Operational Submodel

Figure 9 shows the variable volume of KRI backrest capacity as a blue line. The purple line shows the variable KRI and the green line shows the KRI variable of the operation. In the beginning, the volume of KRI's berthing capacity decreased due to the construction and expansion of the dock, but at an interval of three years from the beginning in 2020 there was an increase as the completion of the use of the new dock. Meanwhile, the number of KRI operations continued to increase, although the relationship between volume of berth capacity and KRI of surgery had a negative relationship. A significant increase was shown in the KRI mobiltas which was a description of the activities of Koarmada II itself.

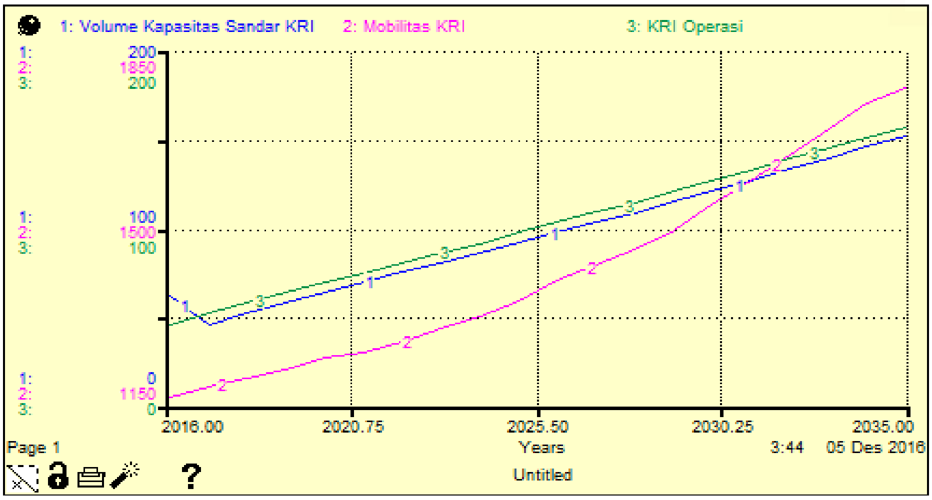

Fig 9:- Operational Simulation of Koarmada II

IV. POLICY SCENARIO

A. National Port Master Plan in the Northern Territory of Surabaya

Port development will expand the use of water areas which will increase the impact on the maritime environment. The Port Authority and the Port Operator Unit have an important role to play in minimizing the possible impacts.

Regarding this policy, the Tanjung Perak Main Port Authority sets out a DLKr and DLKp strategic plan to support maritime sector improvement policies and programs. Where the port development plan is divided into 3 stages, namely:

- Short-term Phase (2016-2020)
- Medium Term Stage (2016-2025)
- Long-term Phase (2016-2035)

B. New Port Policy Scenario

Scenario 1 is the construction of the Manyar port (JIIPE). The JIIPE area, which is a new port project that is directly integrated with a number of industries, according to Tanjung Perak 2016 RIP will complete the target of completion of stages II and III construction starting in 2018. And it is expected that the project will be completed in 2025 by calculating increased terminal capacity and meeting usage requests port in the Tanjung Perak area.

Furthermore, PT Pelindo III as a port manager in East Java Province has spent Rp 2.2 trillion in developing Teluk Lamong Terminal as scenario 2 in order to meet the increasing demands of ports in Tanjung Perak. Based on the existing Master Plan, the target of completion of construction will enter stages III and IV which will begin in 2021 and be completed in 2030.

In general, the purpose of this scenario is to see the impact of increasing port capacity. In the scenario of the construction of a new port, based on the calculation of the BOR at Terminal Manyar pier (JIIPE) the number of vessels that can be served starting in 2025 is only around 0.11% to 2.11% of the total number of ship visits up to 2025. the number of ships per lego is 32 to 34 ships. That

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means there are an additional 454 vessels per year as the terminal capacity.

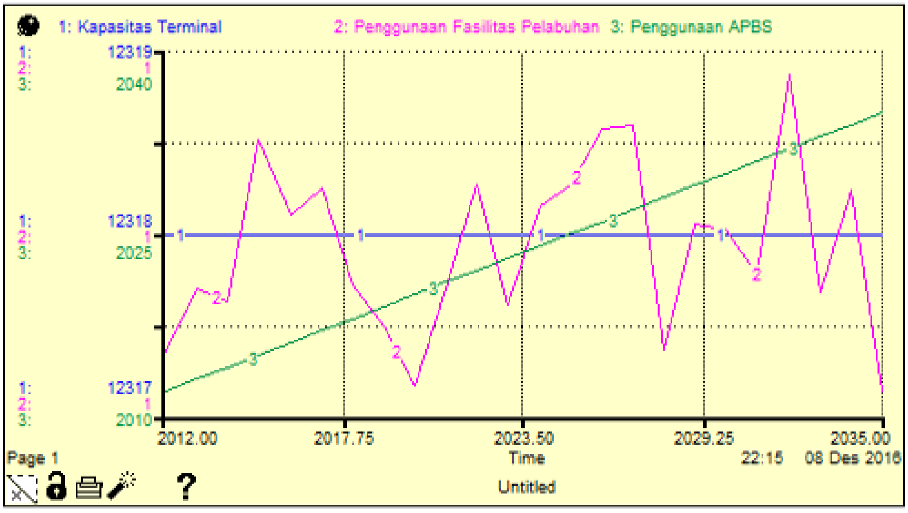
Whereas in Tanjung Perak port, with the development of Teluk Lamong Terminal, the number of vessels that can be serviced starting in 2030 is only around 60% of the total number of ships arriving. With the number of ships that are lego per day, there are 13 to 14 ships. So there is an additional capacity of 598 ships per year. The two scenarios are shown in Table 1.

Variable	Eksisting	Skenari o 1	Skenari o 2
New Port	0	454	
Extension of Terminal Facilities	0		598
Port Settlement Time	0	2025	2030

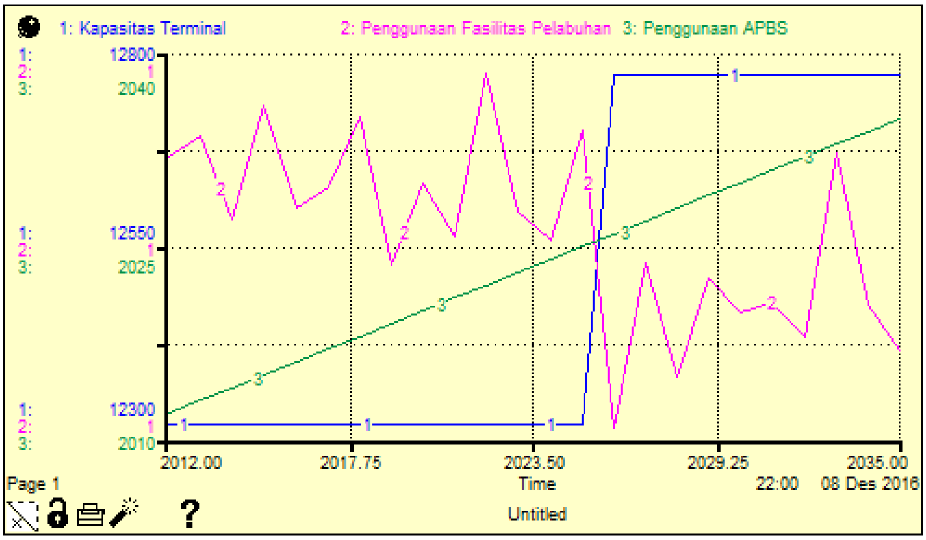
Table 1:- Scenarios for the Construction of New Ports

So that in scenario 1, terminal capacity becomes increased in the period of 2025 which is the time when PT. Pelindo III plans to complete the new port project, namely the construction of the JIIPE Terminal (Figure 10 b). Increased terminal volume capacity, namely the addition of ship visit services for berthing (blue line) increases and will continue to be stable until capacity increases again.

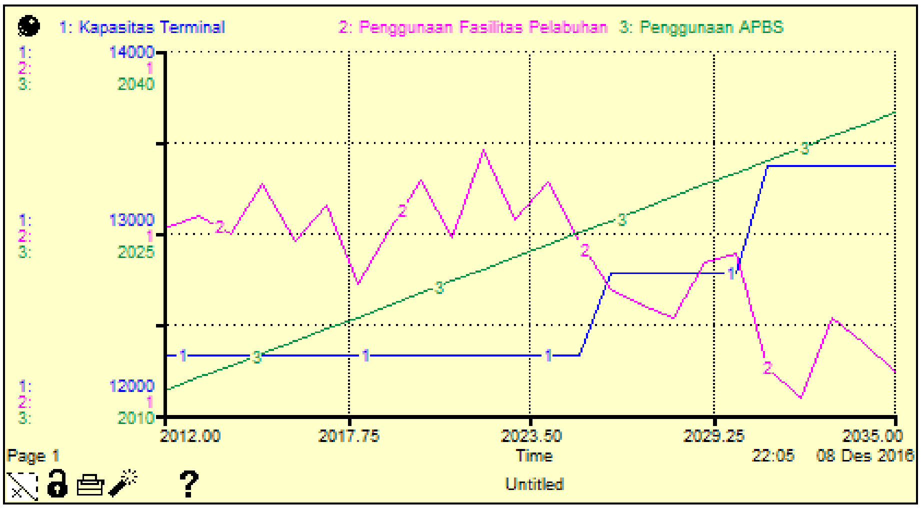
Therefore, with the existing planning, scenario 2 is built, which gives significant results to further reduce the use of this port facility. However, as seen in the graph (Figure 10 c), it is described that the more terminal capacity increases, the higher the demand for ship visits, which in particular increases the use of the APBS.



(a) Eksisting



(b) Skenario 1



(c) Skenario 2

Fig 10:- Simulation Results in the New Port Scenario

C. Policy Scenario Analysis

The policy scenario used in this study is only measuring the increase in port operations in Tanjung Perak and its surrounding areas which have been impacted on operational activities of Koarmada II through KRI mobility, where the simulation results indicate that the development of ports in the region will increase and demand will eventually increase. the use of Alur Pelayaran Barat Surabaya (APBS) becomes more congested. So that it can provide an influence and even a threat from the defense base. Because according to intellectual aspects, the use of grooves in this area can be predicted to increase the threat of underwater sabotage, so that it becomes a critical point for strategic areas as a military base.

V. CONCLUSIONS AND RECOMMENDATIONS

The modeling process using a dynamic system has been completed. Furthermore, in this chapter some conclusions will be drawn referring to the results of the study. While recommendations are given for improvement in future research.

A. Conclusion

The simulation model with a dynamic system that was created has described the relationship between the development of the maritime sector and the operational of the Koarmada II in a comprehensive manner. The conclusions that can be taken are:

- In shipping and port activities, there are observed interrelating relationships, namely ship visits, port density and terminal capacity.
- Each shipping and port submodel has a stock flow diagram that is used to determine the operational performance and the running system.
- In 2020 the number of terminal facilities could not fulfill the demand for terminal facilities at the Port of Tanjung Perak. In addition, the number of vessels visiting capacity cannot fulfill requests for ship visits at Tanjung Perak Port in the period of 2024.
- The scenario of the construction of a new port is actually able to compensate for ship visits at a certain period, which can reduce the level of use of port facilities. However, it cannot stem the speed of use of sea transportation through vessel demand along with increasing ship visit data from year to year.
- The positive impact that occurs on the scenario of developing a new port is increasing employment opportunities and increasing the GRDP of East Java Province and the growth of the National Economy. Thus it will support the development program as a whole.
- The volume of traffic and the number of vessels will increase with the development of new ports, which has an impact on KRI mobility, especially in access lines.
- The use of APBS access by the KRI as a state ship must still follow procedures, where there are regulations and sailing safety provisions that can hamper the KRI's assignment to the operating area. In addition, the presence / presence of operational elements of the KRI in this region also resulted in reduced levels of confidentiality of operations.
- The probability of threats to strategic areas of defense and security is higher, such as vulnerability to sabotage on military bases in this case the Koarmada II. This is because the access channel is free to use and open.

B. Suggestion

- In the final stage of the research there were several recommendations that could be given for further research, namely:
- For the operational implementation of the Koarmada II so that it can be adjusted by spreading all KRI elements at each base closer to the existing trouble spots.
- To be able to consider the location of the ideal base of Koarmada II as one of the factors that do not directly affect its operational activities.
- Calculating the capacity of the Koarmada II pier and Lantamal pier which are spread throughout the archipelago from the point of view of the needs of the

KRI, the use of dock facilities and the constellation of national defense threats.

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