Building the Maritime Paradigm of Sabah, Malaysia Using the Ecosystem-Based Management (EBM) Model a Preminilary Study

Ismail bin Ali[1], Hinmin Chiam Tah Kong[2], Mosli Tarsat[3]

[1]Blue Economy and Maritime Security Research Centre, Universiti Malaysia Sabah, Director

[2]Blue Economy and Maritime Security Research Centre, Universiti Malaysia Sabah, Assistant Registrar

[3]lue Economy and Maritime Security Research Centre, Universiti Malaysia Sabah, Lecturer

DOI: https://dx.doi.org/10.47772/IJRISS.2025.906000147

Received: 16 May 2025; Accepted: 03 June 2025; Published: 03 July 2025

ABSTRACT

This study aims to analyze the effectiveness of the Ecosystem-Based Management (EBM) model in developing the maritime paradigm in Sabah, in line with the national blue economy objectives that emphasize the sustainability of marine resources. Sabah, rich in marine natural resources, offers great potential in sectors such as fisheries, marine tourism, marine biotechnology, and marine energy. The main research question is how applicable the EBM model is in Sabah for strengthening marine resource management, improving synergy among various stakeholders, and driving the sustainable development of the maritime sector. The objectives of the study are to explore the potential of EBM in the context of Sabah's maritime sector, identify the challenges faced, and propose strategic steps to overcome these challenges. The study adopts a qualitative approach based on literature analysis and case studies from countries that have successfully applied the EBM model in managing their marine resources. The findings indicate that while the EBM model has significant potential in enhancing the sustainability of marine ecosystems, several challenges such as institutional capacity limitations, conflicts between stakeholders, and a lack of coordination between the public and private sectors need to be addressed for its effectiveness. This study suggests strengthening more holistic policies and regulations, enhancing cooperation between the government, private sector, local communities, and NGOs, as well as investing in technology and research to support effective EBM implementation. Overall, the study provides guidance for developing a more sustainable maritime paradigm in Sabah through the broader application of the EBM model. The way forward recommends a more inclusive approach that focuses on ecosystem conservation, while still encouraging high-quality and competitive economic development.

Keywords: Maritime Paradigm, Ecosystem-Based Management, Sabah, Blue Economy, Marine Resource Management

INTRODUCTION

Sabah, a state located on the island of Borneo, Malaysia, is an area rich in marine resources and biodiversity. Situated between the South China Sea and the Sulu Sea, Sabah boasts over 1,400 km of coastline and more than 400 small islands, making it one of the world's richest maritime destinations. Its position in the heart of tropical waters makes Sabah a strategic location for economic activities related to the sea, including fisheries, marine tourism, maritime transportation, and the development of invaluable marine energy resources. If harnessed sustainably and strategically, this potential could have a significant impact on the state and national economy. In this context, the maritime paradigm refers to a new way of thinking and approach in the development of sectors related to the sea and waters, with the aim of maximizing economic and social benefits while ensuring environmental sustainability. The maritime paradigm is not only about managing marine resources, but also involves developing human capacity, technology, and innovation in sectors such as marine tourism, sustainable fisheries, marine biotechnology, and marine energy. Therefore, this paradigm encompasses a comprehensive and holistic approach to development, focusing on balancing economic progress with environmental protection. For Sabah, developing a competitive and sustainable maritime paradigm is crucial as it can drive the state’s economy

towards a more dynamic future, in line with Malaysia's vision to become a strong and competitive maritime nation in the global economy.

According to the Ministry of Transport Malaysia (2020), the country's maritime sector has the potential to contribute more significantly to Gross Domestic Product (GDP), which is highly relevant to Sabah's geographical situation, being rich in natural resources and offering opportunities for innovation in the maritime field. However, to achieve this goal, the development of the maritime paradigm in Sabah needs to be supported by strategic planning and effective policies, involving all parties, including the government, private sector, and local communities. One of the main challenges is ensuring that maritime activities do not disrupt the balance of marine ecosystems, which are vital to the livelihoods of local communities and various industries. Therefore, it is essential to formulate an approach that not only strengthens the maritime sector but also protects environmental sustainability and improves the living standards of local communities. Through case studies in Sabah, an integrated approach to developing the maritime paradigm will be outlined, alongside steps to optimize maritime potential while ensuring it is grounded in sustainability principles and social responsibility.

Framework and Theory for Developing the Maritime Paradigm

The conceptual framework for developing the maritime paradigm refers to the structure or framework that helps understand the relationships between key components in the development of a sustainable and competitive maritime sector. In this context, the conceptual framework integrates various key dimensions in maritime sector development, including marine resource management, human capacity development, the use of innovative technologies, and environmental awareness and marine resource conservation. The key components of this conceptual framework are as follows:

Marine Resource Management: Continuous and science-based management of marine ecosystems, including the protection of marine biodiversity and control of overfishing activities.

Human Capacity Development: Providing training, education, and skill development to enhance the efficiency of the maritime sector in areas such as management, technology, and innovation.

Application of Technology and Innovation: The use of modern technologies, such as artificial intelligence (AI), satellite monitoring systems, and marine energy technologies, to improve the effectiveness of the maritime sector.

Marine Environmental Conservation: Protection and restoration of marine ecosystems such as coral reefs, mangroves, and endangered marine species through sustainable management approaches.

Local Community Involvement: Involving local communities in the management of marine resources and the adoption of sustainable maritime initiatives.

The framework for thinking about maritime paradigm development integrates an understanding of the interactions between the economic, social, and environmental aspects of the maritime sector. In this regard, an integrated approach is key, where maritime sector development is not only viewed from an economic perspective but also considers social well-being and environmental sustainability. This conceptual framework can be divided into several main aspects as follows:

Maritime Economy: Focuses on the vast economic potential in sectors such as fisheries, marine tourism, marine energy, and marine biotechnology. The aim is to generate sustainable income without compromising important marine resources.

Maritime Society: Emphasizes the importance of involving local communities in maritime sector development and improving their livelihoods through education and employment in the maritime industry.

Marine Environment: Focuses on the conservation of the environment and the sustainability of marine ecosystems, ensuring that maritime activities are conducted sustainably without damaging marine resources.

The integration of these three aspects is at the core of developing a successful maritime paradigm, where a holistic management approach that considers the various economic, social, and environmental dimensions is required to achieve sustainable and competitive maritime development. Several theories are relevant in building the maritime paradigm, providing guidance for understanding and application in the context of maritime development. Some key theories relevant to the development of the maritime paradigm are essential for understanding how the maritime sector can develop in a balanced and sustainable manner. The Sustainable Development Theory emphasizes that economic development should not be achieved at the expense of environmental and social well-being. In the maritime context, this theory suggests that maritime sectors such as fisheries, marine tourism, and marine energy should be developed in a way that ensures the sustainability of marine resources and ecosystems. This approach aims to balance economic growth with environmental preservation, while improving social welfare through responsible resource management. Additionally, Maritime Economics Theory highlights the contribution of the maritime sector to the global economy, particularly in international trade, ports, and shipping industries. The development of the maritime sector is seen as a major source for strengthening national economies and improving global competitiveness, while also creating employment opportunities and raising the living standards of local communities.

A competitive maritime sector can contribute to more balanced and sustainable economic growth. The Ecosystem and Natural Resource Management Theory focuses on the importance of ecosystem-based management for natural resource conservation. In the maritime sector, this theory suggests that development should consider the impacts on the balance of marine ecosystems, including the management of marine protected areas and the conservation of endangered species. This approach is critical to ensure that maritime sector development does not harm ecosystems but instead provides long-term benefits to both communities and the environment. Furthermore, Innovation and Technology Theory in Maritime Development outlines the importance of applying technology and innovation to the growth of the maritime sector. The development of technologies such as marine energy (tidal and wave power), marine biotechnology, and satellite monitoring systems are crucial components in achieving sustainable maritime development. Technology and innovation not only enhance the efficiency of the maritime sector but also contribute to sustainability and mitigate negative environmental impacts.

Overall, the conceptual framework and thinking for developing the maritime paradigm provide clear guidance for the holistic development of the maritime sector, integrating economic, social, and environmental aspects. Relevant theories such as sustainable development, maritime economics, ecosystem management, and technology support the achievement of the main goals within the maritime paradigm, namely ensuring that the progress of the maritime sector is achieved sustainably and competitively. The implementation of these theories in the context of Sabah and Malaysia can have a positive impact on national economic development, while safeguarding environmental sustainability and improving the quality of life for local communities.

RESEARCH METHODOLOGY

This study employs a mixed-methods approach, combining both qualitative and quantitative methods to provide a deeper and more comprehensive analysis of the development of the maritime paradigm. The qualitative approach, including case studies, expert interviews, and focus group discussions (FGDs), is crucial for understanding the various aspects of the maritime sector and for gathering insights from different stakeholders involved in the industry. A case study in Sabah will be used as an example, given the state's rich marine resources and significant marine ecosystems. The study will assess how key sectors such as fisheries, marine tourism, marine biotechnology, and marine energy can be developed within the framework of a sustainable maritime paradigm. Additionally, interviews with academics, industry practitioners, and government officials will be conducted to gain in-depth views on the potential and challenges in developing the maritime sector, with a specific focus on environmental sustainability and social development. Furthermore, the quantitative approach is also utilized through the distribution of surveys to various stakeholder groups, such as industry operators, academics, and local communities. The purpose of the survey is to gather clearer statistical data on public awareness of the maritime paradigm and the need for more sustainable practices in the maritime sector. In this regard, secondary data analysis is also employed by reviewing government annual reports, maritime sector

statistics, and relevant past studies to identify trends, opportunities, and challenges in developing the maritime paradigm in Sabah and Malaysia as a whole.

LITERATURE REVIEW

Several prior studies have shown that maritime development needs to be viewed holistically, encompassing economic, social, and environmental aspects. One important study by Rodrigue et al. (2017) outlines that Southeast Asia, including Malaysia, holds a strategic position for global shipping and maritime transport. Sabah, for example, is ideally located to develop ports, maritime transportation, and other maritime industries. This study emphasizes that the development of the maritime sector in the region must be supported by good infrastructure and policies that promote sustainable economic growth. In the context of marine resource management and environmental conservation, a study by Daily & Ellison (2002) states that ecosystem-based environmental management is crucial to ensuring the sustainability of marine resources. The study highlights that when developing the maritime sector, approaches that involve the conservation and protection of marine ecosystems, such as coral reefs and marine protected areas, should be prioritized. This is especially relevant in Sabah, which is known for its rich marine biodiversity and is a popular marine tourism destination. The study also points to the need to implement sustainability-oriented practices to ensure that maritime sector management does not negatively impact the environment.

Additionally, Freeman (1987) emphasizes the importance of applying technology in the maritime sector to improve efficiency and effectiveness in managing marine resources. In this regard, technologies such as satellite monitoring for marine protected areas, and the application of marine energy technologies to harness tidal and wave power for clean energy generation, present significant potential for the sustainable development of the maritime sector. Technology can also be used to enhance shipping safety and port management, making the maritime sector more efficient and competitive. The concept of sustainable development, as proposed by Brundtland (1987), is also highly relevant in the context of developing the maritime paradigm. Sustainable development stresses the fact that economic growth should not come at the expense of environmental and social well-being. In the development of the maritime sector, this principle suggests that marine resource management should be conducted carefully to ensure that the economic needs of today do not compromise the ability of future generations to enjoy the same benefits. In this regard, maritime sector development needs to be balanced, integrating economic, social, and environmental elements simultaneously. This literature review highlights that the formation of a competitive and sustainable maritime paradigm requires a more comprehensive approach, involving stakeholders from all sectors and the application of relevant technologies to better manage marine resources and the environment. With the right policies and active engagement from all parties, Sabah has the potential to become a leader in the development of the sustainable maritime sector in Southeast Asia.

DISCUSSION AND RESEARCH FINDINGS

Sabah, with its wealth of natural resources, particularly in the maritime sector, offers significant untapped potential in the development of maritime industries. Sectors such as fisheries, marine tourism, marine biotechnology, and marine energy have vast room for development and can have a positive impact on the state's economy. The development of these sectors will not only strengthen the local economy but also bring long-term benefits in terms of environmental sustainability and responsible marine resource management. The fisheries sector is one of the most promising in Sabah, given its strategic geographic location between the Sulu Sea and the Celebes Sea, which are rich in various fish species. Sabah has abundant fishery resources, but the greatest challenge faced by this sector is unsustainable management. Overfishing and destructive fishing techniques that damage coral reefs and marine ecosystems have become serious issues. Therefore, the development of the fisheries sector in Sabah should focus on sustainable fishing practices. This includes more competitive marine resource management and the enforcement of strict laws to prevent illegal fishing.

Sustainable fisheries development can be implemented by promoting environmentally friendly fishing techniques, such as more organized aquaculture and technologies that enable more efficient monitoring of fish stocks. Furthermore, efforts to introduce tagging systems and quotas to monitor catch volumes should also be introduced. Sabah could adopt models like “Marine Protected Areas” (MPAs), which have proven successful in many other countries, where specific areas are protected from overfishing, allowing ecosystems to recover and

thrive. Marine tourism is an expanding sector in Sabah. The beautiful coral reefs, clear waters, and rich marine biodiversity make Sabah a prime marine tourism destination globally. There are many islands and tourist areas that remain underexplored, providing great opportunities to promote environmentally based tourism and sustainable marine ecosystems. However, the tourism sector must be developed with an emphasis on environmental sustainability to prevent uncontrolled damage to ecosystems.

The best model to implement would be eco-tourism, which focuses on tourism activities that not only benefit the economy but also preserve environmental sustainability. Activities such as diving, snorkeling, and visits to marine parks and protected areas need to be conducted under strict regulations to protect coral reefs and marine biodiversity. In Sabah, cooperation between the government, tourism operators, and local communities is essential to ensure sustainable marine tourism development and reduce its negative environmental impact. Marine biotechnology is a promising sector for Sabah, particularly in the context of research and development of biotechnology products derived from marine sources. Sabah is rich in marine biodiversity that can be harnessed for research in biotechnology, including the production of pharmaceutical and cosmetic products from marine organisms. Research into coral reefs, marine microorganisms, and algae holds great potential for producing materials that can be used in the pharmaceutical and cosmetic industries.

The development of this sector requires support in the form of research and development facilities, as well as investment in technology and expertise needed to bring marine biotechnology to a commercial level. With the right research and adequate investment, Sabah could become a center of excellence in marine biotechnology, providing not only economic benefits but also high-income job opportunities for the people of Sabah. Marine energy is a sector that is receiving increasing attention globally, particularly in efforts to reduce dependence on fossil fuel energy sources. Sabah, with its strategic geographic location in the tropics, has the potential to develop marine energy technologies, including energy from waves, tides, and ocean currents. These technologies can provide clean, renewable energy, which is essential to support sustainable economic development. The development of marine energy requires investment in research and technology, as well as cooperation between the public and private sectors. Sabah could adopt proven technologies from developed countries like Turkey and Norway, which utilize wave and tidal energy systems to supply electricity to coastal communities.

The application of marine energy technologies would greatly benefit Sabah by reducing its reliance on fossil fuels and mitigating the impacts of climate change. Based on this study, the Ecosystem-based Management (EBM) model is found to be the most suitable approach for managing and preserving ecosystems to ensure the sustainability of natural resources and ecosystems amid pressures from human development and climate change. EBM emphasizes the importance of comprehensive management that does not focus solely on a specific species or economic sector but considers the interactions and interdependencies between all elements in an ecosystem. This approach differs from traditional management models, which focus more on managing specific species or sectors. EBM involves multiple stakeholders, including government, private sector, local communities, and non-governmental organizations (NGOs). In this context, ecosystem management and conservation are collective responsibilities that require collaboration among all parties to achieve environmental sustainability, social welfare, and economic prosperity. Therefore, EBM provides a more holistic approach to resource management, particularly in the maritime sector, involving multiple resources such as fisheries, coral reefs, marine energy, and marine tourism.

The EBM model is particularly suitable for the maritime sector because it focuses on the sustainability of marine ecosystems, which involve many interconnected natural resources. In maritime management, marine ecosystems are complex, with numerous components that depend on each other, such as coral reefs, mangroves, seagrass beds, and marine protected areas. Therefore, an ecosystem-based approach is crucial to ensure a balance between the exploitation of marine resources and environmental conservation. Maritime sectors such as fisheries, marine tourism, marine biotechnology, and marine energy require a comprehensive approach to tackle challenges related to natural resource conservation, biodiversity protection, and climate change management. EBM operates by conducting a holistic assessment of marine ecosystems, where management decisions are not only focused on economic benefits but also on the conservation and restoration of ecosystems. For instance, in the fisheries sector, EBM promotes the use of more responsible fishing techniques, continuous monitoring of fish stocks, and the enforcement of no-fishing zones to allow for the recovery of threatened species. Similarly, in marine tourism,

EBM ensures that tourism activities do not harm sensitive marine ecosystems, such as coral reefs. The following diagram illustrates the relationships and processes involved.

Ecosystem-based Management (EBM) Model for Sustainable

Maritime Development

KEY STAKEHOLDERS	FUNCTION / ROLE
Government	Establish Policies and Regulations for maritime ecosystem management.
	Provide Enforcement & Policies to ensure compliance with regulations.
	Support Infrastructure development for sustainable maritime sector facilities.
Private Sector	Provide Investment for the development of the maritime sector.
	Implement Technologies that enhance the effectiveness of maritime management and reduce negative impacts.
	Encourage Innovation in maritime technology, resource management, and economic development.
Community	Engage in Income & Development through sustainable maritime economic activities.
	Participate in Conservation and protection of maritime resources through sustainable practices.
Non-Governmental Organizations (NGOs)	Conduct Research & Development in ecosystem conservation and best practices.
	Support Ecosystem Conservation through educational programs and advocacy.
Infrastructure & Energy Resources	Develop Infrastructure to support the sustainability of the maritime sector (e.g., ports, marine parks).
	Provide Energy Resources from marine sources such as waves and tidal energy to mitigate climate change impacts.

Model Explanation:

Government: The government is the primary body responsible for formulating policies and regulations governing the development of the maritime sector. The government also plays a role in enforcing laws and policies, providing incentives, and ensuring that maritime development adheres to environmental sustainability standards. They are also leaders in developing the infrastructure that supports the maritime sector, such as ports, research centers, and fisheries monitoring systems.

Private Sector: The private sector plays a crucial role in financing maritime development projects and bringing technological innovation into the maritime sector. They are responsible for investing in areas related to the maritime economy, such as marine tourism, marine biotechnology, and marine energy technology. They are also responsible for promoting green economic principles and sustainable development in their operations.

Local Communities: Local communities play a direct role in managing marine resources through activities such as fishing, marine tourism, and other resources. They are also involved in decision-making processes through community forums and dialogue with the government and private sector. Education and awareness about

environmental conservation are also essential, where local communities can act as agents of change in efforts to preserve marine ecosystems.

Non-Governmental Organizations (NGOs): NGOs play a role in conducting research and development, as well as advocating for best practices in environmental conservation. They often act as intermediaries between the government, private sector, and local communities to ensure that environmental sustainability principles are continuously practiced. NGOs can also provide input on policies that need to be developed or amended to support natural conservation.

This EBM model functions when all stakeholders work within a dynamic network of cooperation. The government sets policies that encourage sustainability, while the private sector invests in innovations and technologies that support sustainability. Local communities, as primary users of marine resources, adopt sustainable fishing and tourism practices, while NGOs provide knowledge and research to improve policies and practices. Overall, this model focuses on integrated ecosystem management by considering economic, social, and environmental aspects holistically. This ensures that maritime sector development in Sabah not only brings economic benefits but also guarantees the sustainability of natural resources and social well-being. Several countries have successfully implemented the Ecosystem-based Management (EBM) Model in managing their maritime resources. These include Canada, Australia, and the United States, which have used EBM to manage their marine areas more effectively. In Canada, EBM is used to manage Marine Zones around the East Coast and West Coast. The country prioritizes ecosystem management as the basis for managing marine resources, with an emphasis on protecting biodiversity-rich areas, such as coral reefs and mangrove forests.

Australia has also implemented EBM through the management of the Great Barrier Reef, one of the most famous marine ecosystems rich in biodiversity. Australia applies the EBM approach by monitoring coral reef health, controlling pollution, and involving local communities and the private sector in the management of this marine ecosystem. This success can be seen in the recovery of coral reefs that were once negatively affected by uncontrolled human activities. In the United States, EBM is used in many coastal and marine areas, including large marine protected areas. The success of EBM implementation in these areas shows that integrated and comprehensive ecosystem management can lead to better biodiversity conservation and reduced pressure on marine resources. The EBM model applied in the California Marine Protected Areas, for instance, has proven that with collaboration between the government, private sector, and communities, marine resource management can be done more effectively and sustainably.

The EBM model has demonstrated success in many cases worldwide, particularly in managing marine and coastal areas. In Canada, this model has shown the recovery of threatened fish stocks and an increase in marine biodiversity. In Australia, continuous monitoring and enforcement of EBM policies in the Great Barrier Reef have helped improve coral reef conditions and enhance the overall health of the ecosystem. EBM has also had a positive impact on the development of eco-tourism and sustainable fisheries activities, which provide long-term economic benefits to local communities. This model has also successfully enhanced cooperation between the government, local communities, NGOs, and the private sector. The involvement of all parties in ecosystem management has resulted in more effective outcomes, particularly in managing marine resources that require an inclusive and ongoing approach. By using EBM, these countries have ensured that maritime sector development is undertaken sustainably, without compromising environmental sustainability.

CONCLUSION

The Ecosystem-based Management model is highly suitable for implementation in Sabah, Malaysia, especially in managing its rich marine resources, which are also under threat due to development pressures and human activities. Sabah has incredibly rich marine ecosystems, including coral reefs that serve as habitats for various marine species. However, threats such as overfishing, marine pollution, and climate change are negatively impacting the health of these ecosystems. Therefore, EBM offers a comprehensive approach to address these issues by focusing on environmental protection, economic development, and the social well-being of local communities. In the context of Sabah, the implementation of this model can involve continuous monitoring of coral reef health and marine protected areas, regulating destructive fishing practices, and enhancing awareness and community involvement in marine resource management. The Sabah government can collaborate with the

private sector and NGOs to develop policies that support the use of modern technologies in monitoring and managing marine resources, ensuring that the maritime economy grows while adhering to sustainability principles.

ACKNOWLEDGMENT

We would like to express my deepest gratitude to the University Malaysia Sabah, Research and Innovation Centre and the University Malaysia Sabah, Blue Economy and Maritime Security Research Centre for their unwavering support and invaluable contributions to this study. Their guidance, resources, and expertise in the field have been pivotal in shaping the direction and success of this research. We also extend sincere thanks to the Sabah Maju Jaya Secretariat for their continuous assistance, collaboration, and strategic insights that have significantly enhanced the quality of this work. Their dedication to advancing the development and sustainability of Sabah's maritime sectors has been a source of inspiration. In addition, we would like to acknowledge the other agencies and organizations whose contributions have greatly supported this study. Their cooperation, sharing of resources, and commitment to sustainable maritime development have been essential to the completion of this research. Without the collective effort of these esteemed institutions and individuals, this study would not have been possible. We deeply appreciate the knowledge and expertise they have shared, and we look forward to continuing our collaborative efforts in the future.

BIBLIOGRAPHY

1. Aerts, J. (2018). Marine Biotechnology and Sustainable Development. Marine Policy, 91(3), 137-145.
2. Brundtland, G. H. (1987). Our Common Future: The World Commission on Environment and Development. Oxford University Press.
3. Daily, G. C., & Ellison, K. (2002). The New Economy of Nature: The Quest to Make Conservation Profitable. Island Press.
4. Department of Fisheries Malaysia. (2021). National Fisheries Policy 2021-2030. Kuala Lumpur: Ministry of Agriculture and Food Industries.
5. Freeman, C. (1987). Technology Policy and Economic Performance: Lessons from Japan. Pinter Publishers.
6. Ministry of Transport Malaysia. (2020). National Maritime Policy 2020-2030. Putrajaya: Ministry of Transport Malaysia.
7. Pacific Marine Energy Center. (2022). Wave and Tidal Energy: New Frontiers. Portland, Oregon: Oregon State University Press.
8. Rodrigue, J.-P., Comtois, C., & Slack, B. (2017). The Geography of Transport Systems. Routledge.
9. Sabah State Government. (2022). Sabah Marine Resources: Sustainable Development for the Future. Kota Kinabalu: Sabah State Government Publications.
10. World Bank. (2015). The Role of Ecosystem-Based Management in Achieving the Sustainable Development Goals. World Bank.
11. World Bank. (2017). The Ocean Economy in 2030. Washington D.C.: The World Bank Group.