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Realising the Blue Economy in ASEAN: Frameworks, Priority Sectors and Barriers to Implementation

Arisman and Adilah Citra Anindya

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Realising the Blue Economy in ASEAN: Frameworks, Priority Sectors and Barriers to Implementation

Arisman* and Adilah Citra Anindya**

Abstract: The ocean sustains over three billion people, carries more than 80 per cent of global trade, and could contribute around US$3 trillion, over 5 per cent of global GDP, by 2030. This chapter examines ASEAN's blue economy, anchored in the ASEAN Blue Economy Framework adopted in 2023, which defines an integrated, cross-sectoral approach to ocean, sea, and freshwater resources. It reviews stylised facts and sectoral opportunities in fisheries and aquaculture, maritime transport, marine renewable energy, and coastal tourism, showing that ASEAN produces roughly 25 per cent of global fish output and hosts some of the world's busiest shipping routes and container ports. The chapter then identifies barriers—regulatory fragmentation, environmental degradation, financing gaps, institutional limitations, and climate vulnerability—and proposes strategic pathways: governance coherence, ecosystem restoration, innovative blue finance, human capital development, and inclusive stakeholder participation to build a sustainable, resilient regional blue economy.

1. Introduction

The ocean holds a crucial position in the global economy. Oceans encompass about 90 per cent of the global biosphere and cover about 71 per cent of the Earth's total surface, providing food sources for more than three billion people, serving as a transportation route for over 80 per cent of global trade, and housing submarine cables that carry approximately 98 per cent of international internet traffic (OECD, 2025). According to OECD analysis, the marine sector contributed approximately 3-4 per cent to the global economy between 1995 and 2020. It is expected to reach a

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value of around US$ 3 trillion, over 5 per cent of global GDP, by 2030 (OECD, 2016; OECD, 2025). Meanwhile, the Food and Agriculture Organization (FAO) estimates that over 60 million people worldwide are employed in the fishing industry, with over 83 per cent located in Asia (FAO, 2020). More than 75 per cent of global marine economic growth also comes from countries in Asia and the Pacific.

In this context, the idea of the Blue Economy has emerged as a developmental model that combines economic advancement, ecological sustainability, and social inclusion in coastal and maritime areas, particularly in the ASEAN region. Therefore, this chapter examines the progress of the blue economy within ASEAN in various sectors, analyzes structural complementarities and value chain opportunities, identifies governance and sustainability challenges, and formulates strategic pathways to enhance a comprehensive and sustainable regional blue economy.

2. Blue Economy in ASEAN: The Stylized Facts

Southeast Asia hosts some of the world's most diverse and dynamic oceanic ecosystems. These ecosystems provide essential sources of livelihood for countless individuals and serve as an essential protein source across the region. Within this context, the Blue Economy has become an essential component of ASEAN's broader sustainability agenda (Wanichkorn, 2025). The Blue Economy serves as an essential foundation for sustainable growth in the ASEAN region and provides a route toward economic stability, responsible environmental management, and deeper regional cooperation. ASEAN leaders recognize the blue economy as a complex, interdisciplinary concept because it encompasses the three pillars of the ASEAN Community: the ASEAN Political-Security Community, the ASEAN Economic Community (AEC), and the ASEAN Socio-Cultural Community (Ramli and Waskitho, 2023). This shared commitment was formalized through the ASEAN Declaration on the Blue Economy, which was endorsed by ASEAN Member States

(AMS) in 2021. The ASEAN Blue Economy Framework (ABEF) was adopted by ASEAN leaders during the 43rd ASEAN Summit held in Jakarta in September 2023, identifying it as a key economic goal. Under the framework, AMS reached a consensus on the definition of the term as follows:

"ASEAN defines the Blue Economy as an integrated, holistic, cross-sectoral, and cross-stakeholder approach that creates value added and value chains from resources from oceans, seas, and freshwater in an inclusive and sustainable way, making the Blue Economy the new engine for ASEAN's future economic growth. The ASEAN Blue Economy covers upstream and downstream sectors, serving as an accelerator of the conventional marine sector such as fisheries, aquaculture, fish processing, and tourism and a catalyst for emerging sectors such as renewable energy, biotechnology, and marine and freshwater-based research and education as well as other emerging sectors from aquatic resources" (ASEAN, 2023a).

ASEAN's Blue Economy Vision aims to create value by promoting sustainable practices in marine and freshwater activities and enhancing the benefits they provide to communities. This supports economic integration, growth, and sustainability. By capitalizing on the blue economy's potential, ASEAN seeks to establish a new source of growth that is socially, economically, and environmentally sustainable.

Since 2023, when the ASEAN Blue Economy Framework (ABEF) was adopted, the member states have collectively pledged to pursue a comprehensive and inclusive strategy for the responsible utilization of marine and coastal resources. In several AMS, the blue economy already demonstrates substantial economic significance, contributing approximately 20 to 30 percent of the nation's GDP (Ramli and Waskitho, 2023). The sector generates both direct and indirect employment across key industries, including fisheries, aquaculture, maritime tourism, and shipping, along with emerging areas such as marine renewable energy,

deep-sea resource extraction, marine biotechnology, maritime knowledge, and research (Randhawa, 2024). Furthermore, Southeast Asia occupies a strategic global position, because it contains some of the most active shipping routes worldwide and has a rich variety of marine life, thereby strengthening its capacity to become a hub for marine economic activity (Ramli and Waskitho, 2023).

2.1 ASEAN Blue Economy Framework (ABEF)

2.1.1 The Scope of the ABEF

ASEAN's strong commitment to strengthening regional collaboration in promoting the blue economy is reflected in the breadth of the ASEAN Blue Economy Framework (ABEF). It seeks to promote value creation, sustainability, resilience, and inclusivity. The framework supports current regional initiatives, such as the ASEAN Carbon Neutrality Strategy and the ASEAN Regional Action Plan for Combating Marine Debris (2021–2025). It is also closely associated with the ASEAN Community Vision 2025. It further aligns with key international commitments under frameworks such as the World Trade Organization (WTO) and global development agendas, particularly the United Nations 2030 Agenda for Sustainable Development and Sustainable Development Goals (SDGs).

2.1.2 Objectives of the ABEF

The framework is intended to provide strategic guidance for ASEAN blue economy activities. It fosters collaboration and integration within the region and enhances the ability of ASEAN countries to use aquatic resources sustainably. It will serve as ASEAN's reference text for the blue economy, incorporating elements related to periodic review mechanisms. Specifically, the objectives include:

i) A cooperative, multisectoral approach is essential for creating an inclusive and sustainable value chain. This approach will transform the blue economy into a new driver of ASEAN's future economic growth.
ii) The framework aims to establish a shared understanding of the blue economy, provide a foundation for local blue economy initiatives to

make effective use of the economic opportunities offered by ASEAN's ocean and freshwater resources, and promote collaborative action in this area.

iii) The framework serves as a non-legally binding reference for ongoing dialogue and the exchange of perspectives among AMS and its collaborators regarding the subject of the blue economy.

2.1.3 The Advantages of the ABEF

The framework has the potential to significantly advance regional economic growth, social inclusion, and environmental sustainability. The principal benefits are as follows:

1) **Enhanced sustainable economic growth**: The Blue Economy aims to maximize the economic opportunities presented by marine and freshwater resources by promoting sustainable development across sectors including aquaculture, fishing, maritime transportation, green energy, and tourism. These sectors have the potential to be key drivers of ASEAN's economic growth and job creation.

ii) **Catalyzed emerging sectors**: This framework fosters the development of emerging blue economy initiatives, including marine biotechnology, bioprospecting, and marine data services. These initiatives create new economic opportunities and enhance regional competitiveness.

iii) **Promoted inclusivity**: Ensures that all stakeholders, including small-scale fishers, coastal communities, women, youth, small enterprises, and other frequently marginalized groups, can benefit equitably from the blue economy.

iv) **Promoted sustainability alongside economic growth**: The framework emphasizes the importance of economic growth alongside the protection of freshwater and marine environments. To guarantee long-term ecological and economic sustainability, it addresses environmental concerns associated with unsustainable behaviors and promotes responsible resource management.

v) **Climate-change mitigation and adaptation**: The Blue Economy fosters sectors and ecosystems that offer crucial services, such as capturing carbon, protecting coastlines, and preserving biodiversity,

along with coral reefs, mangrove forests, and other aquatic habitats, thereby promoting climate resilience.

vi) **Facilitated cross-sectoral collaboration and cooperation**: The framework promotes collaboration among local communities, corporations, governments, academic institutions, and civil society. ASEAN can develop a more integrated and coordinated strategy for sustainably managing and utilizing its freshwater and marine resources by strengthening cross-sectoral and cross-national cooperation.

2.1.4 ASEAN Blue Economy Framework Overview

a) Guiding Principles

Principle 1: Value Creation

Value creation refers to generating economic benefits from marine and inland water resources while ensuring they are used in a sustainable and responsible manner. In the context of regional and international trade, creating value involves developing value chains across all ASEAN member states (Figure 1). This is achieved by lowering trade restrictions and supporting economic development while ensuring that marine and freshwater ecosystems are not harmed (Haimbala, 2019). This can be achieved by using environmentally friendly techniques and innovations, such as recirculating aquaculture systems, seaweed production to adapt to and mitigate climate change, blue biotechnology, aquatic data services, and marine spatial planning.

Principle 2: Inclusivity

Inclusivity seeks to ensure that all involved parties, especially MSMEs, small-scale fishers, and local and coastal communities, benefit from the sustainable management of ocean and inland water resources. Involving multiple stakeholders in decision-making processes allows the Blue Economy to leverage a broad spectrum of knowledge and expertise while promoting equitable distribution of economic benefits. This strategy promotes social unity, long-term growth, and the ability of coastal communities through efficient governance and regulatory procedures.

Principle 3: Sustainability

The sustainability concept considers both the environment and society. Ecological sustainability aims to protect marine, coastal, and freshwater ecosystems from degradation while enabling the responsible use of aquatic resources through Blue Economy initiatives. Social sustainability focuses on equitably distributing benefits while considering the needs of current and future generations. It encourages decent employment, equitable income opportunities, and respect for local cultural and social values. It also prioritizes the well-being of vulnerable groups, including women and children.

Figure 1: ASEAN Blue Economy Framework Overview



Source: ASEAN (2023a)

b) Blue Strategies

Blue Conservation Management

Blue Conservation Management (BCM) focuses on strengthening the sustainable management of marine, coastal, and freshwater environments by using scientific approaches and integrated governance. The strategy recognizes the need for a common ASEAN platform with standardized data and indicators to support evidence-based decision-making and effective ecosystem management. The strategy focuses on three key areas of development.

i) **Advancing carbon neutrality by focusing on activities within the aquatic and coastal sectors:** The goal is to promote carbon-neutral development in the aquatic and coastal sectors. This will be achieved by assessing the emissions and carbon sequestration potential of blue carbon ecosystems.

ii) **Promoting the responsible use of natural resources, protecting environmental health, and combating pollution**: The focus is on sustainable resource management, employing strategies such as marine spatial planning, evaluating ecosystems, and investing in natural capital.

iii) **Enhancing Disaster Risk Reduction and Resilience:** This sector uses natural solutions, climate adaptation strategies, and disaster risk reduction tactics to improve the resilience of coastal communities and their environments to withstand challenges.

Blue Science, Technology, and Innovation

The Blue Science, Technology, and Innovation plan seeks to use scientific knowledge, digital technology, and innovation to boost the Blue Economy within ASEAN. This strategy is built around using marine and freshwater science, data systems, and innovative technologies to improve productivity, efficiency, transparency, and resilience throughout the entire Blue Economy value chain. The strategy focuses on four key development areas:

i) Addressing technology and digital gaps among AMS
   - The goal of this area is to strengthen technologi-cal and digital capabilities by developing data-sharing platforms, communication systems, and digital tools that promote collaboration in areas such as fisheries management, monitoring marine pollution, weather forecasting, and responding to disasters.

ii) Improving value chain efficiency using technological innovations
   - Digital technologies like blockchain, big data, artificial intelligence, and advanced analytics can improve supply chain management, increase transparency and traceability, and boost the efficiency of blue economy sectors.

iii) Developing Technology Policy Frameworks
   - To ensure compliance with national and international legal frameworks, this sector promotes the development of policies and regulations that encourage the responsible use of emerging technologies.

iv) Promoting and Coordinating ASEAN Research Facilities and Think Tanks
   - To improve knowledge, support evidence-based policymaking, and prevent the duplication of research efforts related to the Blue Economy, collaboration is encouraged among ASEAN research institutions, think tanks, and innovation hubs.

Blue Priority Sectors

The Blue Priority Sectors initiative aims to promote growth in traditional and new Blue Economy sectors throughout ASEAN. It strives to strengthen existing sectors, such as fisheries, aquaculture, tourism, maritime transportation, and green ports, while fostering the growth of emerging sectors, including renewable marine energy, desalination, biotechnology, and bioprospecting. The strategy is divided into six key areas.

i) Identifying the specific sectors and principal areas in which the blue economy is applied and providing a clear and consistent explanation.
   - This topic aims to foster a shared understanding of the Blue

Economy, covering its scope, significant industries, and applications.

ii) Increasing understanding of blue economy potential and its constraints.
- The objective of this area is to expand our understanding of marine and aquatic resources, their economic value, and the challenges of using them sustainably.

iii) Supporting marine spatial planning
- Marine spatial planning is promoted as a way to enhance resource management, promote cross-sector coordination, develop public-private partnerships, and facilitate evidence-based decision-making to ensure the sustainable development of our oceans.

iv) Strengthening Communication
- This sector promotes stronger communication among governments, industries, communities, and other stakeholders. This facilitates knowledge sharing, promotes best practices, increases awareness of the Blue Economy Initiative, and identifies new development prospects.

v) Developing and Promoting Sustainable Blue Financing Mechanisms
- This sector encourages the development of funding structures that accelerate investment in the sustainable blue economy.

vi) Stimulating traditional and emerging sectoral growth
- This area seeks to stimulate innovation and investment in established sectors like fisheries, aquaculture, tourism, and maritime services, as well as new fields such as marine renewable energy and biotechnology.

c) Blue Enablers

Infrastructure

Infrastructure is fundamental to developing the Blue Economy. The growth of ocean-based industries requires modern, efficient infrastructure, including ports, harbors, jetties, and coastal protection structures. This infrastructure increases connectivity, enabling the movement of products and services while boosting supply chain efficiency and lowering transaction costs.

To achieve these goals, governments and the private sector must collaborate to attract investment and build infrastructure that promotes sustainable resource use and economic growth. Additionally, capacity-building initiatives should complement infrastructure development to ensure stakeholders can effectively utilize new facilities and technologies.

Institutional Setting

A supportive institutional framework is necessary to advance the Blue Economy in ASEAN. Since the Blue Economy includes many different areas, effective policies, governance structures, and coordination mechanisms are required to ensure that economic, environmental, and social goals are in line with current international, regional, and national laws, such as the United Nations Convention on the Law of the Sea.

To improve cross-sectoral cooperation and sustainable resource management, investments in institutional and governance mechanisms, including integrated coastal zone management and marine spatial planning, are also required. Stakeholder involvement, knowledge exchange, and capacity building are all made possible by strong institutions. This makes it possible for communities, companies, and governments to more effectively support the development of the Blue Economy.

Cooperation and Capacity Building

Supporting the transition to a sustainable and inclusive blue economy requires collaboration and capacity building. To satisfy the changing needs of ocean-based businesses, it is essential to develop a qualified workforce with the necessary technical competencies and expertise. Capacity-building efforts may include educational programs, vocational training, technical support, and on-the-job learning opportunities to prepare individuals for work in various sectors of the Blue Economy.

Therefore, governments, businesses, academic institutions, and civil society organizations should give top priority to funding for capacity building. A well-trained staff enhances sector performance and boosts

investor confidence by supplying the human capital required to enable creative, sustainable, and profitable projects.

Sustainable Investment and Finance

Sustainable investment and finance are essential for the long-term growth of the Blue Economy. Blue bonds, transition bonds, sustainability-linked loans, impact investments, and blended finance options can help address funding gaps and improve the viability of Blue Economy projects. By allocating funds to socially and environmentally conscious projects, sustainable financing can boost innovation in all Blue Economy sectors and expedite the construction of vital infrastructure.

3. Sectoral Opportunities of the ASEAN Blue Economy

3.1 Fisheries and Aquaculture

Fish and seafood are gaining importance as a vital protein source globally, especially in Southeast Asia. The production from wild fisheries and aquaculture in this area has seen a notable rise (SEAFDEC, 2025). Currently, several Southeast Asian countries rank among the world's largest producers of fish and seafood, underscoring the sector's critical importance for food and nutrition security, economic development, and livelihoods across the ASEAN region (ASEAN, 2021). Overall, fisheries production in Southeast Asia increased from 46.7 million metric tonnes in 2019 to 48.5 million metric tonnes in 2023 (Table 1), reflecting a generally positive long-term growth trend despite temporary fluctuations during the period (SEAFDEC, 2026). Indonesia had the highest fisheries production volume in 2023, accounting for approximately 34.3 per cent of total Southeast Asian production, followed by Vietnam at 31.4 per cent (Figure 1). These two countries accounted for more than 65 per cent of the region's total fisheries output, highlighting their dominant role in ASEAN fisheries (SEAFDEC, 2025).

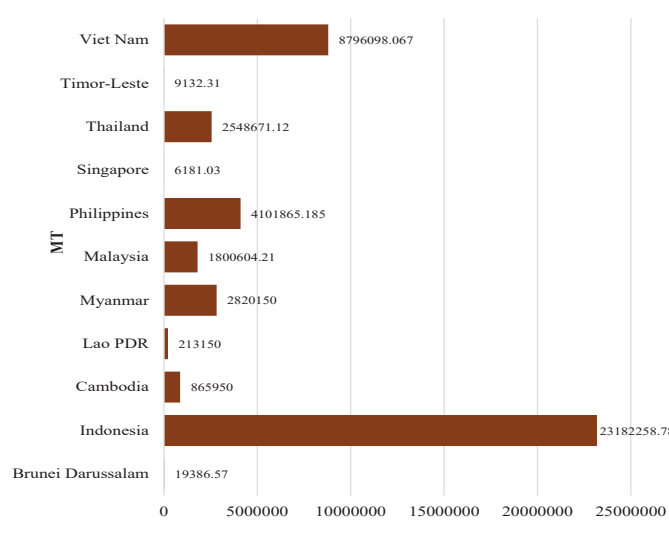
Fisheries production in Southeast Asia can be categorized into three primary subsectors: marine capture fisheries, inland capture fisheries,

Table 1: Total Fishery Production of Southeast Asia (2019-2023)

Total Fishery Production	2019	2020	2021	2022	2023
Quantity (MT)	46,768,079	46,446,162	45,768,419	47,262,176	48,503,521
Value (US$ 1,000)	57,069,153	51,149,926	76,995,331	79,308,929	81,473,683

Source: SEAFDEC (2026).

Figure 2: Total Fisheries Production in Southeast Asian Countries in 2023



Source: World Bank (2026)

and aquaculture (see Table 2). In 2023, aquaculture accounted for the largest share of production volume, contributing approximately 54.5 per cent of total output. Marine capture fisheries ranked second at 38.9 per cent, while inland capture fisheries represented 6.5 per cent. Measured by production value, aquaculture also remained the dominant subsector, accounting for 47.7 per cent of the total, followed closely by marine capture fisheries at 45.5 per cent; inland capture fisheries contributed 6.8 per cent. These figures highlight aquaculture's increasingly important role as the primary driver of fisheries production and economic value in Southeast Asia.

In terms of commodity composition, marine fishes remained the dominant product group in Southeast Asia's marine capture fisheries in 2023, accounting for 86.6 per cent of total production volume. This was followed by molluscs and crustaceans, while seaweeds and other

Table 2: Production of Fishery Subsectors of Southeast Asia in 2023

Sub-sector	Quantity (MT)	Value (US$ 1,000)
Marine capture fisheries	18,885,858	37,069,652
Inland capture fisheries	3,162,510	5,566,756
Aquaculture	26,455,153	38,837,285
Total	48,503,521	81,473,683

Source: SEAFDEC (2026)

marine invertebrates made relatively small contributions (SEAFDEC, 2026). Indonesia led Southeast Asian countries in marine capture fisheries production value, contributing about 36.3 per cent of the regional total in 2023, followed by Viet Nam at 26.4 per cent. Myanmar ranked third with 14.9 per cent, followed by the Philippines (9.3 per cent), Malaysia (6.7 per cent), and Thailand (5.5 per cent). Indonesia also has a wide variety of fishery resources. Key marine capture products include cob, scad, flying fish, skipjack tuna, squid, and tuna. Major production centers are located in North Sumatra, Maluku, East Java, and South Sulawesi (BAPPENAS, 2023). According to the Indonesian Ministry of Marine Affairs and Fisheries, Indonesia has become the second-largest seafood producer globally, following China, due to its extensive marine resources (Ministry of Marine Affairs and Fisheries, 2023).

Between 2019 and 2022, inland capture fisheries production in Southeast Asia generally showed an upward trend. In 2022, total inland capture fisheries production in the region reached 3,073,523 metric tonnes. However, it should be noted that data collection and reporting for inland capture fisheries are still limited and need to be improved. As a result, currently published data may still be inadequate, especially with regard to species composition (SEAFDEC, 2025). Myanmar was the top producer of inland capture fisheries in Southeast Asia, producing

1,648,552 metric tonnes, around 32.7 per cent of the country's total capture fisheries production. In 2022, Indonesia, the second-largest producer, recorded a production amount of 462,970 metric tonnes, contributing 6.2 per cent to the national capture fisheries production.

Aquaculture currently represents the largest fisheries production subsector in Southeast Asia. The production of food fish for both domestic consumption and international trade has become increasingly important to the economies of many developing countries in the region (ASEAN, 2015). Over the five years from 2019 to 2023, aquaculture production fluctuated, yet it consistently dominated regional output. In 2023, approximately 55 per cent of overall output from fisheries was attributed to aquaculture, contributing roughly 48 per cent to the total value of production. Countries such as Indonesia, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam rank among the world's leading aquaculture producers (FAO, 2009). Cambodia also ranked prominently at 22nd place globally (World Bank, 2023). Globally, aquaculture is widely regarded as one of the most viable solutions to declining wild fish stocks caused by overfishing, a perspective shared by many ASEAN countries. Although aquaculture in Southeast Asia is largely characterized by small-scale operations, its value chain mechanisms remain relatively weak.

Approximately 25 per cent of global fish production originates from the ten ASEAN Member States, with about half derived from aquaculture. Indonesia has consistently been among the top aquaculture producers globally. Earlier evaluations placed the nation as the third-largest producer of aquaculture in the world (Yayasan Inisiatif Dagang Hijau, 2018). However, more recent data indicate that Indonesia has strengthened its position and became the world's second-largest aquaculture producer by production volume in 2023 (World Bank, 2023). Globally, aquaculture continues to dominate aquatic food production (FAO, 2019), with Asia supplying more than 90 per cent (102.9 million metric tonnes) of total aquaculture output in 2017. Fisheries commodities are particularly important in ASEAN not only for regional food security but also as a

major source of export earnings and employment opportunities (van Mulekom et al., 2006). At the commodity level, production patterns differ across countries. In Indonesia, Eucheuma seaweed (Eucheuma spp.) was the largest aquaculture product in 2023, contributing 53.5 per cent of national output. In Vietnam, the primary species in aquaculture is the pangasius catfish (Pangasianodon hypophthalmus), which accounts for 31.7 per cent of overall production. Meanwhile, in the Philippines, the third-largest producer, elkhorn sea moss (Kappaphycus alvarezii) dominated with a share of 64.5 per cent (SEAFDEC, 2026).

3.2 Maritime Transport

Southeast Asia is strategically situated at the intersection of the South China Sea and the Indian Ocean. The region's major seas and straits form some of the world's busiest sea lines of communication (SLOCs). The maritime domain is an essential part of ASEAN's strategic, political, economic, and social life because it directly affects member states and their populations. Several ASEAN Member States rank among the countries with the longest coastlines in the world. Indonesia ranks fourth globally, with more than 95,181 km of coastline. The Philippines ranks eighth, with 33,900 km; Myanmar twentieth, with 14,708 km; Viet Nam twenty-third, with 11,409 km; and Malaysia twenty-seventh, with 9,323 km (ASEAN, 2023b). The importance of the region's SLOCs is underscored by the fact that 60 per cent of global maritime traffic passes through Asia. Approximately one-third of all cargo shipped worldwide is projected to pass through the South China Sea (Team, 2017). In 2019, ASEAN's international sea cargo throughput reached 2.8 billion tonnes, based on data available for all ASEAN Member States (ASEAN Stats, 2024).

Southeast Asia is an archipelago composed of various islands that are strategically important to countries outside the region (Simões Toccheto et al., 2014). With a population of over 600 million, this region is home to two major international commercial routes: the Singapore Strait and the Strait of Malacca. The Strait of Malacca is the second most important international sea route. It is a narrow passageway that is 500

Table 3: Top 10 Container Ports in ASEAN

Port	Country	Volume 2024 (Million TEU)	Volume 2023 (Million TEU)	World Rank
Singapore	Singapore	41,12	39,01	2
Port Klang	Malaysia	14,64	14,06	10
Tanjung Pelepas	Malaysia	12,25	10,48	15
Laem Chabang	Thailand	9,55	8,87	20
Ho Chi Minh City	Vietnam	9,16	7,40	22
Tanjung Priok	Indonesia	7,80	7,29	27
Hai Phong	Vietnam	7,15	6,34	29
Cai Mep	Vietnam	7,08	5,48	30
Manila	Philippines	5,50	5,21	36
Tanjung Perak	Indonesia	4,30	4,10	47

Source: World Shipping Council (2024)

nautical miles (800 kilometers) long. The width of the straits varies. It is 200 nautical miles at its widest point, narrowing funnel-like to 11 nautical miles at its southern extremity (Nordin Hussin, 2008). Approximately 140,000 vessels pass through the Malacca and Singapore Straits each year (Idris and Ramli, 2018).

Major ports in Southeast Asia remain crucial to regional and international maritime trade. Singapore is the region's leading maritime hub and ranks as the second-largest container port in the world. Malaysia also hosts two globally competitive ports, with Port Klang and the Port of Tanjung Pelepas ranked 10th and 15th worldwide, respectively. Thailand's Laem Chabang ranks 20th globally, while Viet Nam's Ho Chi Minh City and Hai Phong ports rank 22nd and 29th, respectively. Indonesia's Tanjung Priok ranks 27th among the world's container ports (World Shipping Council, 2024). Port infrastructure development is therefore essential to sustaining Southeast Asia's economic growth

and expanding role in global trade. As trade volumes increase, ports face growing pressure to improve capacity, efficiency, and connectivity. Regional port performance is relatively strong, with an average berthing time of 0.73 minutes per TEU and turnaround time of 1.20 minutes per TEU, ranking second globally after East Asia (UNCTAD, 2023). Table 3 provides an overview of the top 10 container ports in ASEAN.

Digital transformation is modernizing ports worldwide, although only around 20 per cent of the approximately 4,900 ports have upgraded their digital capabilities. Integrating digital transport systems across ASEAN's maritime sector is a crucial step toward enhancing regional connectivity, efficiency, and sustainability. ASEAN has adopted Smart Port Guidelines that provide a regional framework for developing, modernizing, and digitalizing ports within its Member States (ESCAP, 2024). ASEAN's commitment to smart and digital ports is particularly important given the strategic role of major Southeast Asian ports as gateways for global trade and regional connectivity. Several ports, including the Port of Tanjung Pelepas in Malaysia, have made significant progress in operational digitalization through the use of artificial intelligence, cloud-based terminal operating systems, and integrated port management systems (UOB, 2024).

Beyond efficiency and digitalization, ASEAN is increasingly integrating environmental sustainability into maritime transport through the implementation of environmentally friendly shipping practices that focus on the use of clean energy, policy alignment, and regional cooperation. Globally, the shipping sector accounts for nearly 2–3 per cent of greenhouse gas emissions, and major shipping routes in Southeast Asia are among the highest-emitting corridors in the world (IMO, 2025). In response, ASEAN member states have begun to implement measures such as alternative fuels, ship efficiency standards, and carbon reduction strategies in ports. Regional initiatives, including the ASEAN Maritime Transport Working Group and cooperation with international partners, promote low-carbon shipping corridors and green port development (ASEAN, 2023a).

The transition to green shipping reflects a shift in ASEAN maritime development from connectivity-driven logistics to sustainable maritime systems. Digital ports, energy-efficient ships, and cleaner fuels are increasingly seen as integrated components of regional economic competitiveness, not just environmental compliance. As a result, Southeast Asia's maritime sector is evolving into a sustainability-oriented logistics network that combines trade facilitation with climate mitigation goals (OECD, 2018; UNCTAD, 2023).

3.3 Marine Renewable Energy

Southeast Asia stands out as one of the most active areas regarding global energy developments. It is expected to have the second-highest energy demand growth over the next few decades, behind only India. The increased demand is fueled by robust economic expansion, population growth, and the region's role as a center for global manufacturing and industry. Consistent with international decarbonization goals, eight of the ten nations in this area have established targets for net-zero emissions: Brunei Darussalam, Cambodia, Laos, Malaysia, Singapore, and Vietnam aim for 2050; Indonesia has set its goal for 2060; and Thailand is planning for 2065 (IEA, 2024).

Renewable energy development across ASEAN varies considerably in scale and composition. As illustrated in Figures 3 and 4, Indonesia had the largest renewable energy supply in the region in 2023, reaching 34.5 Mtoe, followed by Thailand (22.1 Mtoe) and Viet Nam (18.2 Mtoe). Lao PDR led the region in the share of renewable energy in total energy supply, at 41.7 per cent, followed by Myanmar at 27.2 per cent and Cambodia at 25.5 per cent. ASEAN's principal renewable energy sources are biomass, hydropower, geothermal energy, and biofuels (ASEAN Centre for Energy, 2025). This pattern underscores the region's growing commitment to the energy transition and indicates scope for further diversification into marine renewable energy technologies such as offshore wind, tidal energy, wave energy, and ocean thermal energy.

Figure 3: Renewable Energy Supply in ASEAN in 2023

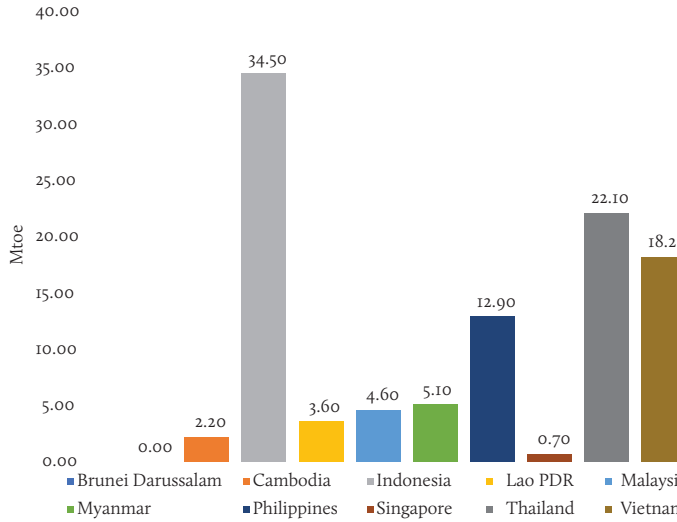
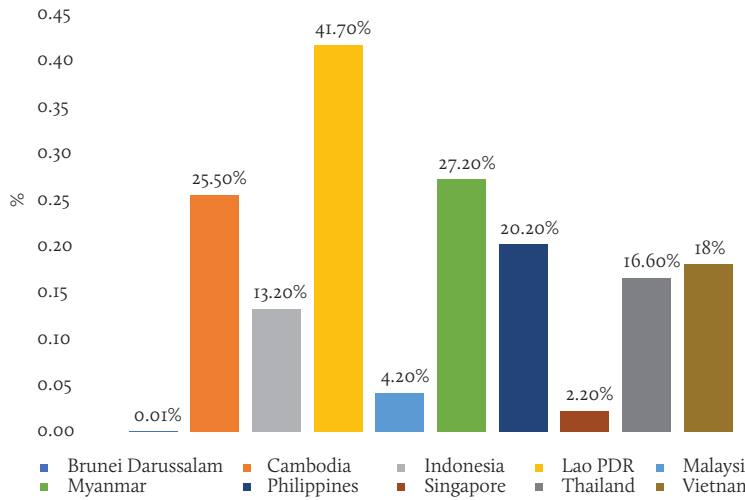


Figure 4: Renewable Energy Share in ASEAN's Energy Supply in 2023



Sources: ASEAN Centre for Energy (2025)

In this context, marine-based renewable energy has become one of the strategic development areas in ASEAN, particularly as the region seeks cleaner and more sustainable energy sources. ASEAN has established a goal of achieving 36 per cent renewable energy within the energy composition of the region by the year 2030 (Quirapas and Taeihagh, 2021) from which there is a vast potential to harness energy. Wave, tidal energy, and ocean thermal energy conversion could be tapped, to provide alternative sources of clean and dependable energy in the region. This article contributes to the growing academic literature on ocean renewable energy (ORE. One source currently being developed is Ocean Renewable Energy (ORE), supported by the geographical characteristics of the region, which has many islands and high tidal dynamics, offering significant potential for marine energy utilization. In essence, Marine Renewable Energy (MRE) refers to a broad category that includes all types of marine energy applications aimed at producing renewable energy. This includes offshore wind facilities, floating solar energy installations, and different technologies designed to capture marine energy resources (Quirapas et al., 2015; Quirapas and Taeihagh, 2021). The Ocean Renewable Energy (ORE), on the other hand, more accurately refers to energy derived directly from ocean dynamics, such as tidal currents, tidal ranges, waves, temperature gradients, and salinity gradients. Marine renewable energy sources include tidal energy, wave and current energy, Ocean Thermal Energy Conversion (OTEC), and offshore wind power (Quirapas and Taeihagh, 2021).

The adoption of renewable energy from the ocean has begun in various ASEAN countries, although most are still in the research, demonstration, and pilot project stages. In Thailand, King Mongkut's University of Technology Thonburi (KMUTT) is developing a coastal wave power plant through a laboratory prototype. Meanwhile, Indonesia has enormous marine energy potential, with an estimated practical wave energy potential of 1,995 MW, tidal energy of 41,001 MW, and Ocean Thermal Energy Conversion (OTEC) of 17,989 MW. In the Philippines, the potential tidal energy amounts to 35 TWh annually, which corresponds

to a power capacity of around 40–60 GW. Meanwhile, the potential for wave energy is anticipated to be 33 kW/m/year on the Pacific coast and 35 kW/m/year on the South China Sea coast. In Vietnam, the tidal energy potential is estimated to be between 200 and 500 MW, and the wave energy potential is roughly 350 MW (Quirapas and Taeihagh, 2021). Moreover, ASEAN nations are viewed as having significant opportunities for advancing marine renewable energy, such as offshore wind projects in Vietnam (Duong, 2022).

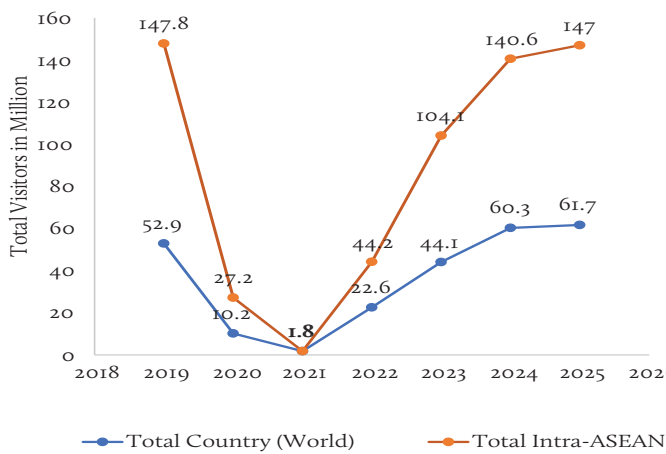
At the national level, a number of countries have begun to include marine energy in their energy transition strategies. Brunei Darussalam, through its Department of Energy, is targeting a 30 per cent contribution from renewable energy by 2035 and is exploring floating solar power plants (Narayan, 2025; Ramli and Waskitho, 2023). Cambodia has demonstrated its commitment to sustainable energy through increased solar energy production and investment. However, the utilization of marine-based energy is still not optimal. This includes energy from wind, wave, and tidal sources. Malaysia is actively encouraging the development of marine energy. The country is presently searching for appropriate sites and formulating guidelines to examine the potential for harnessing wave energy, tidal energy, ocean thermal energy, and ocean current energy for electricity generation. The Philippines has set a target to elevate the proportion of renewable energy to 35 per cent by the year 2030 and to 50 per cent by 2040, concentrating particularly on research related to tidal and ocean energy (Alexander, 2023). Despite its geographical constraints, Singapore is advancing technologies for renewable ocean energy and intends to cut greenhouse gas emissions. The nation is additionally focused on establishing standards for green energy, processes for certifying renewable energy, researching ocean energy, and creating test locations for tidal energy facilities.

3.4 Marine and Coastal Tourism

Coastal cities worldwide rely significantly on beach tourism as a driver of economic growth (Mejjad et al., 2022; Schaffer and Tham, 2020).

Globally, coastal and marine tourism accounts for nearly half of all tourism activity and is estimated to be worth around US$ 4.6 trillion, representing approximately 5.2 per cent of global GDP (Ocean Panel, 2020). In ASEAN, tourism is a major economic sector and a key component of the ASEAN Economic Community. In 2019, travel and tourism contributed 12.1 per cent (US$ 380.2 billion) to the region's GDP and accounted for around 13.3 per cent of employment, equivalent to 42.3 million jobs. International tourist arrivals to ASEAN countries increased from 135.1 million in 2018 to 147.8 million in 2019, with a compound annual growth rate of 7.1 per cent during 2015–2019 (Strategic, 2019). However, the sector contracted sharply during the 2020–2021 pandemic. As shown in Figure 5, total visitor arrivals to ASEAN Member States fell from 147.8 million in 2019 to 27.2 million in 2020 and just 1.8 million in 2021 because of widespread travel restrictions and border closures. Since 2022, the sector has shown strong signs of recovery. Total visitor arrivals rose to 44.2 million in 2022, 104.1 million in 2023, and 140.6 million in 2024, and are expected to reach approximately 147 million

Figure 5: Visitor Arrivals to ASEAN Member States by Country of Origin



Source: ASEAN Stats (2025)

in 2025, nearly returning to pre-pandemic levels. Intra-ASEAN tourism has followed a similar trajectory, rising from 22.6 million visitors in 2022 to an estimated 61.7 million in 2025. This recovery underscores the resilience of ASEAN's tourism sector and its continuing importance as a driver of regional economic growth, employment, and connectivity (ASEAN Stats, 2025).

From the 1960s to the present, coastal tourism has been one of the key spatial patterns of destination development in the ASEAN region (Hampton et al., 2024). Since the 1980s, coastal areas in Southeast Asia have become major destinations for international mass tourism. Coastal resort areas have transformed from small-scale, low-cost tourist enclaves to large, high-investment tourist areas that accommodate significant numbers of tourists through international resort chains and global franchises. These geographical transformations are especially noticeable in the three ASEAN countries where coastal tourism is a significant factor: Indonesia, Malaysia, and Thailand (Hampton et al., 2024). The extent of beach tourism can be demonstrated through the number of hotel rooms, which provides an indication of a destination's relative scale. For instance, in 2018, Bali had more than 53,000 designated hotel rooms, significantly exceeding Yogyakarta, Indonesia's second-largest tourist destination, which had approximately 14,300 rooms (Hotel Investment Strategies, 2019). Beach and marine tourism are key drivers of the ASEAN tourism sector. Internationally recognized destinations, such as Bali, Palawan, Phuket, and Preah Sihanouk Province, attract large numbers of visitors each year (ASEAN, 2025). The popularity of these destinations has led to the concentration of tourism development in coastal areas, especially in Thailand and Malaysia. Large-scale resort complexes and supporting infrastructure in these areas generate significantly higher tourism activity than recreational destinations inland.

The development of coastal tourism destinations is a key priority of ASEAN countries. In Cambodia, the government prioritizes the development of coastal tourism infrastructure, including road connectivity, airports, and sanitation systems, as a key requirement for driving growth

in the tourism sector. In Indonesia, coastal and marine areas are leading tourist destinations as well as significant sources of economic activity. The government encourages environmentally sustainable tourism practices by utilizing the principles of ecotourism and community-centered tourism to aid in the conservation and sustainable management of marine resources while generating economic prospects for local communities. Launched in 2018, the Sustainable Tourism Development in Indonesia promotes a broader and more inclusive strategy for growth, which encompasses the establishment of tourism projects focused on marine environments in four specific areas (World Bank, 2021). Malaysia has taken numerous steps to guarantee the long-term viability of its tourism sector. The National Tourism Policy for 2020 to 2030 emphasizes the importance of island and coastal tourism to foster sustainable development, curb overtourism, establish sustainability certifications, and enhance governance capacity. Additionally, the National Ecotourism Plan for 2016 to 2025 designates marine protected regions as ecotourism spots while improving the management of both marine and land resources. In the Philippines, the Department of Tourism has recognized national parks and cultural heritage locations in coastal and marine regions as priorities for sustainable tourism development.

4. Barriers to Implementing the Blue Economy in ASEAN

4.1 Regulatory Fragmentation

A major challenge to the application of the Blue Economy within ASEAN is the fragmentation of legal and policy frameworks governing marine and coastal resources. The Blue Economy is inherently cross-sectoral. However, in many ASEAN Member States, these sectors are managed by different ministries and agencies operating under separate legal and institutional frameworks, often with limited coordination. The absence of integrated ocean governance mechanisms creates policy overlaps, regulatory inconsistencies, and jurisdictional conflicts that hinder effective decision-making and resource management.

Several ASEAN countries still lack comprehensive national blue economy strategies, marine spatial plans, or unified ocean policies. As a result, economic development objectives frequently compete with environmental conservation priorities, leading to inefficiencies in policy implementation and resource allocation. At the regional level, differences in national regulations, standards, and institutional arrangements further complicate efforts to promote cross-border cooperation and harmonized blue economy initiatives.

4.2 Environmental Sustainability Risks

Environmental decline represents a significant challenge to the enduring viability of the Blue Economy in the ASEAN region. The marine and coastal ecosystems in this region serve as the essential basis for fishing, tourism, coastal protection, biodiversity conservation, and carbon sequestration. However, intensifying economic activities and resource exploitation are putting increasing pressure on the environment.

Overfishing and illegal, unreported and unregulated (IUU) fishing continue to affect several AMS. Cambodia, Myanmar, the Philippines and Vietnam continue to struggle to control unsustainable fishing activities (ADB, 2020; Bello, 2021). Indonesia has reported that a significant proportion of its fish stocks are either fully exploited or overfished. Marine plastic pollution is another major concern. Indonesia and Vietnam are among the largest contributors to global marine plastic leakage, while Thailand and the Philippines continue to struggle with ineffective waste management systems and marine debris. According to a study, six out of ten ASEAN countries are among the top twenty nations worldwide with the most mishandled plastic waste. The countries are Indonesia (2nd), the Philippines (3rd), Vietnam (4th), Thailand (6th), Malaysia (8th), and Myanmar (17th) (Jambeck et al., 2015). Habitat degradation is also widespread. Indonesia has experienced significant mangrove loss and coral reef degradation, while Cambodia and Myanmar continue to face pressure on their coastal ecosystems due to deforestation and unsustainable development activities.

4.3 Financial Barriers

The successful transition toward a sustainable Blue Economy requires investments in infrastructure, technology, innovation, and ecosystem restoration. However, financial constraints remain a major obstacle across ASEAN.

Cambodia faces limited public and private investment in ocean-based sectors, restricting its ability to develop sustainable marine industries and conservation initiatives. In the Philippines and Viet Nam, inadequate port infrastructure, logistics systems, and coastal connectivity continue to limit economic opportunities in maritime sectors. Singapore, while possessing advanced maritime infrastructure, faces high development and labor costs that may affect the competitiveness of emerging blue economy sectors.

4.4 Institutional and Governance Limitations

Institutional capacity remains uneven across ASEAN and represents a major barrier to effective Blue Economy implementation. Successful ocean governance requires capable institutions, skilled human resources, reliable data systems, and effective monitoring and enforcement mechanisms.

Cambodia faces shortages of skilled personnel and institutional capacity to implement blue economy-related policies and regulations. In Indonesia, fisheries monitoring and enforcement systems face difficulties due to the country's vast maritime territory. The Philippines also faces governance challenges at the local level, where technical and financial limitations constrain the implementation of marine resource management programs. Viet Nam has identified limited awareness and insufficient human resource capacity as barriers to sustainable marine development.

4.5 Climate Change and Resilience Challenges

Climate change is a cross-cutting challenge affecting all aspects of the Blue Economy. The Philippines, with its extensive coastlines, low-

lying coastal areas, and dependence on marine resources, is particularly vulnerable to climate-related risks.

The Philippines is regarded as one of the countries most susceptible to the impacts of climate change globally. It faces frequent typhoons, coastal flooding, and rising sea levels. Thailand is also extremely susceptible to climate threats and ranks among the nations that are significantly impacted by climate change. Singapore is growing increasingly concerned about rising sea levels and protecting its coastal infrastructure. Meanwhile, Indonesia's coral reef ecosystems are becoming more vulnerable to coral bleaching events associated with rising ocean temperatures. In Cambodia and Myanmar, mangrove ecosystem degradation further increases coastal vulnerability to storms and flooding.

5. Strategic Pathways for a Sustainable and Inclusive ASEAN Blue Economy

Effective implementation of the Blue Economy in ASEAN requires a comprehensive strategy to address the region's interconnected economic, environmental, institutional, and social challenges. A key priority should be strengthening governance and regulatory coherence, as many ASEAN Member States continue to face fragmented policy frameworks, overlapping institutional mandates, and limited cross-sectoral coordination. Strengthening regional cooperation through the ASEAN Blue Economy Framework (ABEF), marine spatial planning, integrated coastal management, and cross-border collaboration can improve policy consistency and support the sustainable management of shared marine resources.

At the same time, greater emphasis should be placed on environmental sustainability and ecosystem restoration. Persistent challenges such as overfishing, illegal, unreported, and unregulated (IUU) fishing, marine plastic pollution, coral reef degradation, mangrove loss, and biodiversity decline threaten the long-term viability of marine-

based industries across the region. Strengthening marine conservation measures, promoting sustainable fisheries and aquaculture practices, restoring coastal ecosystems, and expanding blue carbon initiatives can help safeguard natural capital, enhance climate resilience, and support economic growth.

It is equally important to address financial and technological constraints in order to accelerate blue economy development. Many ASEAN countries continue to experience limited access to sustainable financing, inadequate infrastructure, insufficient research capacity, and gaps in technological adoption. Expanding innovative financing mechanisms, such as blue bonds, blended finance, public-private partnerships, and impact investment funds, can help mobilize resources for blue economy projects.

Human capital development and stakeholder participation are also necessary to ensure that the blue economy grows inclusively and equitably. Strengthening the technical capacity of government institutions, labor skills, and knowledge transfer can facilitate the transition to more sustainable ocean-based sectors. Additionally, it is essential to ensure the meaningful participation of coastal communities, small-scale fishers, women, youth, and MSMEs to distribute the benefits of blue economy development more equitably and enhance social resilience.

Finally, ASEAN should continue to encourage both traditional and emerging blue economy sectors, while also incorporating climate change adaptation and mitigation into development strategies. ASEAN should strengthen its position as a global leader in sustainable ocean-based development by combining good governance, environmental stewardship, sustainable financing, technological advancement, and inclusive participation. This will ensure long-term economic growth and ecological resilience.

6. Conclusion

The Blue Economy has emerged as ASEAN's strategic approach to achieving long-term economic growth while conserving marine and freshwater resources. Adopting the ASEAN Blue Economy Framework (ABEF) demonstrates the region's dedication to integrating economic development, environmental sustainability, and social inclusion into a shared agenda. ASEAN has tremendous potential in several key blue economy sectors, including fisheries and aquaculture, maritime transport, marine renewable energy, and marine and coastal tourism. Fisheries and aquaculture are critical to supporting food security, livelihoods, and regional economic development. Maritime transport benefits from ASEAN's location along some of the world's busiest shipping routes. The region also holds significant potential for developing marine renewable energy, supported by its abundant ocean resources. Marine and coastal tourism also contributes significantly to economic growth, employment, and local community development across ASEAN member states.

Despite these opportunities, implementing the Blue Economy in ASEAN faces challenges such as fragmented regulatory frameworks, environmental degradation, limited financing, institutional and governance constraints, technological gaps, and capacity issues. Overcoming these challenges requires stronger regional cooperation, improved governance and policy coordination, sustainable financing mechanisms, technological innovation, ecosystem conservation, and inclusive stakeholder participation.

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