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Integrated Marine Pikotage for Balance of Shipping Business and National Maritime Security

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***Abstract*— Marine guidance/pilotage is one of the efforts that can be implemented to improve business prospects and also to maintain maritime safety and security at sea. A balance between business processes and marine safety needs to be realized because it is the most decisive factor in national stability. The problem an in this research is how to determine the priority weight of pilotage criteria and develop strategic plans for integrated pilotage to achieve a balance between business and marine security. The purpose of this research is to develop a strategic plan for the development of activities integrated pilotage to strike a balance between business and marine safety. The method used in this research is the determination of criteria based on the concept of the Delphi method and weighting the priority of criteria based on the hierarchy using the Analytical Hierarchy Process (AHP) method. The research results obtained 5 (five) significant criteria for the preparation of an optimal integrated marine scouting strategy. Based on the AHP concept, a weighting value of the 5 criteria of the strategy is obtained, which includes: (1) National economic development with the highest weight, 0.42, (2) National shipping safety with a weight of 0.23, (3) Economic improvement through the use of the sea as a source of the national economy with a weight of 0.18. (4) State sovereignty in the sea with a weight of 0.11. (5) Increased trade by sea with a weight of 0.06. Furthermore, the planning of 6 (six) Main Strategies of Pilotage at Sea is carried out as outlined in the Road Map of the selected Strategy based on the results of the weighting.**

Keywords*— *Marine Pilotage Strategy, Business Balance and Maritime Security, Delphi, and AHP Methods.

I. INTRODUCTION

Maritime security is a global issue that has continued to develop in the last few decades. Understanding the concepts and thoughts related to maritime security is very dependent on understanding the maritime domain that is faced with the national interests of a nation. The maritime security domain is related to several aspects which include; maritime physics, physical management activities, rules regarding its management, and maritime area management culture. If mapped in the interests of the nation and state, the maritime domain has political, economic, social, and military aspects with a very strong weight as Drivers to develop national interests [1].

Could be explained There are at least four indications that the maritime or marine area has a very important value for human history, First, the sea has a natural resource potential, which is very large, Second, the sea is a medium of transportation and exchange, where it can be explained that sea transportation is a local affair, but marine technology continues to develop, marine transportation that is local and regional, can be a system that can dominate the world and create a system of colonization. Third, the sea is a medium of information and dissemination of ideas. Fourth, the sea is a medium of domination, meaning that the sea is a strategic position where a country/community can be attacked or attacked, it is not surprising if various countries compete or

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seek sources of instability (security), the support of the national economy, the arena of international political- diplomatic cooperation, aligning nation and socio-cultural society, all of which indicate that the maritime domain has a strong weight to be used as drivers for the life of the nation and state [2].

According to Aghil et al (2017), the sea route is still the prima donna in the business world because of its high carrying capacity and more competitive costs compared to other modes of transportation [3]. Bozorgpour (2017) compares the carrying capacity between land, sea, and air transportation modes with truck capacity as a standard for comparison [4]. The comparison shows that the transport capacity of sea transportation is much larger than other modes of transportation, as can be seen in Figure 1 below.

Vehicle	Capacity	Truck Equivalency
Barge	1500 Tons 52,500 Bushels 453,600 Gallons	57.7 (865.4 for 15 barges in tow)
Hopper car	100 Tons 3,500 Bushels 30,240 Gallons	3.8
100 car train unit	10,000 Tons 350,000 Bushels 3,024,000 Gallons	384.6
Semi-trailer truck	26 Tons; 910 Bushels 7,865 Gallons 9,000 for a tanker truck	1
Panamax containership	5,000 TEU	2,116
VLCC	300,000 tons 2 million barrels of oil	9,330
747-400F	124 tons	5

Figure 1. Comparison of transport capacity between modes of transportation

(Bozorgpour, 2017)

Apart from the capacity aspect, the costs required for the implementation of transportation through sea transportation modes are also worth comparing with other modes. The comparison of transportation costs between transportation modes conducted by Damdinsuren & Ishdamba (2017) shows that transportation via sea transportation has a competitive value compared to other modes [5]. This comparison can be seen in Figure 2 below :

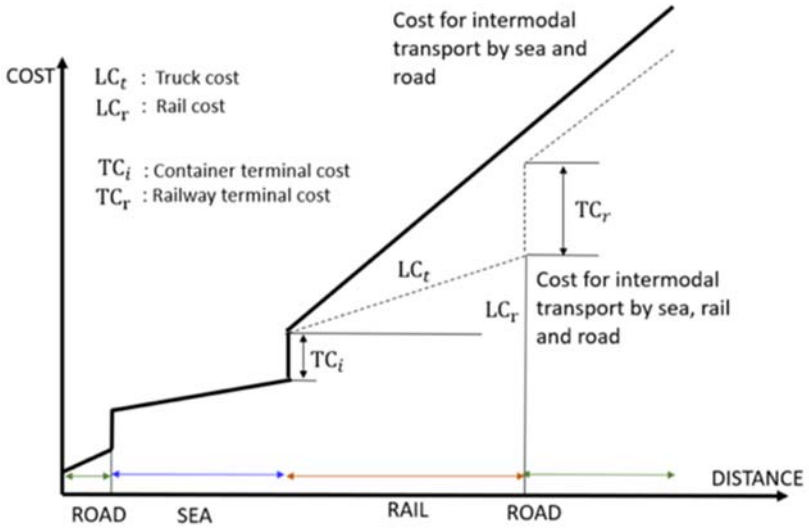

Figure 2. Sea, Land, and Train Intermodal transportation costs
(Damdinsuren & Ishdamba, 2017)

In the maritime world, there are six Choke Points, namely the Panama Canal, the Suez Canal, the Bad El Mandep Strait, the Bosphorus Strait, the Strait of Hormuz, and the Strait of Malacca. Density at the choke point occurs because the shipping lane is a world economic transportation route Sea Lines of Communication (SLOC) and shipping lane for the world's tankers or Sea Lines of Oil Trade (SLOT). The choke point, SLOC, and SLOT areas of the world can be seen in Figure 3.

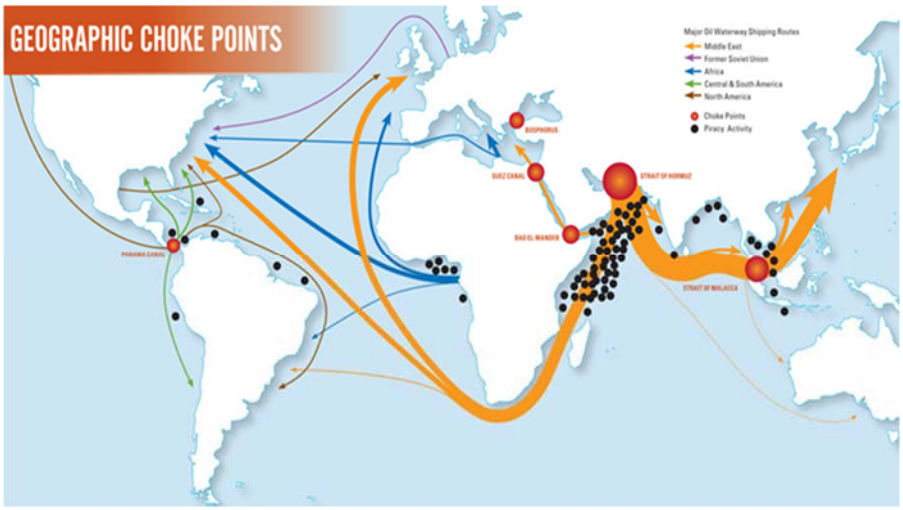

Figure 3. Choke Point, Sea Lines of Communication, and Sea Lines of Oil Trade in the world [6]

(Ersoz, & Karaman, 2011)

The Strait of Malacca as one of the six choke points has a length of 550 nautical miles or about 900 km and connects the Indian Ocean and the Pacific Ocean. There are ±100,000 ships per day or almost 50% of the world's trade ships passing through this strait. The business value obtained can reach USD 435 billion. The Strait of Malacca is also the busiest stopover for tankers in the world. A total of 16 million barrels per day which is equivalent to a third of the world's oil or 70% of oil in Asia passes through the Malacca Strait [7]. This makes the Malacca Strait a strategic and important sea transportation route to support the growth of the business world [8].

From a maritime perspective, the Malacca Strait has vulnerabilities because in this Strait there are the narrowest SLOC and SLOT shipping lanes in the world, namely 1.5 Nautical Miles, and there is a shallowness of about 25 meters so, in the Malacca Strait, no less than 60 ship collision accidents occur every year [9]. In addition, to ship collisions and running aground, other shipping accidents are very likely to occur, such as fires and shipwrecks. In addition to the danger of navigational accidents, the Malacca Strait is also prone to piracy (Armed Sea Robbery), namely theft or robbery carried out on ships sailing across the Malacca Strait. Besides vulnerabilities to security and safety that can harm business people, many other vulnerabilities harm the state such as smuggling, illegal immigrants, and transnational crimes.

Activities to maintain the security and safety of shipping in the Malacca Strait require a relatively large cost. For countries that are not yet classified as developed countries, the use of funds for operational activities is considered quite burdensome to the burden of the state budget, so a "Gun or Butter" dichotomy arises, the namely classical model of the production possibilities curve using the relationship between "weapons" (military or security budget) and "butter" (food needs or Economics and Business). The term indicates that in the use of a country's budget, an increase in one part will have an impact on a decrease in the other part [10]. However, according to Habibi et al (2015), if the Government can handle it well, then the dichotomy will turn into a Gun and Butter continuum, namely security that is still guaranteed by not putting economic growth or business development at the bottom of the list [11]. To achieve this, an appropriate strategy is needed in dealing with the sea transportation system so that there is a balance between efficiency, for business people, and the effectiveness of government agencies in maintaining the security and safety of shipping in the Malacca Strait.

The strategy that can be done to achieve this balance is to apply Integrated Sea Pilotage, which is a model of deterrence and enforcement of shipping safety and security that is carried out comprehensively by combining Deep Sea Piloting and civil security personnel who are on board or on board the ship during a voyage in the Straits. Malacca is part of the safety and security system

for sea transportation service users. With the implementation of Integrated Sea Pilotage, it is expected to be able to fill the void in the patrol sector, streamline security operations and streamline security patrol costs in the Malacca Strait, in addition to increasing state revenue from the piloting charge and providing opportunities for the creation of new jobs. Moreover, this Integrated Sea Pilotage reduces the allocation of patrol boats in the Malacca Strait so that security patrol boats at sea can be used for patrols in other patrol sectors.

Based on studies on previous research on maritime security which focused on research on security and efficiency, this research was made as a development of the previous study. The results of previous research that can be used as a grand theory are: First, the potential threat to maritime security, either directly or indirectly, is very dynamic. Such is the magnitude of the threat that exceeds the value of the business itself [12]. Second, therefore, security is an essential prerequisite of modern transport operations [13]. Third, business in the era of globalization provides opportunities to do business across national borders which has a high risk of threat as well. For this reason, the allocation of costs for insurance in businesses that use sea transportation services is absolute [14]. Fourth, so that insurance premiums are relatively not high, maritime security certainty is a prerequisite that must be met. For this reason, the involvement of armed forces in overcoming security disturbances is a very natural thing, because basically, the security created by the military is to provide support for business people [15]. Fifth, in the context of regulations or arrangements for users of sea transportation services in the Malacca Strait, as a strait used for international shipping, referring to the Toress Strait case study, Pilotage in internal waters is something that can be accepted and applied by coastal states unilaterally (Peter & Ball, 2016), so it is very reasonable if the Government of Indonesia implements Mandatory Pilotage for users of sea transportation services in the Malacca Strait [16]. Sixth, this is reinforced by the opinion that there is a need for a commitment to environmental protection and the protection of the local population . Seventh, factors of health and environmental protection, should be part of the regulation. Eighth, it is proven that the human factor is the main cause of accidents at sea (Bateman 2010), so the presence of Pandu is expected to reduce accidents in the Malacca Strait, considering that Pandu is relatively more in control of the terrain. Ninth, there is a relationship between the costs incurred for increased security with the security obtained and increased profits [17]. Tenth, so that business actors can increase their profits with relatively low-security costs, then there is a role that should be fulfilled by policy actors, in this case, the government. Eleventh, as more and more security systems are implemented, there are consequences for distribution speed and efficiency, so a balance is needed [18].

The problem in this study is how to determine the criteria and priority weights for scouting as well as how to develop an integrated pilotage strategy to achieve a balance between business and national maritime security. Furthermore, the purpose of this research is to develop a strategic plan for the development of integrated pilotage activities to achieve a balance between business and maritime security. This research is systematically organized in the following forms: Part 1 introduction, Part 2 shows the material and method, Part 3 shows the results and discussion and section 4 is the conclusion and suggestion.

II. Materials And Methods

2.1. Maritime Security Concept

First, Security is a recognizable face of a country. Security is a reality that determines the sovereignty and safety of a nation and state. In addition, security is a national need that exists in and is the main since the sovereignty of a country gets recognition. According to Budiarjo, State Security grows and develops in a political system related to the implementation of the state defense function within the framework of the political system. Three important issues need to be raised in the topic of Defense Science in the dimension of the International system. First, the existence of defense science must be able to accommodate the interests of the state so that it can be accepted as a theoretical, conceptual, and systematic reference by academics. Second, the existence of defense science can take the relevant principles of interaction between countries such as international cooperation for the development of defense science. Third, defense science develops security concepts, especially human security as a strengthening factor for defense science in the position of state defense and security.

Meanwhile, the concept of security maritime is generally understood as a concept that emphasizes aspects of national interests in the maritime domain and how the existing actors play a role in maintaining marine safety. On the other hand, United Nations (UN) defines maritime security by explaining the existence of various maritime threats, such as sea piracy, fishing, maritime terrorism, smuggling drugs, arms trafficking, and environmental pollution. While Bueger (2015) explains that maritime security has closely related to the concept of maritime resilience; safety and marine waters resilience; effort develops maritime security and response to various hazards above crime on the sea. Therefore, to address maritime threats it needs to involve not only

government actors, but also the community. Thus, maritime security can be understood as a joint effort to create good order in the sea. Based on the definition of the various experts above can be concluded that the concept of maritime security can from an economic point of view, be defense and sovereignty. From a defense and economic perspective, every country that owns the sea area can be positioning the area as an important area because it saves marine potential..

2.2. Strategic Management Concept

Good strategic management can lead an organization to be able to implement its strategy through program planning, budgeting processes, performance management systems, changes to organizational structures, and program and project management. In addition, strategic management theory can be related to a strategic plan that is carried out to plan a strategy in making decisions to realize the desired goal.

Another definition of strategic management is a series of fundamental decisions and actions made by top management and implemented by all levels of an organization to achieve the goals of the organization.

2.3. Integrated Marine Pilotage Concept

Integrated Marine Pilotage is a model of deterrence and enforcement of shipping Safety and security which is carried out comprehensively by combining Deep Sea Piloting and Security Personnel who are on board or on board the ship during shipping at sea as part of the safety and security system for users of transportation services at sea. With the implementation of Integrated Sea Pilotage, it is hoped that it can fill the void in the patrol sector, streamline security operations and streamline the cost of security patrols at sea, in addition to increasing state revenue from the piloting charge and providing opportunities for the creation of new jobs in the maritime sector.

Integrated marine Pilotage is also a win-win solution to the rejection of the existence of Maritime Private Security which is currently considered to interfere with the interests of coastal states, due to legal problems regarding the presence of weapons on merchant ships, such as: Which country has the authority on the use of weapons, which country's legal regime will be applied to the use of lethal force, what if the flag state and the coastal state differ on the interpretation of the law and the use of lethal force.

2.4. Delphi Analysis Concept

The Delphi method is a method that is carried out by making a series of rounds of questionnaires given to experts to reach a consensus on their opinions. The Delphi method was developed in the early 1950s by Derkley and his associates at the Rand Corporation, California. This method is recommended as a form of structured group communication process. Because repeated questionnaires used as the main tool can reduce the dominance of individuals to develop a consensus on a matter. This technique aims to avoid the friction that occurs due to the prominence of someone's idea that is better than someone else's idea in a forum to achieve a concession.

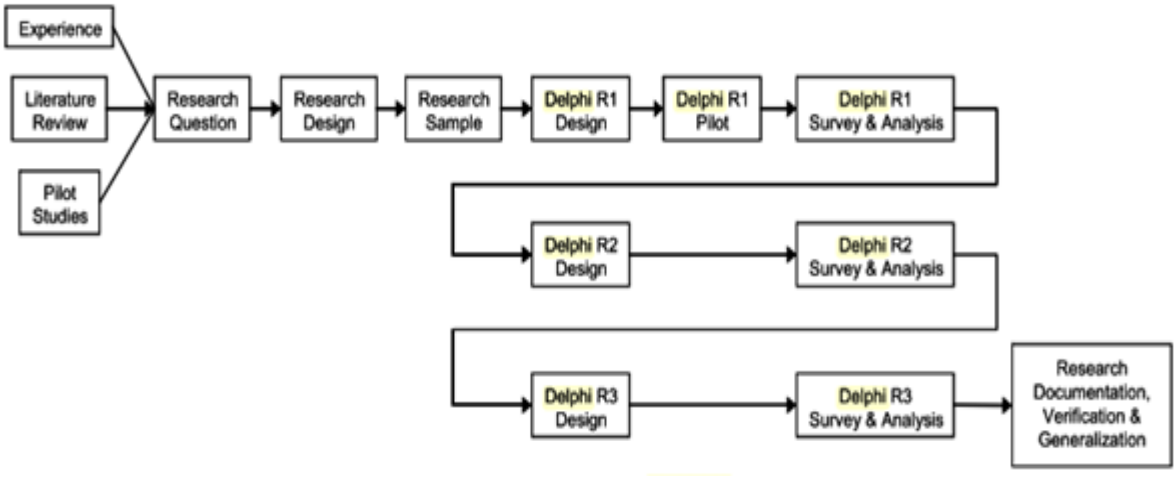

Figure 4. Delphi Analysis Concept

In the Delphi concept, expert panelists are selected and their identities are kept confidential. This group of expert panelists is

selected selectively and their position represents several experts who understand the problem for which a consensus is to be found. These expert panelists were then asked to fill out a written questionnaire and collect it. After collecting this first result, the answers of the panelists will be combined to create new questions in the next round of questionnaires. The process of taking answers to this questionnaire will be repeated several times until a consensus is reached from the overall answers of the expert panelists.

2.5. Concept of AHP (Analytical Hierarchy Process).

AHP analysis or Analytical Hierarchy Process is an analytical method that was developed to find a priority order or ranking of various alternatives contained to solve problems. This analysis was developed by Prof. Thomas L. Saaty (1964) of Wharston Business School.

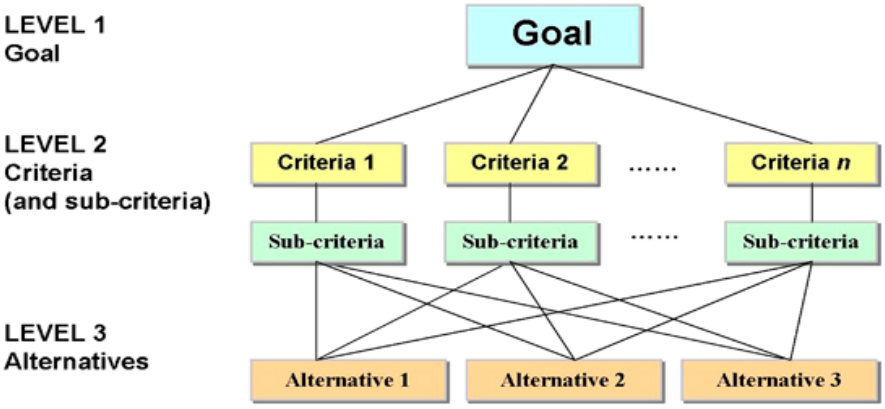

Figure 5. Concept of AHP Analysis.

In complex circumstances, decision-making is influenced by many factors that cover various levels and interests. So it is necessary to determine priorities and test the consistency of the various options that exist. AHP is a general theory of measurement used to find the ratio scale of discrete or continuous pairwise comparisons. This comparison can be obtained from an actual measure or a basic scale that reflects the strength of feelings and relative preferences.

2.6. Research Methods and Steps

Target this research aims to obtain an optimal strategy that has a weight that can be implemented to ensure the balance of business and maritime security. The method of steps of this research are: (1) the first step, filtering all the criteria that affect the influencing process with the Delphi method, (2) the second step, analyzing the criteria, (3) the third step analyzing the marine Pilotage system and weighting criteria and strategies using the AHP method, (4) The fourth step provides discussion, suggestions for improvement and conclusions.

III. Results And Discussion

3.1. Delphi Analysis for Determination Criteria.

The analysis of the Delphi method is very suitable for compiling criteria for determining the right Pilotage Strategy. The Indonesian government's initiative by initiating the implementation of scouting in the Malacca Strait is very reasonable, although at this time the scouting is still voluntary. When viewed from the traffic density, navigational hazards, and other vulnerabilities, the implementation of Mandatory Scouting in the Malacca Strait should have become an urgent need. The reasons for the Indonesian Government to enforce the Pilotage in the Malacca Strait at this time are issues of sovereignty, maritime security, marine safety, trade interests, economic development, and others. The Malacca Strait Extraordinary Pilotage includes:

a. Pilotage crossing the Straits of Malacca and Singapore (± 48 Nm) from Iyu Small Island to Nongsa Island / Batam.

b. Guide from North Belawan Port to Tanjung Balai Karimun STS Transfer area.

c. Pilotage from North Belawan to the Nipah Transit Anchorage Area - NTAA .

d. Guide from North Belawan to P. Nongsa / Batam.

e. Guide from North Belawan to Horsbourgh Beacon.

f. Guide from North Belawan to Kuala Tanjung Port, Dumai Port and Pakning River (Bengkalis).

g. Pilotage from Horsbourgh Suar to the Tanjung Balai Karimun STS Transfer area, NTAA, Kuala Tanjung Port, Dumai Port and Pakning River (Bengkalis), Belawan Port, Lhok Seumaue Port.

Figure 6. Criteria for Implementing Extraordinary Scouts based on the Delphi Concept.

In the Delphi concept, expert panelists are selected and their identities are kept confidential. This group of expert panelists is selected selectively and their position represents several experts who understand the problem for which a consensus is to be found. These expert panelists were then asked to fill out a written questionnaire and collect it and develop the criteria. Based on the analysis in Figure 6, the implementation of the Extraordinary Scout Pilotage, the criteria for the Assessment of Business Balance Strategy, and maritime security in the Malacca Strait are developed. Preparation of criteria on This research phase uses the concept of the Delphi method so that several significant Criteria (X) are obtained for the balance of business and maritime security in the Indonesian Malacca Strait, namely:

(1) Criterion X1: National economic development,

(2) Criterion X2: State sovereignty at sea,

(3) Criterion X3: National shipping safety,

(4) Criterion X4: Increased trade by sea, and

(5) Criterion X5: Economic improvement through the use of the sea as a source of the national economy.

From the results of the criteria obtained from the Delphi results, the priority order of Criteria will be determined using AHP (Analytical Hierarchy Process).

3.2. Determination of Criteria Weights using AHP (Analytical Hierarchy Process)

The next stage of this research is processing the Delphi concept questionnaire data followed by determining strategic priorities through the AHP (Analytical Hierarchy Process) method and in this data processing process is carried out using Excel Software, with the data processed is questionnaire data which is a perception respondents/ experts regarding the Criteria of an integrated pilotage strategy for the balance of shipping business and maritime security. The following are the results of the Matrix Normalization of integrated guiding criteria with the concept of Pairwise Comparison.

Table 1. Result of Normalization of Matrix Criteria

Criteria	X1	X2	X3	X4	X5
X1	1	5	3	5	2
X2	0.2	1	0.25	4	0.5
X3	0.333333	4	1	5	1
X4	0.2	0.25	0.2	1	0.5
X5	0.5	2	1	2	1

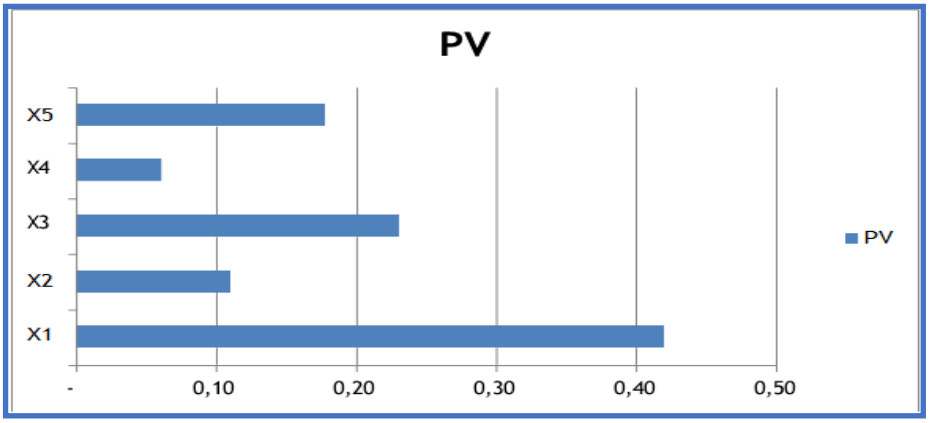

Figure 7. Results of Pairwise Comparison between Criteria

Pairwaise-comparison Value (PV), X1=0.42, X2=0.11, X3=0.23, X4=0.06, X5=0.18

At this stage, the weighting of pairwise comparisons against the criteria has been carried out and the weighting of an integrated pilotage strategy for the balance of the shipping business and sea security, namely the weighting between Criteria (X), with 5 criteria which include: National economic development (X1), Sovereignty of the state at sea (X2), National shipping safety (X3), Increased trade by sea (X4), Economic improvement through the use of the sea as a source of the national economy (X5).

Based on the results of the total weight values in the Figure above, it can be seen that the strategies that have a major influence in determining the development of integrated pilotage for the balance of shipping business and maritime security are:

a) National economic development (X1) with the highest weight of 0.42.

b) National shipping safety (X3) with a weight of 0.23.

c) Economic improvement through the use of the sea as a source of the national economy (X5) with a weight of 0.18.

d) State sovereignty in the sea (X2) with a weight of 0.11.

e) Increased trade by sea (X5) with a weight of 0.06.

3.3. Development Suggested Strategy

After the results of the various stages of analysis that have been carried out, the next step is to formulate an integrated pilotage development strategy for the balance of the shipping and maritime security business, which includes a strategy for fulfilling Human Resources, improving the quality of Human Resources, and several integrated pilotage development strategies for business balance. shipping and maritime security. The strategy was made so that in the development of integrated pilotage for the balance of shipping business and maritime security, it can create a balance between business and maritime security.

The following is a recommendation for the formulation of an integrated pilotage development strategy to balance the shipping

business and maritime security. An Integrated Pilotage strategy has multiple benefits both for navigation safety and preventing the threat of criminal acts at sea, such as piracy and smuggling. For this reason, besides analyzing the balance between business efficiency and security effectiveness. The research will also include the extent to which sea transport service users support this Integrated Pilotage strategy.

Table 2. Recommendations for the Formulation of Integrated Pilotage Strategies

	Main Strategy of Guiding at Sea		Road Map (*Month)		
No.	Strategy Code	Strategy Name	Time	Start	Done
1	S1	Development of tactical level, strategic level of Marine Pilotage to policy level that can be implemented in real-time.	60	0	60
2	S2	Development of appropriate and required equipment for marine scouting to improve aspects of law enforcement at sea.	12	6	18
3	S3	Improve the socialization of integrated scouting in a systematic, planned, and sustainable manner.	24	12	36
4	S4	Improve and develop supervisory capabilities in the maritime sector	24	24	48
5	S5	Improve and develop work synergies across all components at sea to balance business and maritime security	36	24	60
6	S6	Develop human resources following the qualifications of all stakeholder agencies related to marine scouting and national maritime security	36	24	60

The next step is to develop a selected Strategy Implementation plan in the form of a real implementation schedule for Strategy implementation which can be explained in Figure 8 below.

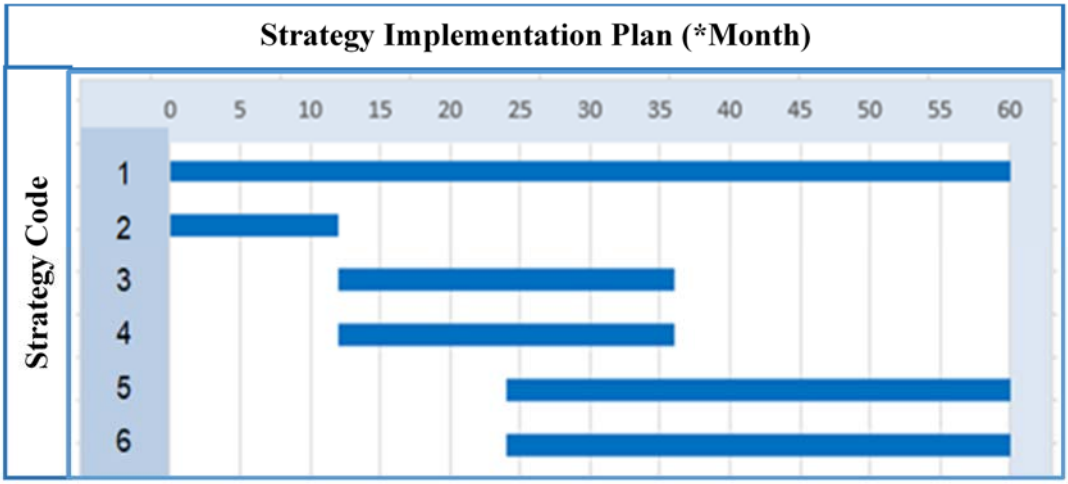

Figure 8. Implementation Plan / Road Map Strategy

The strategy implementation plan is prepared based on a schedule associated with the strategic priority scale, which is the result of weighing the importance of the implementation of the selected strategy.

IV. Conclusion

Based on the results of the study, it was found that 5 criteria were weighted in the preparation of an integrated Marine Pilotage Strategy, which included: (1) National economic development with the highest weight, 0.42, (2) National shipping safety with a weight of 0.23, (3) Economic improvement through the use of the sea as a source of the national economy with a weight of 0.18, (4) State sovereignty in the sea with a weight of 0.11, (5) Increased trade by sea with a weight of 0.06.

Furthermore, it was analyzed and obtained 6 main strategies, namely (1) Developing the tactical level, and strategic level of Marine Pilotage to the policy level that can be implemented in real terms, (2) Development of appropriate and required equipment for marine scouting to improve aspects of law enforcement in Indonesia. sea, (3) Increase socialization of integrated scouting in a systematic, planned, and sustainable manner, (4) Improve and develop supervisory capabilities in the maritime sector, (5) Improve and develop work synergies across all components at sea to balance business and maritime security, (6) Develop human resources following the qualifications of all stakeholder agencies related to marine scouting and national maritime security.

By looking at the weight values obtained in the AHP analysis, the main priority in an integrated pilotage strategy to achieve a balance of business and marine safety is the development of the tactical level, the strategic level of Marine Pilotage to the policy level that can be implemented in real terms. The current condition is that there are still many disturbances to navigation at sea and maritime security from piracy and smuggling. So the strategy that must be carried out is to collaborate with agencies related to sea security to be able to ensure shipping safety and sea security. Integrated Pilotage can be a solution to achieve business goals and also improve maritime security. Marine security is maintained, and the economy is improving.

Disclosure of Conflict of Interest

The authors declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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