An Overview of Empowering Global Maritime Technology on Indonesia Seaweed Industries Innovations in 2045

Bayu Mangkurat[1,2,3]

[1]Coordinating Ministry for Maritime Affairs and Investment, Republic of Indonesia.
[2]Faculty of Biology. Jenderal Soedirman University.
[3]International Women University, Indonesia
bayu@maritim.go.id

Wibawanto Nugroho Widodo[4,5], Filda Rahmiati[6], Nana Nurwaesari[7], AB Susanto[8], Agus Hery Susanto[2], Ratih Pangestuti[9], Maya Puspita[10]

[4]IKAL Strategic Center. National Resilience Institute Alumni Association (IKAL), Republic of Indonesia.

[5]Pelita Harapan University

[6]Faculty of Business, President University

7. National University, Indonesia

8. Faculty of Fisheries and Marine Sciences. Diponegoro University

9. Research Center for Food Processing and Technology, National Research and Innovation Agency (BRIN)

10. Indonesian Seaweed Association (ARLI)

Abstract

As an archipelagic state actor in the international system, Indonesia builds, secures, and uses its maritime domain strategically to protect and advance its national interests in a cooperative, competitive, and conflictual world. In order to reach the 2045 vision, Indonesia as a Global Maritime Fulcrum in Golden Indonesia 2045, the realization of this vision cannot be carried out without the help of technological advances. Younger generation as human resources also plays an important role to support this mission. This research is using a qualitative study based on open sources data using the strategic policy as the unit of analysis. Furthermore, the study results show several strategic policies that were compiled based on the 9 main agendas from the Coordinating Ministry for Maritime Affairs and Investment of the Republic of Indonesia; linking to technology and innovation needed. The strategic policies using PEST analysis, empower Indonesian youth and seaweed cultivation towards 2045 were analysed in these studies. This research presents several recommendations that can be implemented in encouraging the interest of the younger generation as the main actors in realizing Indonesia's World Maritime Axis in 2045 through the latest technology and innovation.

Keywords: Maritime Axis, Ocean Technology, Seaweed Industries, Human Resources, Indonesia 2045

1. Introduction

Geographically, Indonesia is the largest archipelagic country in the world consisting of more than 17,504 islands. Indonesia becomes an island country that has vast sea areas that need to be protected, especially thus located in the territorial sea (Hadyanti, 2023). In addition, based on the context of Human Resources, Indonesia is one of the most populated countries, namely 267.7 million people (Badan Pusat Statistik, 2020). In 2030 to 2040, Indonesia is also predicted to face a Demographic Bonus. The Demographic Bonus is the period when the productive age population (15-64 years) will be larger than the non-productive age population (65 years and over) with a proportion of more than 60 percent of the total population of Indonesia (Ministry of Communication and Informatics of Indonesia, 2020). While these two appear to be distinct from one another, there is a relationship between the two contexts in which Indonesia's large population and varied sociocultural conditions can be advantageous for strengthening its maritime sovereignty, which it currently owns geographically.

To be able to continue maintaining Indonesia's maritime sovereignty, the breadth of Indonesia's maritime resources makes Indonesia's maritime environment as one of the resources that need to be properly secured nationally and internationally. In this case, maritime is not only related to the sea area, but also all matters related to land, sea and water (Hadyanti, 2023). All these components become one part that are interrelated and need to be protected as a territorial area. However, the maintenance of Sea Power is not an independent endeavor, but rather requires collaboration with other forces, including political, diplomatic, and official power (Mangindaan, 2002). In light of Indonesia's strategic position in maritime security, the forthcoming expansion of the country's marine territory presents the Indonesian government with a confluence of difficulties and possibilities (difficulties and Implications of Indonesia's Strategic Position in Maritime Security, 2022).

So, to maximize the defense system, it is necessary that the Indonesian Government needs to have the cooperation of all defense components. Human resources and technology advancement are two important keys to support Indonesia’s maritime development in the future (Hadyanti, 2023). This is related to the Demographic Bonus in Indonesia which is expected to assist the government in realizing Golden Indonesia in 2045. In the effort of realizing *Indonesia Emas* (Golden Indonesia), pushing back and defending Indonesia's maritime sovereignty is obviously needed to be done by the Government of Indonesia and all of its people, because to maintain Maritime Power, the government cannot stand alone. Historically, the success of Indonesia's diplomacy in the 1957 Djuanda Declaration made Indonesia have a large sea area and made the sea a juridical and sovereign territory. Besides, the changes of Indonesian Map in 2017 by the Coordinating Ministry of Maritime Affairs has become the basis and facilities to be utilized for the benefit of the community and strengthening the Republic of Indonesia through inter-island integration through maritime routes.

The large number of islands in Indonesia must be utilized strategically for security as well as economic interests (Lembaga Ketahanan Republik Indonesia, 2018). Therefore, in order to maximize the Demographic Bonus and Indonesia's maritime wealth towards Golden Indonesia in 2045, the Demographic Bonus as a human asset must maximize the use of technology and innovation in maritime affairs.
In order to achieve this, indeed, changes must be made to maritime policy reform so that Indonesia can become the world's maritime axis, especially in 2045. However, with the increasing maritime threats that Indonesia continues to face, Indonesia's world maritime policy axis needs to support the framework of a broader maritime strategy that includes all elements of maritime, particularly through technology (Suseto, et al., 2018).
Not only that, but innovation also has a very important role in maximizing the utilization of Indonesia's maritime resources. One of these resources is seaweed. The potential of seaweed as a significant resource for blue economy (Prayuda and Sary, 2019). The Blue Economy is being implemented as a strategic initiative aimed at fostering economic development in Indonesia. The objective of this initiative is to optimize the use of coastal regions, therefore contributing to sustainable economic growth (Kristianto et al., 2023). The cultivation of seaweed is an innovative concept that has significant potential as a valuable economic resource, particularly in terms of its high fiber content for use in food production (Prita et al.,2021). Furthermore, Seaweed cultivation can become a national food identity which is good for large communities.
What's more, seaweed has many advantages that are good for the body, so these advantages are good for forming a healthier and stronger society. Later, this will have a good impact on Socio-Cultural in Indonesia. In addition, Seaweed Cultivation can also open wide doors for the utilization of technological advancement. In fact, when seaweed extract is added to food, nutraceutical, pharmaceutical and industrial companies, it will increase the production and consumption or use of seaweed-based products (Lomartire, et al., 2021). The role of the younger generation in promoting global maritime technology and seaweed cultivation based on 9 (nine) maritime development agendas to prepare vision 2045 will be discussed further in this study.

2. Maritime Development

The abundance of maritime resources is one of Indonesia's blessings. However, it is also prone to different types of maritime security threats. Several literature studies state that the development of the maritime sector requires the Operation of Indonesian Navy Ships so that Indonesia's maritime resilience and security is maintained. However, technology cannot be eliminated from this either. The Indonesian Navy needs to adjust the technology of the Republic of Indonesia Warships (KRI) elements according to government policy and create sustainability for the natural resources (Amelia, *et al*., 2021). In maritime development, technology is a very important element to be developed and used. Technological

innovation is also required in the development of a military system which then has political goals. That way, Indonesia can have a balance of power both in the regional and global regions (Hadyanti, 2023) .

The application of information technology (IT) in the maritime security system in Indonesia offers many opportunities but also faces challenges that must be overcome. Some previous studies have also answered how to analyse maritime technology using the theoretical framework of Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis (Cahya, *et al.,* 2023).

However, there is still a few literatures which are discussing maritime technology based on PEST analysis or analysis that is stacked based on Political, Economic, Socio-Cultural, and Technological contexts, especially PEST analysis of Indonesian maritime technology which is then related to the 2045 vision in which Indonesia will become the World Maritime Axis when this country reaches Gold Indonesia. PEST analysis is more often used to analyse threats and opportunities in the context of the environment for maritime technology (Putra, *et al.*, 2016). In addition, other literature that is often discussed through the use of PEST analysis is related to defence and security in Indonesian maritime affairs (Bimo*, et al*., 2022).

Therefore, through the latest data taken from the Coordinating Ministry for Maritime Affairs and Investment (2022), the maritime capacity and technological advancement analysed using PEST analysis; connected to the younger generation, especially from the Demographic Bonus that will occur in Indonesia particularly, in 2030 to 2040 to achieve the vision of Indonesia 2045 namely, Indonesia Gold and make this country a World Maritime Axis.

This research is a literature study, namely by using a series of studies that collect data related to literature study data collection methods such as journals, books, and websites. The method of analysis used is descriptive, which describes the facts and then analyses them, not only describing but also providing a comprehensive explanation of what has been found in the literature study. Furthermore, the available materials were analysed qualitatively using Political, Economic, Socio-Cultural, and Technological analysis or PEST analysis. We can identify the big picture of opportunities and threats. Through this methodology, a Strategic Policy which relate to 9 (nine) maritime development agendas for 2045 and it needs formulated to be carried out by the Indonesia Government; implemented by the Indonesian Young Generation in facing the Golden Indonesia period in 2045 especially by taking advantage of global technological advances in encouraging the Development of Indonesian Maritime Capability (RI) and develop innovations from its resources such as Seaweed Cultivation.

2.1Indonesia Seaweed Industries Innovation towards Indonesia 2045

Youth nowadays cannot be separated from technology. In fact, the current younger generations are called tech savvy. They play a major role in controlling

and realizing this 2045 vision through existing technological advances for Indonesian maritime affairs.

The advantages of youth in technology should not be wasted. As previously mentioned, economic empowerment is also needed as a provision for youth in realizing Golden Indonesia, because technological development and innovation alone are not enough. In this case, seaweed is one of Indonesia's maritime natural resources, where these resources can become economic material in empowering Indonesian youth for Golden Indonesia 2045.

According to data from the Coordinating Ministry for Maritime Affairs and Investment of the Republic of Indonesia in 2020, Indonesia was the second largest producer of seaweed after China (Rahayu, 2022). Certainly, this is a positive signal for Indonesian youth to develop seaweed industries in the future.

Table 1.2 Top 5 Seaweed Producing Countries in 2020*

No.	Country	Seaweed (Thousand tons)
1.	China	20.863
2.	Indonesia	9.618
3.	Chile	19
4.	Vietnam	14
5.	India	5

Source: Food and Agriculture Organization (FAO), 2022

The data above shows the spread of seaweed in several regions of Indonesia, including, South Sulawesi; East Nusa Tenggara; Central Sulawesi; East Java; West Nusa Tenggara; North Kalimantan; Southeast Sulawesi; North Sulawesi; Maluku to Western Sulawesi (Rahayu, 2022).

In fact, from data table 1.2 above, FAO projects that Indonesia will experience an increase in its Aquaculture Production in 2030 by as much as 42 percent, where China will only reach 27 percent (Rahayu, 2022). Indonesia will reach the peak of the Demographic Bonus in 2030, so this opportunity is very good to be maximized (Ministry of Communication and Informatics of Indonesia, 2020). However, we should keep in mind that this prediction was made when the COVID-19 pandemic had not yet existed.

If we connect Seaweed cultivation with economic potential, it can be said that seaweed farming is still relevant to youth-characteristic economic activities. It is not too stiff because Seaweed cultivation is not very labour intensive. The main task is that of attaching cuttings to lines, by placing and removing lines to or from sea and drying the crop. Hence, Seaweed cultivation can be one of the solutions to limited resources in the economy, where these economic activities can provide additional income for the younger generations that creates a level of financial resilience.

Empowerment of this economic activity must then be supported by qualified technology and innovation. In Indonesia, Seaweed cultivation is concentrated on *Eucheuma* and *Gracillaria*, while *Sargassum*, *Gelidium* and *Hypnea* are still

harvested from the wild (±30,000 tons) annually. Seaweed farmers and technicians in Indonesia are still using methods that are not very modern. They perform several culture systems. First, the Bottom Method, while the seeds are dispersed at the bottom of brackish water ponds. Second, Off-bottom Method, where the seed is tied on plastic rope. Third, Floating Rack Method, where the seed is tied to a plastic rope and then the rope is connected to a bamboo raft, while the fourth method is the Long Line Method, where the seed is tied to a plastic rope then connected to a main rope. Besides, it can be done in deep water (Alamsjah, 2018).

Compared to several other maritime countries, the technology and innovation used by Indonesia in Seaweed Cultivation is still minimal, as the following below.

Table 1.3 Seaweed Cultivation Research Development

Methods	Japan	China	France	Indonesia
Cultivation using natural stock & habitat	✓	✓	✓	✓
Cultivation using seed culture & artificial habitat	✓	✓	✓	✓
Cell & tissue culture ●Protoplast isolation ●Transient Expression Assays ●DNA - Mediated Gene Transfer & Stable Transformation ●Plant Regeneration	✓	✓	✓	
Transgenic Plants	✓	✓	✓	
Engineering potentially useful plant traits ●Engineering viral resistance ●Resistance to fungal & bacterial pathogens	✓	✓	✓	
Manipulating plant products Carbohydrates Fats & oils	✓		✓	

Source: Alamsjah, 2018.

From the table above we can see how Indonesia is still quite behind in its Seaweed cultivation techniques, especially compared to the three countries above, where Japan and France excel in having all kinds of innovative techniques in Seaweed cultivation. This certainly needs to be an important note, especially for the government to implement a maritime strategic policy that is in line with the 9 (nine) maritime development agendas for 2045 to realize Indonesia as a Maritime Axis, especially through its global maritime technology and Seaweed cultivation innovations.

Then, what can be developed from Seaweed Industries to encourage the empowerment of the younger generation in realizing Indonesia as the world's maritime axis in 2045? Seaweed production itself is spread in various regions in Indonesia with different potential and various types of seaweed as described in the following table.

Table 1.4 Production and Seaweed Centre Area in Indonesia, 2020

No.	Regions	Production	Commodity
1.	South Sulawesi	3.442.076 ton	Cottoni, Gracilaria
2.	East Nusa Tenggara	2.158.903 ton	Cottoni, Spinosum
3.	Central Sulawesi	927.787 ton	Cottoni, Spinosum
4.	East Java	699.236 ton	Cottoni, Gracilaria
5.	West Nusa Tenggara	677.111 ton	Spinosum, Gracilaria
6.	North Kalimantan	523.258 ton	Cottoni
7.	Southeast Sulawesi	272.325 ton	Cottoni, Spinosum
8.	North Sulawesi	247.024 ton	Spinosum, Cottoni
9.	Maluku	191.489 ton	Cottoni
10.	West Sulawesi	94.187 ton	Spinosum, Cottoni

Source: Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia, 2022.

The spread of Seaweed production shows that this industry has a lot of potential such as, Indonesia as the second largest Seaweed producer in the world; Mariculture land potential; Simple technology; Nutrient contents; Market demand increase; Job creation; Diverse derivative products; and Seaweed cultivation helps against climate change through absorbing carbon emissions. Hence, from those

abundance of potentials, youth can develop their role in global maritime technology and seaweed production towards the maritime vision and mission in 2045.

2.2Indonesia's 2045 Maritime Vision and Mission in PEST analysis

In 2045, Indonesia will be 100 years old where the vision of Maritime development 2045 is 'Indonesia the Centre for World Maritime Civilization' and its mission is 'Implementing Maritime-Based National Development'. Maritime 2045 is an effort to realize these strategic ideas which are compiled in a Long-Term Development Concept, towards Golden Indonesia 2045. In addition, the concept of maritime development is a multidimensional concept, which includes the dimensions of defense and security, economic and environmental dimensions, and socio-cultural dimensions in line with the blue economy concept. In the following table, trying to explain further what strategic policies can be developed further and related to maritime development as a multidimensional concept (Coordinating Ministry for Maritime Affairs and Investment, 2022).

Table 1.1 Maritime Strategic Policy on PEST Analysis

Political	**Economic**
● Strengthening Maritime Governance. ● Awakening Indonesia's identity as the world's maritime axis country in the perspective of the international community.	● Development of Creative Industries and Maritime Micro, Small Medium Enterprise (MSMEs). ● Agenda for Management of Natural Resources and Aquatic Environment. ● Expansion of Maritime Business Zone Development. ● Encouraging the Blue Economy.
Socio-Cultural	**Technological**
● Maritime Basic Infrastructure Development in Indonesia. ● Advancement of Culture and Character of the Maritime Nation.	● Development of the Maritime Service Industry based on information and communication technology (ICT). ● Agenda of Maritime Connectivity Improvement. ● Strengthening National Competitiveness through Maximizing Human Resources for Technology. ● Development of Maritime Literacy and Technical Skills through Maritime Education and Training.

	● Strengthening the Maritime Innovation System.

Source: Maritime 2045, National Development Conception Towards Indonesia Centre for World Maritime Civilization in 2045, Coordinating Ministry for Maritime Affairs and Investment, 2022

The table above explains the PEST analysis related to maritime strategic policy. In the political context, firstly, Strengthening Maritime Governance. This agenda is one of management's keys to success in achieving maritime development goals and objectives. The agenda for strengthening Maritime Governance is one of the implementations of strategies in order to increase maritime resilience as well as concrete actions in achieving the goal of realizing good maritime governance. Furthermore, strengthening knowledge-based maritime governance is the main policy in carrying out this agenda. Secondly, in the political context, geopolitics is also an element that must be considered. Realizing Indonesia as a maritime axis in 2045 is obviously necessary in the perspective of the international community. In this way, Indonesia has a strategic position, and other countries will value its many maritime resources.In the economic context, firstly, the Development of Creative Industries and Maritime Micro, Small Medium Enterprise (MSMEs) is very important. It is to encourage the growth and development of creative-based industries and medium, small and micro industries oriented to the maritime sector, either with or without partnering with large industries, and taking into account the geographical aspects of Indonesia as an archipelagic country. Secondly, Agenda for Management of Natural Resources and Aquatic Environment. This can have a good impact on improving Maritime Services. The development of Maritime Services is one of the policy directions for the development of the maritime industry. This policy is intended to grow service industries and creative industries in the maritime sector so that they become hosts in their own country. Besides in this case, recognizing this development that can involve small traders who live in coastal areas, so that they can develop businesses with seafood-based ingredients ranging from making souvenirs to food and beverage products that can be resold to large communities. Thirdly, Maritime Business Zone Development. This strategic initiative is intended to develop growth centres taking into account the geography of archipelagic countries and local specific commodities, through the development of Special Economic Zones, Special Industrial Zones, Tourism Areas

and other forms. Fourthly, encouraging the Blue Economy. Blue Economy refers to the sustainability terms where it uses ocean resources for economic growth, improved livelihoods, and also jobs while the human beings are still preserving the health of the ocean ecosystem (United Nations, 2022).

Then in the Socio-Cultural context, first, Maritime Basic Infrastructure Development. Strategic initiatives Maritime infrastructure development must be carried out in a balanced and equal manner, starting from underdeveloped areas, and evenly in the context of an archipelagic country. Second, Advancement of Culture and Character of the Maritime Nation. This advancement agenda is one of the implementations of strategies to increase the nation's competitiveness in order to make Indonesia a Superior Maritime Nation. This is also a response of real action in achieving the goal of creating an innovative and strong character Indonesian maritime society, and also to build highly competitive human resources.

Lastly, in the context of technology. Firstly, is the Development of the Maritime Service Industry based on information and communication technology (ICT). This development includes the use of artificial intelligence and the provision of up-to-date data and information in providing services in the maritime sector. Secondly, Maritime Connectivity Improvement Agenda. This technology agenda is related to the implementations of the Economic Strategy to support the goal of equitable development and its results and is intended to address the problem of economic disparity and welfare disparities between islands, between regions. The main policies that will be taken to strengthen this agenda are strengthening the maritime transportation system and increasing the reliability of IT and Energy connectivity so as to reduce disparities in prices of important commodities and equitable access to information and energy which will have an impact on increasing national unity and integrity.

Thirdly, in order to strengthen National Competitiveness, we need to make Indonesia an advanced Maritime Nation through promoting culture and strengthening character as well as developing Maritime Human Resources and Science and Technology. This strategy was chosen with the consideration that human resources are a strategic asset in maritime development. Through the development of maritime science and technology which is then educated and disseminated to human resources, there will be a strong maritime nation that is reliable in technology and not left behind from other countries. Fourthly, development of maritime literacy and technical skills through Maritime Education and Training is necessary, so the nation, especially the young generation will have the updated knowledge and experience regarding the advancement of Maritime technology. Fifty, strengthening the Maritime Innovation System supported by the Government of Indonesia is obviously needed. This is an effort to increase the productivity of the community and SMEs by using science and technology approaches, culture, management, and other sources of innovation.

In other words, from the four major aspects in the PEST analysis above, supportive policies and incentives help are very much needed in improving and developing

maritime technology in Indonesia, especially in encouraging the development of human resources as the next generation of Indonesian maritime guardians and preservers. Where they cannot do it alone with their capabilities as humans, but need to be supported by technological assistance (Coordinating Ministry for Maritime Affairs and Investment, 2022)

2.3The utilization of Maritime Technology to support Indonesia's 2045 Maritime Vision

In interpreting Indonesia's vision in 2045 as a maritime axis in the world, we need to consider whether the human resources that Indonesia had at that period will be sufficient and capable of developing the task of realizing Indonesia as a world maritime axis. Therefore, the 2045 vision cannot be separated from the younger generation as the nation's future. Broadly speaking, there are 9 (nine) maritime development agendas for 2045 including, Development of Maritime Infrastructure Facilities; Enhanced Maritime Connectivity; Management of Natural Resources & Aquatic Environment; Maritime Industry Development; Defense and Security Strengthening, and Maritime Safety; Strengthening Maritime Diplomacy & Occupation; Strengthening Maritime Governance; Advancement of Culture and Character of the Maritime Nation; Development of Maritime Science and Technology and Human Resources (Coordinating Ministry for Maritime Affairs and Investment, 2022). Besides, of the nine 2045 Maritime Development Agenda, technology cannot be separated from its role in developing and helping the success of the existing nine 2045 maritime development agendas. The development of technology itself has a major role, namely, the current younger generation who will be in control in the future.

In this case, we can describe several examples of technologies related to the 2045 maritime development agenda. For example, Improving Maritime Connectivity (agenda 1); Defense and Security Strengthening, and Maritime Safety (agenda 5); and Strengthening Maritime Governance (agenda 7) is to maximize the use of the Internet of Things (IoT). The most suitable example for this is the Indonesian Maritime Area Security for the Eastern Region, which often experiences piracy and criminal acts. The use of IoT can support the role of intelligence in securing the Eastern Indonesian Maritime Region by applying various sensors and cameras connected to the internet. Then existing servers can monitor vast areas of ocean waters with little or no manpower at all. So, everything depends on the speed of the server and camera sensors connected to the ships, ports or water areas. All information including weather, humidity and temperature levels in each area of the observation area can be updated in real time from time to time may effectively mitigate environmental impacts on the sustainability of valuable natural resources, such as seaweed. Apart from that, we can also predict the estimation of the condition of the observed waters, such as how many foreign ships enter East Indonesian waters. So that we can find the right solution in dealing with it and the policy makers can obtain data in real time, also use this data as the basis for future policy making (Turyadi, et al., 2021).

Technology also helps other agendas, namely, Development of Maritime Infrastructure Facilities (Agenda 1); Increasing Maritime Connectivity (agenda 2); and Strengthening Maritime Diplomacy and Occupation (agenda 6). One key objective of Jokowi's doctrine is to build a sea-toll and upgrade port infrastructures. This is of course very helpful for the territory of Indonesia which consists of many islands separated by vast waters. With the construction of the Sea toll and ports, domestic economic activity will increase. Indeed, this development cannot be separated from elements of technology and innovation. Various CCTV cameras and sensors that can monitor how many ships are coming, from which countries or regions, how many economic activities are taking place, to which water areas need to be further developed so that foreign tourists can visit them, all of those measurements can be an analysis of the technology used. Not only that, but maritime security must also be upheld through a legal body that adjudicates. The revitalization of the Maritime Court must pay attention to the existing legal basis that regulates its activities, namely Law no. 17 of 2008 concerning Shipping and the Code of Commercial Law (KUHD). The Maritime Court must act decisively in adjudicating and resolving all cases that occur in Indonesian maritime waters. For example, advocating for ship accidents caused by non- or negligent application of crew safety standards at sea, piracy, and so on. Of course, all of this requires assistance from technology to be able to obtain legal and valid evidence, which is monitored directly at the place of observation, so that the court can resolve existing problems with valid real time data (Santoso, Dewi & Nafisah, Fadhillah, 2017).

In addition, technology is closely related to supporting the Management of Natural Resources & Aquatic Environment (agenda 3); Maritime Industry Development (agenda 4); and the Advancement of Culture and Character of the Maritime Nation (agenda 8). In a book entitled Transformation of Maritime Culture Based on Technology Innovation (Widjaja, 2019), it is explained that efforts to transform maritime culture through technology need to be carried out. One of the efforts that have been made and mentioned in this book is to build the concept of an innovation village.

In an effort to encourage the development of fisheries which is a source of income for villagers, where Indonesia's vast maritime conditions have a very large influence on the types of income sources carried out by the community. This fishing business is then given a touch of innovation and more modern technology. Some examples of villages that have implemented this fishery innovation and technology such as *Nila Village* in *Dusun Bokesan, Sleman*; *Kampung Ranjungan in Betahwalang Village, Demak; Kampung Sidat in Kaliwungu Village, Cilacap; and also, Kampung Gabus in Babakan Village, Ciseeng,* West Java. From these examples, eel farming in Kaliwungu village has become a model for other villages in Indonesia, especially with the large population of eel which spread across Indonesia, making this a good business opportunity (Antaranews, 2021).

Strategic ways are needed to encourage young people to become interested in helping the maritime vision and mission in 2045. There are several steps that the

government can take. Firstly, provide more incentives for research and development in maritime fields for Indonesian youths. Secondly in terms of modern context, collaborative education, and training on technology for young Indonesians to go other maritime countries is very needed such as Australia, Cuba, Japan, New Zealand, Philippines, Singapore, Sri Lanka, Taiwan, UK (Suseto, *et al.*, 2018). Besides, Indonesian youths may visit countries with minimal marine resources, so they can feel fortunate to live in Indonesia. This comparative study is expected to foster a sense of love and sense of belonging among the youths for Indonesia's maritime natural resources.

There is another thing which is no less important to prepare Indonesia to become the world's maritime axis in 2045, conducting activities and training for youth empowerment in technology and innovation of seaweed cultivation. It is because youth must have a sense of power particularly, in the economy.

3. Conclusion

In conclusion, the result of this study is clear that the 2045 vision of making Indonesia a world maritime axis is not a small and easy thing, therefore strong synergy is needed between existing human resources and maximizing technology and innovation to maximize the strategic policies that will be carried out by the government in realizing Indonesia as the World Maritime Axis. The nine Strategic Policies are prepared based on what Maritime Indonesia needs to achieve the 2045 vision where all existing policies fit into the political, economic, socio-cultural to technological context. From the PEST analysis that has been carried out, strategic policies in the technology sector have the most points, where all policy contexts must be sustainable with the role and assistance of technology. In other words, the role of technology cannot be removed from realizing the vision of Indonesia 2045 namely, Indonesia Gold and making Indonesia to be the world's maritime axis.

There are several important recommendations for the government in encouraging youth interest and involvement in maritime technology, including, provide more incentives for research and development in maritime fields; establish student exchange or full scholarship to study from other maritime countries, conduct collaborative education and training on technology for young Indonesians to go abroad, and also conduct youth empowerment activities such as innovation in Seaweed cultivation.

References

Alamsjah, M. A. (2018). *An Overview of The Seaweed Cultivation in Several Countries: Technology and Challenge*. Atlantis Press. DOI: 10.2991/icpsuas-17.2018.2.

Amelia, P., Lathifah, A., Yasa, I.N.A. (2021). *Analysis of the impact of maritime sector development in supporting Indonesian Navy Ship operations*. Retrieved on May 25, 2023, from www.elsevier.com/locate/procedia.

Annyla D.O. Kristianto, A. D.O., Mangkurat, B., Alisafira, S., Hutahean, A. A., Manafi, M. R., (2023) Mini Review: Kerangka Acuan Blue Economics Dalam Pemanfaatan Konservasi terumbu Karang Di Taman Nasional Laut Kepulauan Seribu. Science Technology and Management Journal, 3(2), 75-78.

Badan Pusat Statistik. (2020). https://www.bps.go.id/

Bakrie, C. R. (2007). *Pertahanan negara dan postur TNI ideal*. Jakarta: Yayasan Obor Indonesia.

Bimo, E.A., Prabawa, E., Sembiring, E.K., Ramsi, O., Sjamsoeddin, S., Yusgiantoro, P., Midhio, I.W. (2022). *The Application of AHP and PESTEL-SWOT Analysis on The Study of Military Amphibious Aircraft Acquisition Decision Making in Indonesia*. Technium Social Sciences Journal Vol.27. DOI:https://doi.org/10.47577/tssj.v27i1.5414.

Cahya, D.D., Mamahit, D.A., Widodo, Y.P., Saragih, H.J.R., Suwarno, P (2023). *Analisis SWOT Penerapan Teknologi Informasi Maritim dalam Sistem Keamanan Maritim di Indonesia*. NUSANTARA: Jurnal Ilmu Pengetahuan Sosial. DOI: 10.31604/jips.v10i2.2023.853-860.

Coordinating Ministry for Maritime Affairs and Investment. (2022). *Maritim 2045, Konsepsi Pembangunan Nasional Menuju Indonesia Pusat Peradaban Maritim Dunia Tahun 2045*.

Hadyanti, A.M. (2023). *Technology Design 4.0 to Create Maritime Power*. DOI: 10.57235/jetish.v2i1.334.

Lembaga Ketahanan Nasional Republik Indonesia. (2018). *Materi Pokok Bidang Studi Strategi*. Tim Pokja Bidang Studi Strategi. Indonesia.

Lomartire, S., Marques, J.C., Gonçalves, A.M.M. (2021). An Overview to the Health Benefits of Seaweeds Consumption. https://doi.org/10.3390/ md19060341.

Mangindaan, R. (2002). "Maritime Strategy of Indonesia in 2000-2010" In Maritime Strategies in Asia, eds. Jiirgen Schwarz, Wilfried A Herrmann, and Banns-frank Seller. Bangkok: White Lotus Press, 325–37.

Ministry of Communication and Informatics. (2020). *Komitmen Pemerintah Wujudkan Bonus Demografi yang Berkualitas*. Retrieved on May 29, 2023, from https://www.kominfo.go.id/content/detail/27423/komitmen-pemerintah-wujudkan-bonus-demografi-yang-berkualitas/0/berita

Prayuda, R and Sary, V. (2019). "Economy Terhadap Pemberdayaan Masyarakat Pesisir Di Era Masyarakat Ekonomi ASEAN" International Relations Department , Faculty of Social and Political Sciences," 3(2), 46–64, 2019.

Prita, A. W., Mangkurat, R. B., & Mahardika, A. (2021). Potensi Rumput Laut Indonesia Sebagai Sumber Serat Pangan Alami. Science Technology and Management Journal, 1(2), 41-46.

Putra A.I.N., Hakim, A (2016). *Analisa Peluang dan Ancaman Keamanan Maritim Indonesia sebagai Dampak Perkembangan Lingkungan Strategis*. Repository Sekolah Tinggi Teknologi Angkatan Laut. Retrieved on May 29, 2023, from http://repository.sttal.ac.id/15/.

Rahayu T.B.H. (2022). T*he Future of Seaweed in Indonesia*. Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia.

Rimmer,M.A., Larson,S., Lapong, I., Purnomo, A.H., Pong-Masak, P.R., Swanepoel, L., Paul, N.A. (2021). *Seaweed Aquaculture in Indonesia Contributes to Social and Economic Aspects of Livelihoods and Community Wellbeing*. *Sustainability* 2021 ,*13*,10946. https://doi.org/ 10.3390/su131910946

Santoso, Dewi, Nafisah, Fadhillah. (2017). *Indonesia's Global Maritime Axis Doctrine: Security Concerns and Recommendations*. Jurnal Hubungan Internasional Tahun X, No.2. DOI: 10.20473/jhi.v10i2.7306.

Sumarwoto (2021, December 24). *Kampung Sidat Kaliwungu Cilacap Jadi Percontohan*. Retrieved on May 30, 2023, from https://jateng.antaranews.com/berita/423657/kampung-sidat-kaliwungu-cilacap-jadi-percontohan

Suseto, B., Othman, Z., Razalli, F.M. (2018). *The Need to Reform Indonesia's Maritime Strategy: A Review.* Indonesian Journal of Geography Vol. 50, No.2 (145-153). DOI: http://dx.doi.org/10.22146/ijg.27954.

Turyadi, I.U., Johan, F., Widyanto, D. (2021). *Analisa Dukungan Internet of Things (IoT) terhadap Peran Intelijen dalam Pengamanan Daerah Maritim Indonesia Wilayah Timur*. Vol 7 No 1 Tahun 2021. Retrieved on May 30, 2023, from http:// http://jurnal.unmer.ac.id/index.php/jtmi.

United Nations. (2023). Regional Information Centre for Western Europe. *Blue Economy: Oceans as The Next Great Economic Frontier*. Retrieved on May 30, 2023, from https://unric.org/en/blue-economy-oceans-as-the-next-great-economic-frontier/

Widjaja, S. (2019). *Transformasi Budaya Maritim Berbasis Inovasi Teknologi* [Review of the book Maritime Culture]. Amafrad Press.