VOLUME 2 – SUPPLEMENT REPORT

REGIONAL STATE OF OCEAN AND COASTS 2021:

Gearing Up for Recovery, Resiliency, and Inclusive Prosperity, The Blue Economy Way

PEMSEA

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Regional State of Ocean and Coasts 2021 (Volume 2): Gearing Up for Recovery, Resiliency, and Inclusive Prosperity, The Blue Economy Way

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Table of Contents

1. Introduction 1

2. Our Ocean Wealth: Overview 1

3. COVID-19 Impacts on the Ocean Economy 5
3.1 Socioeconomic impacts 6
3.2 Fisheries and aquaculture 7
3.2.1 Capture Fisheries 7
3.2.2 Aquaculture 8
3.2.3 Impact on Small-scale Fisheries and Women 8
3.3 Coastal and Marine Tourism 10
3.3.1 Impacts of COVID-19 on the Tourism Industry 10
3.3.2 Impact on Marginalized Sectors 13
3.4 Maritime Industry 13

4. Compounding Environmental Pressures 15
4.1 Consequences of COVID-19 on the Environment 15
4.1.1 Solid Waste and Marine Plastic Debris 16
4.1.2 Greenhouse Gas Emissions and Climate Change 16
4.2 Fisheries and Aquaculture 17
4.3 Coastal and Marine Tourism 19
4.4 Ports and Shipping 20

5. Charting the Right Course to Recovery, The Blue Economy Way 22
5.1 Manage the Crisis and Mitigate the Socioeconomic Impacts 23
5.2 Advance Sustainable and Inclusive Blue Growth 23
5.3 Promote Low Carbon Footprint and Foster Resiliency 25
5.3.1 Marine Renewable Energy 25
5.3.2 Fisheries 26
5.3.3 Marine Transportation 27
5.3.4 Blue Carbon 27
5.4 Forge Ahead with Innovations and Digitalization 29
5.5 Strengthen Governance, Coordination, and Partnerships 30

Bibliography 33

List of Tables

Table 5.1: Green Shipping Solutions to be Compliant and More Efficient 27

List of Figures

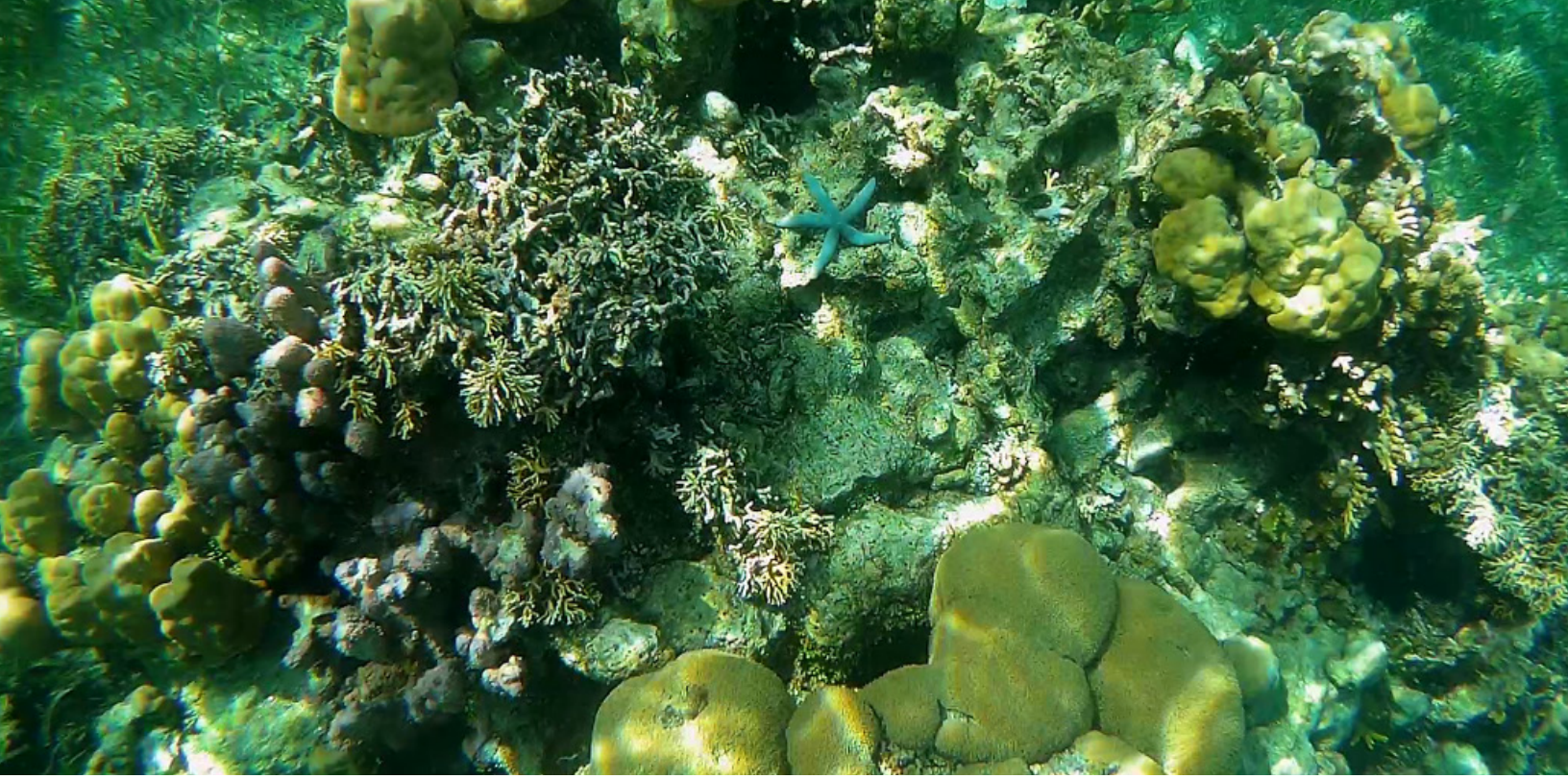
Figure 2.1: Value of Ocean Economic Activities (in US$ billions) and Contribution to GDP (%) 4
Figure 2.2: Employment in Ocean Economy 4
Figure 2.3: Valuation of Ecosystem Services (in US$ billions) 5
Figure 3.1: COVID-19's Direct and Indirect Shocks, which Governments are Trying to Mitigate 5
Figure 3.2: COVID-19's Impact on Tourism Arrivals and Revenues in 2020. 11

List of Boxes

Box 1: Benefits from the Ocean 3
Box 2: Aligning Policy with Structural Change: Key Specific Actions 28

Acronyms and Abbreviations

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
C	Celsius
CO_2	carbon dioxide
COVID-19	Coronavirus disease 2019
EAS	East Asian Seas
ESG	environmental, social and governance
FAO	Food and Agricultural Organization of the United Nations
ft	foot; feet
GDP	gross domestic product
GHG	greenhouse gas
GW	gigawatts
ICT	information and communications technology
IMF	International Monetary Fund
IoT	Internet of Things
IUU	illegal, unreported, and unregulated
MPA	marine protected areas
MW	megawatts
NDC	Nationally Determined Contributions
OECD	Organization for Economic Co-operation and Development
PPE	protective personal equipment
PSA	Philippine Statistics Authority
R&D	research and development
RSOC	Regional State of Ocean and Coasts report
SDG	Sustainable Development Goals
SEAFDEC	Southeast Asian Fisheries Development Centre
STI	science, technology, and innovation
UNCTAD	United Nations Conference of Trade and Development
UNEP	United Nations Environment Programme
UNWTO	United Nations World Tourism Organization
WRI	World Resources Institute
WTO	World Trade Organization
WWTP	wastewater treatment plants



Tagaliling Marine Protected Area, Mati, Davao Oriental *(Photo from DENR Philippines)*

1. Introduction

Over the past year, the COVID-19 pandemic continued to affect countries around the world. It has caused a global health and economic crisis unprecedented in scale and impact, with overstretched health systems, widespread lockdowns, school closures, disruptions to food supply, and income losses that are disproportionately affecting the poor, women, the elderly, informal workers, and other vulnerable groups (World Bank 2021b).

This report is a supplement to the *Regional State of Oceans and Coasts (RSOC) 2021 (Volume 1). Blue Economy: Where are We Now? Where are We Heading?* (PEMSEA, 2021). The impacts of COVID-19 on the ocean economy, and health of the people and the ocean are explored in this Volume 2 report. Using the initiatives, best practices, innovations, policies, and lessons learned discussed in the RSOC report (Volume 1), this supplemental report provides key recommendations to move forward with the blue economy as a way for a sustainable, inclusive, and resilient recovery.

2. Our Ocean Wealth: Overview

The wealth of a nation consists not only of the physical and produced capital, measured by GDP, but also natural capital, human capital, and social/institutional capital (World Bank, 2006).

The value of the ocean consists of: (a) the income from goods and services produced by the ocean industry or the economic activities with dependence on the ocean and coastal and marine resources, and (b) natural assets – coastal and marine resources, and the goods and services they provide. These two are intrinsically linked as oceanic resources and the coastal and marine

ecosystems provide direct and intermediate inputs to the ocean-based economic activities, while conversely, these economic activities can impact the health of marine ecosystems.

Oceans are now recognised as essential for addressing many of the global challenges, such as climate change, food security, poverty reduction, improved medical care, and provision of energy, water, and other natural resources, and its importance in world trade, logistics, travel, tourism, leisure pursuits, traditional knowledge, and community identity. The ocean supports all these basic human needs, which are extraordinarily unlikely to go out of vogue, making ocean investments very sustainable.

The ocean economic activities include *established* sectors like fishing, ports, shipping, marine tourism, etc. as well as *emerging* sectors like marine renewable energy, marine biotechnology, desalination, etc. We measure their value by using the national income accounts or the gross domestic product.

The ocean also provides ecosystem services that are not usually quantified and captured in the gross domestic product (GDP) accounts, such as *regulating* services (e.g., shoreline protection, carbon sequestration, etc.), *supporting* services (e.g., habitat, nutrient cycling, primary production, etc.), and *cultural* services. There is a need to measure and quantify these benefits and services to show that they are just as valuable as the physical or produced capital, if not more.

The 'blue economy' comprises sectors that can *sustainably* use the ocean for small-scale and commercial activities, such as wild capture fisheries, aquaculture, tourism, shipping, marine renewable energy, and industries that use coastlines and ports for trade, and ocean resources for manufacturing (e.g., seafood processing, marine biotechnology). Pre-COVID-19, the ocean industry or economic activities in ten countries in the East Asian Seas region are worth **$1.5 trillion** in value added in 2015 (**Figure 2.1**). There are around **61 million people** who are employed in the ocean industries (**Figure 2.3**). On the other hand, the ecosystem services of the mangroves, coral reefs, seagrass, tidal flats, and other coastal habitats in 8 countries in the region are worth around **$2 trillion**. Note that these are initial estimates since the standardized methodology for ocean accounting is still being finalized. There is lack of disaggregated data so not all ocean economic activities have been measured. There are more people who are dependent on the ocean for their livelihoods as small-scale, household, and informal activities are not yet accounted for. The valuation of ecosystem services is based on existing studies, some of which are site-specific, hence, there could be over- or under-estimation.

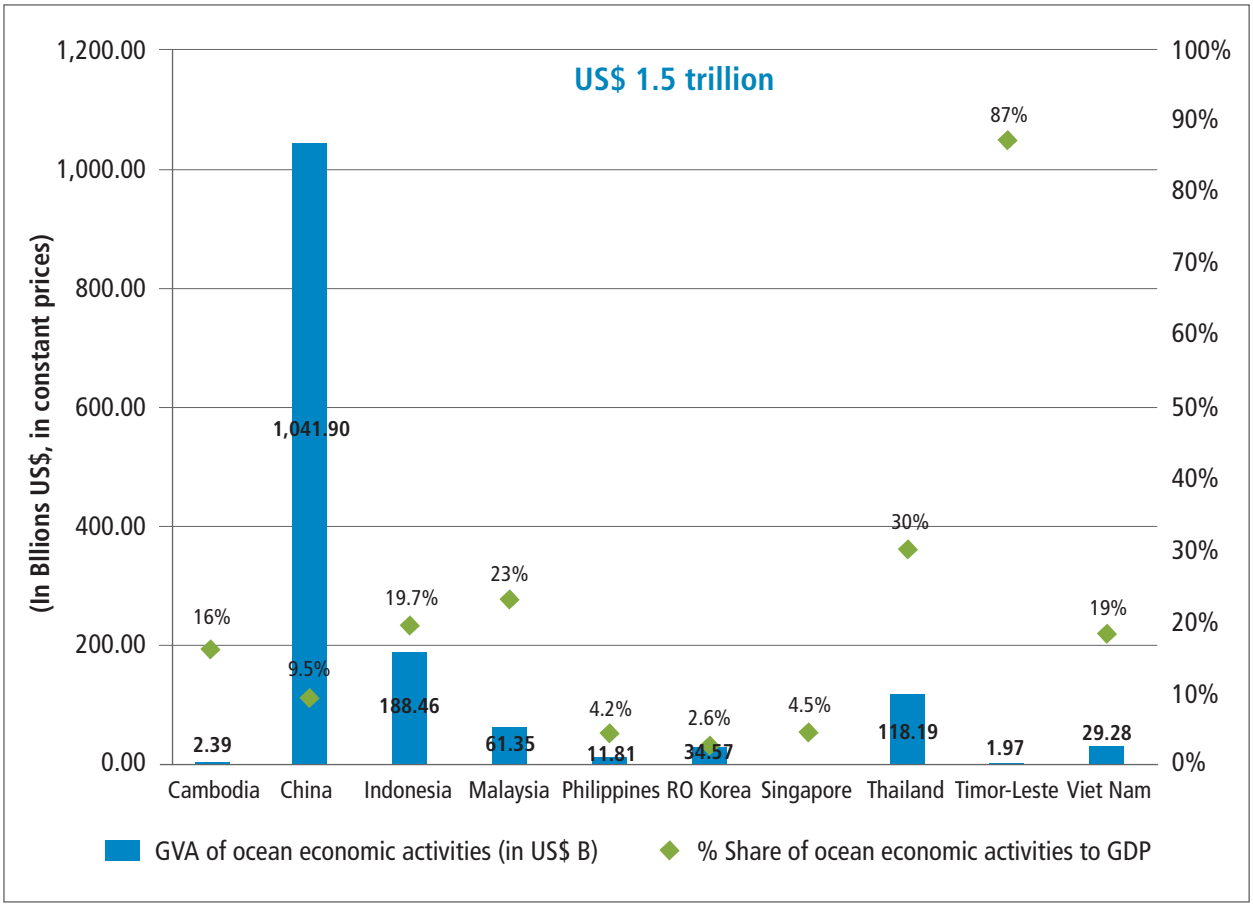
Policy support and capacity development are needed to: institutionalize the regular monitoring of marine water quality, coastal and marine habitats and resources, and ocean economic activities; develop and regularly update the ocean accounts; and mainstream the ocean accounts in policy-making, planning, and ocean management. Knowing the structure of the ocean economy and ecosystem services can be used to assess how environmental degradation, biodiversity loss, and climate change can affect development and future human welfare, and identify measures that need to be put in place. The ocean accounts operate as a sustainable development scorecard for the blue economy.

Box 1. Benefits from the Ocean

- **Food security and nutrition.** The ocean provides food (fish), source of protein, and means of livelihood to the people in the EAS region. Moreover, this region supplied 74% of global aquaculture of fish, molluscs, and crustaceans, 99.5% of of farmed seaweeds, and 37% of capture fisheries (FAO, 2020).
- **Genetic resources and medicines**. Mangroves have been a source of traditional medicines with antibacterial, and antiviral properties. Through **marine biotechnology**, copies of marine compounds from sea snails, macroalgae, and sponges are being used to develop medicines, such as anti-infectives, pain killers, and anti-cancer and anti-HIV drugs.
- **Renewable energy**. The EAS region is a top producer of energy from coastal and offshore **wind power** while **tidal, current and wave energy** and **ocean thermal energy conversion** are being harnessed to help in the transition to zero-carbon and non-depletable energy systems. Through marine biotechnology, microbial fuel cells and other **bioenergy** sources are being developed and deployed.
- **Water**. Desalination is providing needed water in areas with water scarcity issues. However, it is energy intensive, and the disposal of the brine can create environmental impacts. New technologies to address the energy issue, and reuse of brine should be promoted. Deep seawater utilization is also becoming a niche industry (e.g., Japan and RO Korea).
- **Connectivity**. **Ports** are the economy's gateways to the world and also generate supporting activities, such as logistics, bunkering, crewing, banking, insurance, and information and communications technology (ICT). Around 90% of the international trade in the EAS region is done through shipping (UNCTAD). The huge demand for **shipping services** to support growing local, intra-regional and world trade as well as travel and cruise tourism has been a boon to the **shipbuilding and repairing industry,** and **manufacturing of related parts and equipment, and maritime services**. Moreover, most of the world's communications is not carried out by satellites, but by fiber-optic **submarine cables** carrying telecommunication signals across the ocean, a critical infrastructure for the ICT, financial services, and business process outsourcing (BPO) hubs.
- **Blue carbon**. The ocean serves as the largest carbon sink in the world. Studies show that mangroves, seagrass, and coastal wetlands annually sequester carbon at a rate **ten times greater** than mature tropical forests, and store **three to five times more** carbon per equivalent area than tropical forests (NOAA). Thus, the coastal and marine ecosystems have an important role in climate change mitigation and adaptation. The carbon sequestered in these vegetated coastal habitats has been termed "blue carbon". An initial estimate of the blue carbon value of mangroves and seagrass in the region amounts to **US$ 68 billion**, and **US$ 20-40 billion**, respectively (PEMSEA, 2021).
- **Shoreline protection**. Mangroves provide the most cost-effective protection for frequent lower intensity storms (1-in-10-year events).[1] For the Philippines, mangroves provide more than US$1.6 billion in averted damages during catastrophic events (e.g., 1-in-25-year storm).[1] The protection benefits generated by mangroves, seagrass and coral reefs amount to **US$1.8 billion/year**.[2] Thus, the protection benefits can be higher if these three ecosystems are protected in an integrated way.

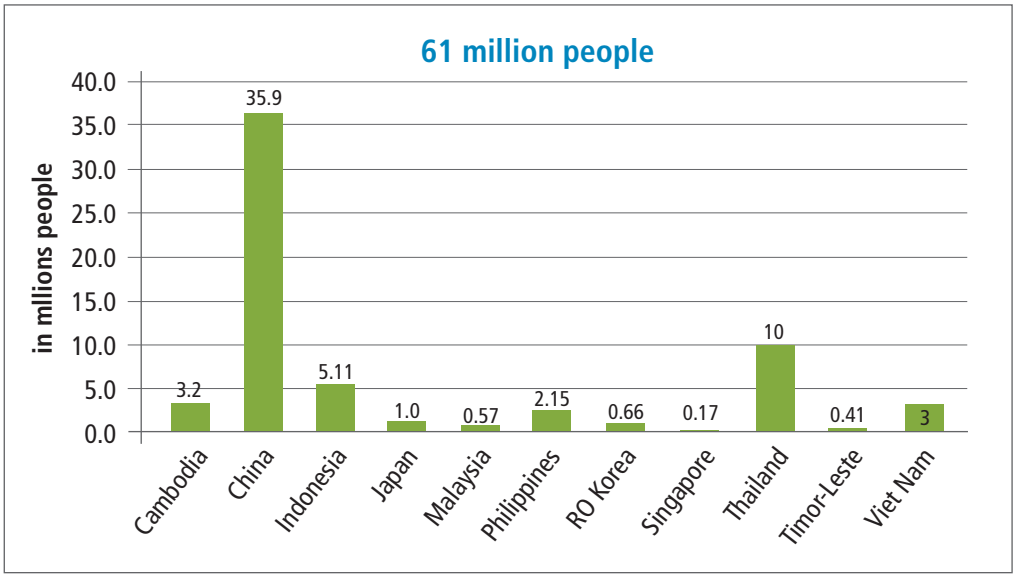
[1] Wealth Accounting and the Valuation of Ecosystem Services, 2017.
[2] UNDP/IH Cantabria, 2017.

Figure 2.1: Value of Ocean Economic Activities (in US$ billions) and Contribution to GDP (%).



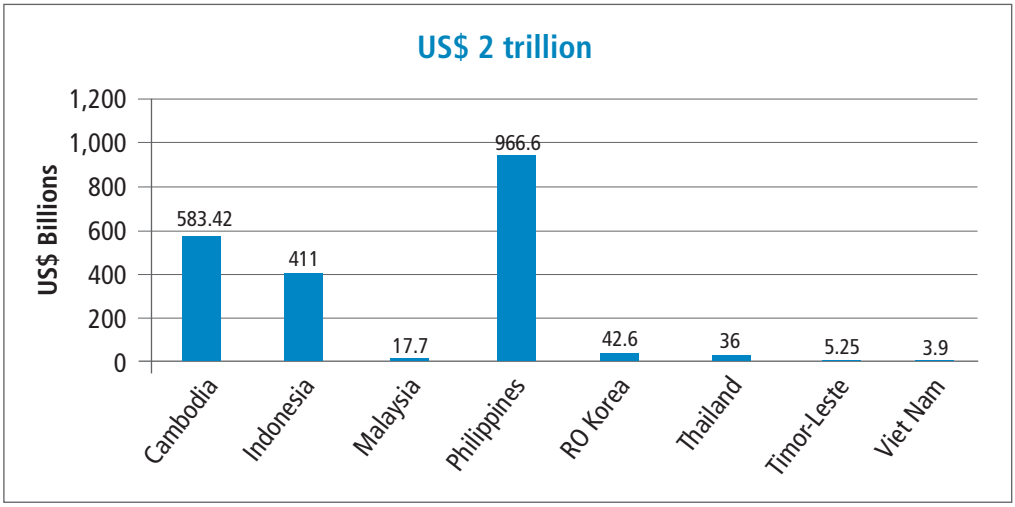
GDP - gross domestic product; GVA - gross value added
Source: NSOC Reports.

Figure 2.2: Employment in Ocean Economy.



Source: NSOC Reports and NSOC Briefs.

Figure 2.3: Valuation of Ecosystem Services (in US$ billions).



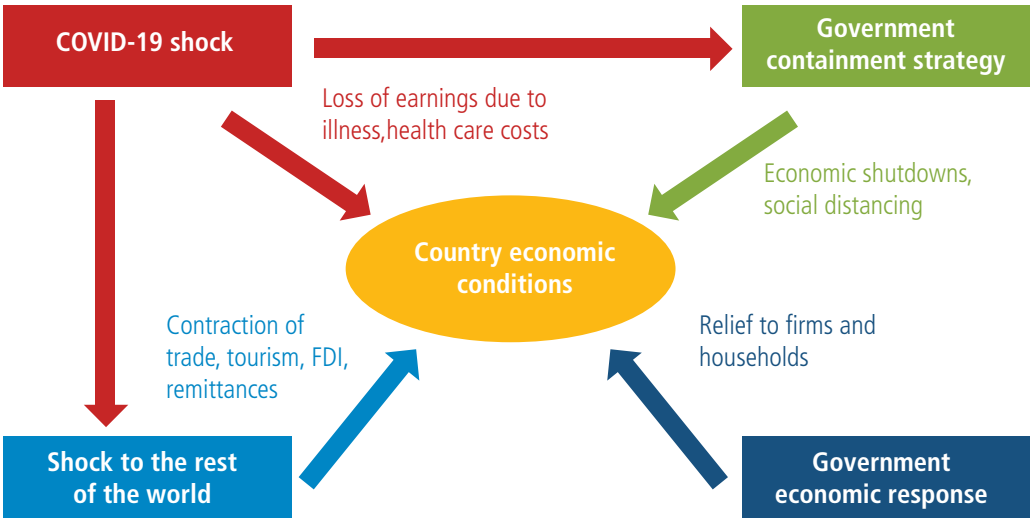
Source: NSOC Reports.

3. COVID-19 Impacts on the Ocean Economy

COVID-19 is the highly contagious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Heng Li, et al. 2020). It has reshaped the world, led to loss of human life, decimated jobs and livelihoods, and threatened food systems and global supply chains.

The COVID-19 pandemic has inflicted multiple shocks on the East Asia-Pacific region: the disease, domestic economic shutdowns, and reverberations from the rest of the world (World Bank 2020) (**Figure 3.1**). Long-term structural changes are still to be distilled yet. Recovery packages remain to be defined in many countries. Due to varying success of the vaccine campaigns in different countries, the speed with which life "returns to normal" remains to be seen.

Figure 3.1: COVID-19's Direct and Indirect Shocks, which Governments are Trying to Mitigate.



Source: World Bank 2020. From Containment to Recovery

3.1 Socioeconomic Impacts

The pandemic and efforts to contain its spread led to a significant curtailment of economic activity. These domestic difficulties were compounded by the pandemic-induced global recession that hit the EAS countries, which rely on trade and tourism hard. Country outcomes were generally related to how efficiently the disease was contained and how exposed countries were to external shocks. The economy of the Philippines contracted in 2020, as shown by -9.6% growth in GDP. Thailand's economy also contracted, with -6.1% growth in its GDP. Other ASEAN countries also posted negative growth rates: -2.1% in Indonesia, -5.6% Malaysia, and -5.4% in Singapore. On the other hand, although Viet Nam's economy slowed down, it posted a 2.9% growth in GDP. A simultaneous supply and demand shock led to the global recession and unprecedented contraction in global trade in 2020.

- **Demand-side.** The macroeconomic impacts of the pandemic crisis in countries affected by the outbreak specifically are sharp declines in domestic consumption as people's mobility are restrained due to stringent lockdowns, resulting in severe declines in business sales and investment spending.
- **Supply-side.** There are also spill-overs of weaker demand to other sectors and economies through trade and production linkages, and supply-side disruptions to production and trade (Sawada and Sumulong, 2021). Maritime trade has been marked by "pandemic-induced logistical challenges", such as shortages of equipment and containers, less reliable services, and congested ports, resulting in supply chain bottlenecks.
- **Employment.** Infections decreased labor supply and productivity. Layoffs and income losses due to sickness, quarantine, and unemployment have reduced economic productivity. The lockdowns hit the service sector hard, particularly industries that involve physical interactions, such as tourism, recreation, retail trade, restaurants, and transportation services.
- **Trade.** World trade is expected to fall by between 13 and 32 percent in 2020 as the COVID-19 pandemic disrupts normal economic activity and life globally (World Trade Organization or WTO, 2020). Global merchandise trade volume is predicted to grow by 10.8% in 2021, followed by a 4.7% rise in 2022. Services trade is still likely to lag behind the goods trade, particularly in sectors related to travel and leisure (WTO, 2021).

The direct trade effects of COVID-19 are related to direct supply disruptions hindering production (local/regional lockdowns and forced production stoppages), increased transport cost due to implementation of stricter rules, supply-chains contagion effect, which amplified the direct supply shocks (manufacturing sectors in less-affected nations found it harder and more expensive to acquire the necessary imported inputs from the hard-hit nations), and finally to demand disruptions due to a decrease in consumption and trade or the overall aggregate demand (recession), and precautionary or wait-and-see purchase delays and delayed investments (IHS Markit, 2021).

In 2021, there is a strong growth in demand – for goods, as opposed to services – is largely the result of pandemic restrictions easing, but also from economic stimulus packages and sharp increases in the price of raw materials, and as worldwide commerce started to stabilize during the second half of 2021 (UNCTAD, 2021).

Vulnerable groups and gender issues

Disease outbreaks disproportionately affect vulnerable and marginalized people. Women, girls, children, youth, the elderly, persons with disabilities, indigenous populations, refugees, migrants, displaced people and minorities are at greater risk of suffering the adverse effects of the epidemic around the world (Regional Risk Communication and Community Engagement Working Group, 2020), particularly in countries with weak health and sanitation infrastructure (FAO, 2021).

The emergence of severe and widespread increased food insecurity and malnutrition affecting millions of vulnerable people, especially in rural settings and communities reliant on fish for animal protein and micronutrients is a cause of concern. This is a setback to achieving the SDG targets.

Ocean economy

The COVID-19 pandemic and response measures have significant short- and long-term effects on macroeconomic activity as well as on the structure of the economy. Among the sectors that have been greatly affected by the pandemic and the restrictions it imposed are the ocean-based industries (Northrop, Konar, Frost, and Hollaway, 2020).

3.2 Fisheries and Aquaculture

Seafood is a highly traded natural commodity, and fisheries provides livelihoods for millions and essential protein for billions of people worldwide.

3.2.1 Capture Fisheries

The EAS region has contributed significantly to global total fisheries production, with the majority of the region's fish and fishery products traded on both international and domestic/local markets.

The pandemic affected the value chains and those who are dependent on small-scale fishing for their livelihoods. This includes the lack of tourists and usual local buyers; loss of international markets; issues around COVID-safe fishing practices, transportation and storage; and increased production costs, etc.

Reduced demand from hotel, retail, and catering services

In pre-pandemic times, the food services and hospitality sectors were important commercial channels for seafood products. COVID-19 has significantly impacted the Southeast Asian capture fisheries due to reduced demand for fish and fishery products from hotel, retail, and catering services, as well as limited market access due to restrictions on human movement and strict regulations on human biosecurity and fishing vessel supplies (SEAFDEC, 2020a).

For instance, seafood prices in Japan have significantly dropped including bluefin tuna, which is caused by a lower demand from hotels and restaurants due to the pandemic (Nippon.com, 2020, as cited in FAO, 2021). On the other hand, consumers are starting to look for long shelf goods, such as the frozen products that eventually caused reduced demand for fresh goods (Souza, 2020).

Supply-chain impacts due to lockdown

The perishable nature of fisheries products requires capital-intensive cold chains and/or processing methods to extend storage life (such as drying and salting).

In the global fish trade, the situation reduced the production and distribution of products due to a decreased number of personnel and restrictions in transporting and exporting products. Social distancing makes it difficult to keep fish landing sites fully operational, and restricted space onboard vessels is considered as added health risk.

3.2.2 Aquaculture

Aquaculture has been strongly affected by the COVID-19 pandemic. Market disruptions caused by travel restrictions and recurring confinement measures have created challenges for the sale of fish products, and therefore led to high maintenance costs in order for fish farmers to keep fish stocks fresh (OECD, 2020a).

China. For instance, as one of the largest producers, exporters, and importers of fish, China has suffered immensely from the pandemic. FAO (2020) reported that the export of fish species, such as tilapia and catfish, and the processors of whitefish in the country is said to have struggled in maintaining orders from abroad.

Indonesia. Indonesia has also seen a dip in their aquaculture sector as restaurants, markets, and shopping malls shut down or limit work hours to observe social distancing measures (Ambari and Mubarok, 2020). As a result, fishers worry about their income and some even fear that they may lose their jobs.

Philippines. In a province of the Philippines, the ongoing crisis has made it more difficult for smallholder fish farmers as they have experienced difficulty in accessing fry and fingerlings due to limited travel, therefore increasing the cost of fingerlings and other needed inputs, such as formulated feeds, due to travel restrictions (Manlosa *et al.*, 2021).

3.2.3 Impact on Small-scale Fisheries and Women

Small-scale fisheries. Many of the countries in the region issued lockdowns which limited the fishing operations and greatly affected the small-scale fisheries (SEAFDEC, 2020b). With fish and fish products among the most highly traded food products in the world, supply chains were immediately

severely disrupted. The restrictive measures put in place were (and still are) particularly damaging, especially for small-scale fisheries.

Small-scale fisheries are the backbone of socioeconomic well-being in coastal communities, where fish is crucial for food security and health, providing not only daily protein requirements, but also a range of essential micronutrients that fend off diseases of malnutrition.(Teh and Pauly, 2017).

Women. Women in Asia, particularly those from impoverished fishing families, are active participants in a variety of fisheries operations, including gleaning, processing, marketing, and in aquaculture. Gleaning by women and children has an important role in securing household food and nutritional requirements. Women also clean and dry fish and sell both fresh and dried fish and seaweeds. Value chains for dried small fish are important, and most lie in the informal sector dominated by rural women, who were highly affected by restrictions on movement.

Women make up half of the workforce, yet they are frequently assigned to the most unstable and low-paying professions. They are more prone to job loss, particularly informally employed and female migrant workers in seafood processing plants (Briceo-Lagos and Monfort, 2020 as cited in FAO, 2021). As a result, they may not be able to receive social protection benefits given by governments.

The current lack of data on women's contributions and engagement highlights a critical gap in fisheries management. Proper accounting of small-scale fisheries and women fisherfolk can contribute to improved fisheries development plans and management. **SDG Target 14.b** is aimed at providing access of small-scale artisanal fishers to marine resources and markets, while **SDG 5** focuses on gender equality and empowerment of women.

Fishing boats in Viet Nam. *(Photo by M. Ebarvia)*

3.3 Coastal and Marine Tourism

Tourism is one of the world's major economic sectors. It is the **third-largest export category** (after fuels and chemicals), and in 2019, it accounted for **7% of global trade** and employed one in every ten people globally and – through a complex value chain of interconnected industries – provided livelihoods to millions of people in developed and developing countries.[3]

3.3.1 Impacts of COVID-19 on the Tourism Industry

COVID-19 has negatively impacted the tourism sector in the Asia-Pacific region as international travel restrictions were implemented due to the pandemic. No country has escaped the decimation of its tourism sector, from Cambodia where travel and tourism accounts for 28 percent of its GDP[4] to Timor-Leste where it generates almost 64 percent of all exports in 2018.[5] Before the COVID-19 pandemic, tourism contributed $285 billion worth of revenues to the countries in the EAS region.[6]

According to the UNWTO (2021): Northeast Asia experienced an 88 percent drop in international tourism arrivals in 2020, and a further decrease of 94 percent in January-July 2021. Likewise, Southeast Asia experienced a decrease of 82 percent in international tourist arrivals in 2020, and 98 percent decrease in January to July 2021. **Figure 3.2** shows the impact of COVID-19 on tourism arrivals and revenues in the EAS region.

With tourism as a hard-hit sector, countries that have the highest share in tourism are expected to have a higher decline in their GDP, and the higher the share of employment in tourism, the harsher the impact to workers and economies. The direct contribution of tourism to the GDP of the countries in the EAS region ranges from 2 percent in Japan to 7 percent in Malaysia and Thailand, and 9% in the Philippines.[7] In Southeast Asia, Cambodia, Thailand and Viet Nam are the countries with the highest share of employment in tourism, reaching 6.7, 9.0 and 6.9 percent, respectively.[8]

At present, tourism has been hit hard, and millions of jobs were lost in one of the most labour-intensive sectors of the economy. Many countries in the region have been reported to have millions of workers, including staff from airlines, hotels, travel agencies, and transport companies, whose jobs and health are at risk as a result of the pandemic crisis. The total employment share in travel and tourism in the region has also decreased, with an 18.2 percent drop in Northeast Asia and a 16.8 percent drop in Southeast Asia.[9]

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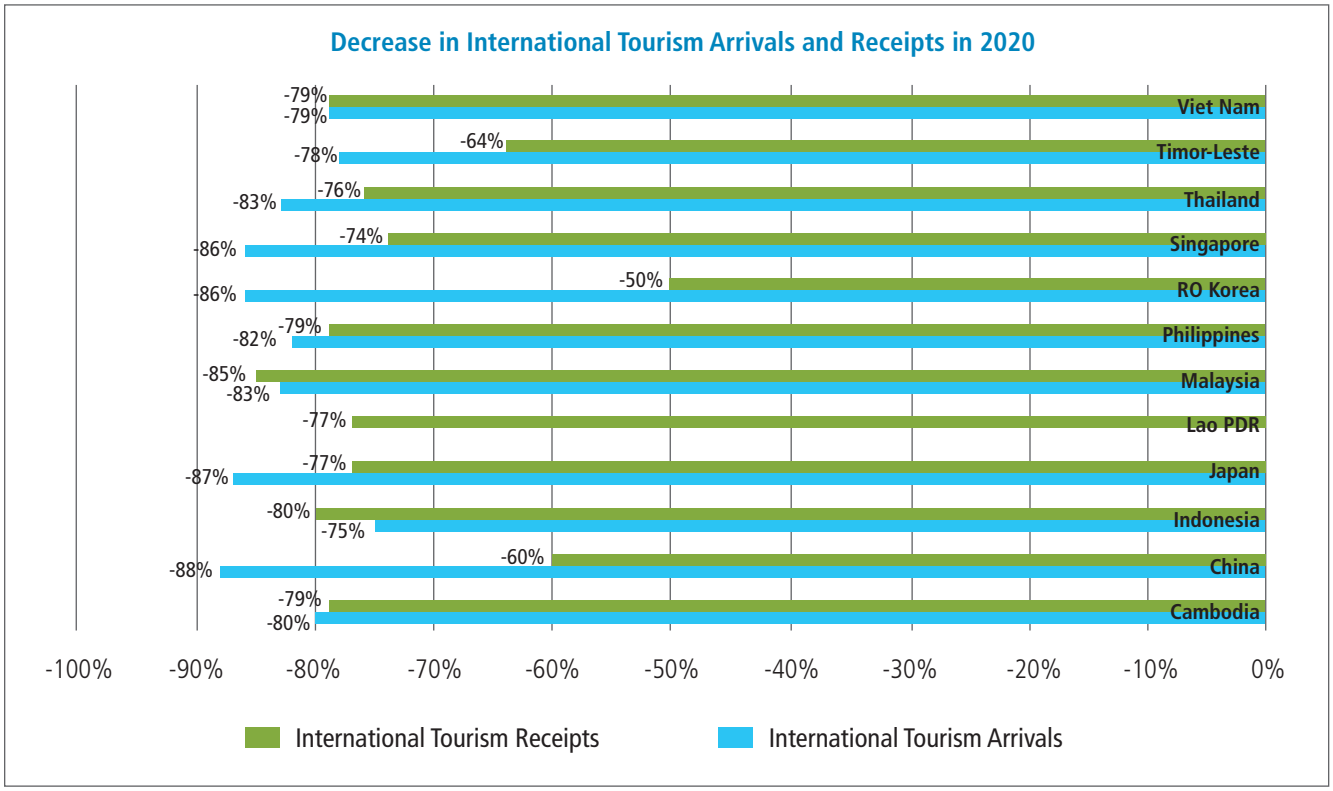
3 UNWTO, 2020.
4 WTTC, 2016.
5 World Bank, 2021.
6 PEMSEA, 2021 and World Bank, 2021.
7 UNWTO, 2021.
8 ILO, 2020.
9 UNWTO, 2021.

Figure 3.2: COVID-19's Impact on Tourism Arrivals and Revenues in 2020.



Source of data: UNWTO Tourism Dashboard, data as of 27 October 2021. (https://www.unwto.org/international-tourism-and-covid-19).

Impacts in selected countries

China. According to the International Labour Organization (2020), the abrupt decline in the number of tourists for China has left a huge impact on the tourism sector in the region at an early stage of the pandemic. In 2019, there were approximately 62.5 million international arrivals in China.[10] The number of international visitor arrivals was estimated to have dropped to 27.2 million in 2020 due to the coronavirus pandemic.[11]

Moreover, as China is considered a global tourism powerhouse over the past decade, the sudden travel restriction imposed by the government on its citizens for the sake of safety precautions has left an immediate impact on global destinations.

Indonesia. In 2020, there were about 4.05 million international visitor arrivals in Indonesia,[12] the number significantly decreased in comparison to the previous year's 16.1 million tourists[13] due to the COVID-19 travel restrictions. Over 550,000 hotel employees, or around 78.5 percent of

[10] World Bank, 2021.
[11] Statista Research Department. 2021a.
[12] Statista Research Department. 2021b.
[13] World Bank, 2021.

the total registered workers in the industry were laid off due to exceeding losses of S$9.5 billion (Straitstime.com, 2020).

Philippines. The total direct GVA of tourism was PhP 2.51 trillion in 2019 (US$ 52.3 billion), contributing 12.8 percent of the Philippine GDP in the same year (PSA, 2021). There were 5.8 million people employed in the tourism sector, representing 13.6 percent of total employment in 2019 in the country (PSA, 2021). The Philippines has been experiencing a high influx of tourists since 2010, but due to the coronavirus (COVID-19) pandemic, the country implemented a nationwide lockdown, causing tremendous impacts on its inbound tourism market. The number of international tourist arrivals to the Philippines significantly declined in 2020 compared to the previous year. From approximately 8.26 million foreign tourists coming to the Philippines in 2019, this figure dropped to just about 1.5 million in 2020 (Statista, 2021c).

Viet Nam. The tourism industry and job employment have been great contributors to the growth of GDP in Viet Nam. International visitors are also affected due to the travel restrictions imposed by different countries. It was revealed that there is a 55.2 percent decrease in the number of international arrivals by sea in March 2020 compared to last year (Tien, 2020). In 2019, Vietnam welcomed 18 million international arrivals, a record number for the country, however, the number of international tourists went down to 3.83 million in 2020 (Statista, 2021d).

Boracay *(Photo from DENR Philippines)*

3.3.2 Impact on Marginalized Sectors

Tourism also often serves as a first entry point to work especially for women, youth, migrant workers, and rural population (UNCTAD, 2020d). This is because tourism employment does not usually require high education levels (but, conversely, little training exists to enable career advancement). It is also labor intensive, creating many jobs though only a few are well-paid with promotion prospects; hence, many jobs are taken by migrant workers and women where alternative livelihood may be scarce (ADB, 2020). However, with the current health crisis, EAS countries suffered great losses, which led to massive layoffs in the tourism sector.

Gender-wise, women make up 54 percent of the global tourism workforce, compared to 39 percent in the broader economy, but earn 14.7 percent less than men. In addition, women's work in tourism is dominated by informality, subcontracting, high staff turnover, long working hours, and seasonal variations in employment. In Asia and the Pacific, 53% of tourism workers are female (UNWTO, 2019). Compared to men earning, women in the tourism industry earn 14.7 to 16.8 percent less (UNWTO, 2019), hence making them more vulnerable.

3.4 Maritime Industry

Shipping. Maritime transport, which handles over 80 percent of the global merchandise trade by volume and over 70 percent by value, underpins the global supply chain and economic interdependence with shipping and ports (UNCTAD, 2021b). Container shipping was valued at around US$14 trillion in 2019, and deadweight tonnage is estimated to have grown from 11 to 275 million tonnes between 1980 and 2020 (Statista, 2021e).

The COVID-19 pandemic disrupts the transport network of supply chains that significantly affect world trade and economic activity. As reported by UNCTAD (2020b), the widespread issue of lockdowns, travel bans, closure of stores (during the first half of 2020), and transport restrictions imposed additional challenges to the structural market imbalance. Most of the passenger and cruise ships have been affected, but the container and cargo shipping has continued although with some hindrances.

Following the outbreak, there was an unprecedented drop in maritime mobility, across all categories of commercial shipping. With few exceptions, a generally reduced activity is observable from March to June 2020, when the most severe restrictions were in force. The variation of mobility was quantified to be between –5.62 and –13.77 percent for container ships, between +2.28 and –3.32 percent for dry bulk, between –0.22 and –9.27 percent for wet bulk, and between –19.57 and –42.77 percent for passenger traffic (Millefiori, et al. 2021).

According to the Global Trade Update (UNCTAD, 2020), the intra-regional trade of East Asia and Pacific region declined in varying degrees. China was able to alleviate the impact with over 3% of export growth in April 2020. Meanwhile, Japan and South Korea plunged by 21% in imports and 20% and 26% in exports, respectively, in 2020.

Ports. The outbreak-imposed lockdown resulted in port congestion, with some manufacturers failing to pick up the cargo (Teoh, 2020). The lockdowns and movement restrictions also caused

a. factory closures in China and other EAS countries resulting in supply-chain disruptions
b. transportation and logistics constraints, as well as a labor shortage, which hampered the timely delivery of components from China and other nations to Southeast Asian plants, and vice versa
c. rerouting of vessels, changes in schedules and port calls, as well as variations in volumes (UNCTAD, 2020a).

Singapore is the second biggest world container port, and there was a significant decrease in the number of liner shipping operators along with the number of liner shipping services and ship calls. Singapore ports lost 4.8 percent of the liner shipping services compared to the second quarter of 2019. A decline of 6.2 percent in the number of ship calls, and 3.5 percent in the capacity of the size of deployed ships was observed. (UNCTAD, 2021a).

Shipbuilding and maritime services. Shipbuilding and ship repair segments have collapsed in 2020, while maritime finance and ship brokerage have been greatly affected (Kuo, 2020). Hence, this forces the shipping industry to adopt a more disciplined approach, cutting capacity and reducing costs to maintain profitability instead of market share (UNCTAD, 2020c).

On the other hand, the second half of 2020 shows that there is a surge in demand for retail, such as furniture and electronics, during the COVID-19 pandemic that has led to sudden increased demand for cargo space. Freight liners have redirected to the lucrative Asia-US route, and every idled ship in the world's fleet of merchant vessels was pulled into trade.

In Asia, manufacturers vie for cargo space amidst a shortage of an estimated half a million containers. The price of a 40-foot container also skyrocketed from US$ 1,486 in May 2020 to US$ 5,472 by May 2021 (Almendral, 2021). According to the IHS Markit's Port Import/Export Reporting Service (PIERS) database, US-Asia import goods rose to 16.9% by the second half of 2020. Data from this platform's Container Availability Index (CAx) show that 20-ft container is in short supply in Shanghai, China, and in Port Klang, Malaysia, while both 20-ft and 40-ft containers are in short supply in Singapore.

Impact on seafarers

Attention must be given to the plight of seafarers, many of whom had their service extended on board ships after many months at sea, unable to be replaced or repatriated after long tours of duty,

due to COVID-19 restrictions. The UN recognizes their indispensable role in securing vital global supply chains and transporting over 80 percent of world trade, which includes medical supplies, food, and other basic goods that are critical for the pandemic response (UN News, 2021).

(Photo by Maritime Port Authority of Singapore)

4. Compounding Environmental Pressures

4.1 Consequences of COVID-19 on the Environment

The long-term impacts of the pandemic on sectoral economic activities and on the environment are not fully assessed yet. Below are key findings of OECD (2021a):

- The COVID-19 pandemic and response measures have significant short- and long-term effects on macroeconomic activity as well as on the structure of the economy. The structure of the economy plays a key role in how economic effects translate into effects on environmental pressures.
- The short-term reductions in environmental pressures are significant: energy-related emissions declined by 7 percent, agriculture-related environmental pressures by less (around 2%). The reduction in the use of non-metallic minerals, including construction materials, reached double digits.
- Long-term changes in environmental pressure will depend crucially on their economic drivers and the regional impacts. Some sectors – e.g., manufacturing and construction – are more affected than others – e.g., agriculture. Regional differences are also large, with strong long-term effects like in India.

- There is a projected long-term – potentially permanent – downward impact on the levels of environmental pressures of 1-3 percent, depending on the indicator. A slow recovery can double these impacts.

4.1.1 Solid Waste and Marine Plastic Debris

In contrast to some of the short-term benefits of the pandemic to the health of the ocean, the increasing usage of personal protective equipment (PPE) to contain the spread of the virus have caused major supply chain disruptions and waste disposal pressures. The recent COVID-19 pandemic has led to an increased demand for single-use plastic, including its use in food deliveries and on-line shopping package materials. Millions of discarded single-use plastics have entered the environment, potentially causing a spike in plastic washing up on beaches and polluting the marine waters and seabed.

More than eight million tons of pandemic-associated plastic waste have been generated globally, with more than 25,000 tonnes entering the global ocean (Peng, *et al*. 2021). Most of the plastic is from medical waste generated by hospitals that dwarfs the contribution from PPE and online-shopping package material.

Asia creates the most discarded face masks per capita per day, accounting for 52.9 percent of the worldwide total, due to the mandated usage of single-use facemasks (and face shields) in several nations which have increased more plastic pollution (Benson, *et al.,* 2021). Most of the plastic waste entered the world's oceans via major rivers. The three waterways most polluted by pandemic-associated plastic were all in Asia: the Shatt al-Arab River that feeds into the Persian Gulf; the Indus River, which empties into the Arabian Sea; and the Yangtze River, which flows to the East China Sea (Peng, *et al.,* 2021).

Better medical waste management in pandemic epicenters, especially in developing countries, is essential considering the long-term effect on the marine environment, aquatic life, and food chain.

4.1.2 Greenhouse Gas Emissions and Climate Change

Energy demand will grow as much as 66 percent by 2040, and coal alone will account for almost 40 percent of the increase (Prakash, 2018). This poses a risk to the Paris Climate Agreement's goal of limiting the average global temperature gain to 2°C above pre-industrial levels. Although the region's greenhouse gas (GHG) emissions have been low relative to those of advanced economies in per capita terms, that is starting to change, largely because of its increasing reliance on coal and other fossil fuels. Demand for coal is partly driven by the fuel's relative abundance in the region and its low cost compared with oil, gas, and renewable energy. Between 1990 and 2010, emissions of CO_2 increased faster in Southeast Asia than anywhere else. Meanwhile, East Asia

(China, Korea, Japan), as a center of industrial production, is responsible for about 30 percent of energy-related global emissions of CO_2 (Westphal *et al.*, 2013).

Short-term positive impacts during the lockdown

The reduction in power usage, specifically fossil fuels, has led to improved air quality. There is a reduction in GHG emissions when there is less consumption of fossil fuels and this is favorable to the fight against global climate change (Rume and Islam, 2020). With construction projects being halted and factories being shut down, there was a significant decrease in demand for power in 2020.

The International Energy Agency (IEA, 2020) has found a significant drop in oil barrels demand by 435,000 barrels globally during the first three months of 2020 compared to the same period the previous year.

China, which is considered the highest consumer of coal in the world, has decreased its coal use by 36% compared to the same period last year (CREA, 2020; Ghosh, 2020). More than two months of lockdown in China has brought the CO_2 emissions to below the normal limit (Evans, 2020 as cited by Rume and Islam, 2020).

Levels of nitrogen dioxide (NO_2) have also declined across China based on satellite images from NASA Earth Observatory as the lockdowns caused factories to close (Ghosh, 2020). For instance, air quality has improved as concentrations of NO_2 have been observed to significantly decrease in Wuhan, China following implementations of lockdown measures in the early onset of the pandemic crisis (Gope *et al.*, 2021).

4.2 Fisheries and Aquaculture

Major threats to the fisheries stocks include the ever-increasing fishing pressure brought about by the growing number of fishers per fishing area and the use of more efficient fishing gears and mechanized fishing operations. Illegal, unreported, and unregulated (IUU) fishing has resulted in dwindling fish abundance in many areas in the region. The use of destructive fishing methods (e.g., cyanide, blast fishing, and fine mesh nets) has long contributed to the rapid decline of fish stocks and habitat degradation. By-catch and discards from trawling are also considered as threats to fisheries sustainability. The biased investment in industrial fisheries has resulted in overfishing throughout Southeast Asia—in the Gulf of Thailand, demersal fish stocks in the 1990s had fallen to just one tenth of their levels in the mid-1960s when trawling began (FAO, 1997). The disparity between industrial and small-scale sector catches has not been easily quantified due to inconsistent or lack of accounting of small-scale catches (Teh and Pauly, 2017).

Decreasing numbers of fish are also the direct results of loss of mangroves and seagrass beds, diminishing coral cover, land use changes, and pollution in coastal and marine areas.

The EAS region is the aquaculture hub of the world, but at a cost to ocean health and security. Instead of relieving fishing pressure, many global forage fish stocks and so-called "trash fish" can be overfished in an effort to derive fish oil and fish meal to feed farmed fish.

There are also unresolved concerns with effluent discharge, the use of chemicals, disease transfer, and the destruction or alteration of important ecosystems, such as the destruction of mangroves to create farmed shrimp ponds, rice farms, and palm oil plantations.

The resulting economic loss is estimated at US$ 83 billion per year for fisheries and over US$ 6 billion per year from diseases in aquaculture (World Bank, 2017).

These issues are further exacerbated by climate change. Warmer waters hold less dissolved oxygen, exacerbating dead zones, fish kills, and algal blooms. Warmer water temperatures have caused coral bleaching. Ocean acidification will have damaging impacts on coral reefs, and shell-forming marine organisms. This could alter marine food chains and food supply to humans. Acidification could also decrease storm protection from reefs, tourism opportunities, and other benefits provided by the marine ecosystems.

The contributory factor of the weather has affected small-scale fishers as there is less catch of fish during the southwest monsoon season while those who rely on estuarine fishing have less catch of crabs and shrimps. While this seasonally occurs, fishers perceived the reduction in catch as being exacerbated by the negative effects of water pollution, and IUU fishing (Manlosa *et al*., 2021).

Another important issue that has not been properly discussed is that fisheries are highly energy intensive, and emissions from fishing vessels are among the largest contributor to ocean and coastal fisheries-related greenhouse gas emissions (WRI, 2021).

For all these reasons, the sustainability of fisheries is essential. Blue economy growth in the fisheries sector requires a central focus on ecological sustainability, disaster and climate resiliency, and inclusive development.

Some positive impacts during the pandemic

Fishing operations have been affected due to the implementation of regulations of different countries resulting in changes in pelagic tuna fisheries in Japan (Seafoodnews, 2020, as cited in FAO, 2021).

Nevertheless, the pauses and reduction in the operation of fishing fleets can also be linked to potential upsides. The resting of overfished fish stocks may help in speeding up their recovery (Korten, 2020), although studies suggest that this might take 10-15 years for depleted stocks to completely recover in the absence of governance (FAO, 2021).

A reduction in the release of greenhouse gases is also one upside as there is decrease in fossil fuel use, which may therefore aid in mitigating climate change (FAO, 2020).

Despite these challenges in the aquaculture industry, a number of adaptations have been practiced by the concerned countries. Currently, there has been a development in terms of direct retail sales through means of online ordering and home delivery or aquaculture drive-in (FAO, 2020).

Processing and freezing of fish that have reached their commercial size has also been widely practiced. Consequently, small-scale aquaculture and fish farming operators that are located in areas where fish imports are abundant and important may benefit from the enforced restrictions since there will be reduced competitors (BBC News, 2020, as cited in FAO, 2020).

4.3 Coastal and Marine Tourism

As one of the largest, fastest, and most consistent growth sectors in the world economy over the last six decades, tourism's significant contribution to job creation, export revenue, and domestic value added, is well recognized. However, for many destinations, tourism growth in recent years was economically, socially, and environmentally unbalanced, often the result of rapid and unplanned growth in visitor numbers, which can negatively affect not only the tourist experience but also the environment and host communities upon which tourism depends (OECD, 2021b).

Massive influxes of tourists, often to a relatively small area, can have huge social and environmental impacts. They add to the water and energy needs of the local population as well as pollution, putting local infrastructure and habitats under enormous pressure. Most of the plastic used by tourists is designed to be thrown away and often cannot be recycled, leading to large amounts of trash. The UN Environment Programme (UNEP) estimated that 4.8 million tonnes or 14 percent of all solid waste (in 2016) is produced each year solely by tourists. This waste can potentially overload waste management systems, especially in destinations that are more rural in nature or have a low population.

In many areas, massive new tourism developments have been built—including airports, marinas, resorts, and golf courses. Overdevelopment by the tourism industry has the same problems as other coastal developments, but often has a greater impact as the tourism developments are located at or near fragile marine ecosystems. The damage does not end with the construction of tourist infrastructure, which often does not include wastewater treatment systems. Some tourist resorts discharge their sewage and other wastes directly into coastal waters surrounding coral reefs and other sensitive marine habitats. Untreated wastewater can result in eutrophication and harmful algal blooms, and has health impacts on the tourists and coastal communities. Recreational activities also can have a huge impact. For example, careless boating, diving, snorkelling, and fishing have substantially damaged coral reefs in many parts of the region, through people

touching reefs, stirring up sediment, and dropping anchors. Marine animals, such as whale sharks, seals, dugongs, dolphins, whales, and birds are also disturbed by increased numbers of boats, and by people approaching too closely.

Tourism can also add to the consumption of seafood in an area, putting pressure on local fish populations and sometimes contributing to overfishing. Collection of corals, shells, and other marine souvenirs—either by individual tourists, or local people who then sell the souvenirs to tourists—also has a detrimental effect on the local environment.

On a positive note…

The pandemic may have caused disruptions in the coastal tourism sector as previously mentioned, but it has also helped in the restoration of many coastal and marine ecosystems, improved air quality, and reduced water pollution in tourism areas. It was reported that water pollution was reduced in the beach areas of Bangladesh, Malaysia, Thailand, Maldives, and Indonesia (Rume and Islam, 2020).

Vehicles and aviation contribute almost 72% and 11% of the transport sector's GHG emissions, respectively (Henriques, 2020). In 2020, 96 percent of air travel dropped globally due to the COVID-19 pandemic (Wallace, 2020). Global daily carbon emissions are said to have a 17 percent decrease during the peak of confinement measures in early 2020 (Hudson, 2020).

4.4 Ports and Shipping

When holistic planning is absent, expanding port facilities can harm the environment and the people living in nearby cities and communities. For example, during construction, damage can occur through destruction of coastal habitats, land reclamation and the dredging, and the construction of buildings and roads to connect to the port.

Once operational, there are air and water pollutants, solid waste, noise pollution, and a higher-than-normal emission level of GHG. Ports do not exist in isolation and rely on many services for its good functioning. To address climate change effectively in ports, there is a need to understand the broader context within which ports operate. The resilience of ports is as good as its weakest link along the logistics value chain.

The environment must be considered in all the details of shipping, from building of a new vessel, its operation, and to its decommissioning. Anchoring of ships can damage benthic communities. It is essential to reduce the impact of the marine shipping industry by regulating exhaust emissions, anti-fouling, ballast water, etc. as ships are directly operating over the seas.

There are problems associated with the discharge of **ballast water**, which can pose serious ecological, economic and health problems. Ballast water, which helps keep vessels stable in the water and maintain ideal buoyancy, can **accidentally introduce aquatic invasive species**. The economic and social impacts of invasive species include both their direct effects on native fisheries and biodiversity, public utility operations, tourism, and outdoor recreation, as well as costs associated with invasive species control efforts.

International shipping is a large and growing source of GHG emissions. Ocean transport accounts for about 2.5 percent of global emissions (European Commission, 2021.) According to IMO, CO_2 emissions from shipping are projected to increase by 50 to 250 percent in the period to 2050, despite fleet average efficiency improvements of about 40%, and in the absence of further regulations (IMO, 2014). There are significant technical and decarbonization opportunities in the marine transport sector that serve to enhance the objectives of the Paris Agreement. Reducing both international and domestic emissions in marine transport could lead to a 2030 and 2050 estimated mitigation potential between 0.50 and 1.8 gigatons of CO_2 (WRI, 2021).

Khlong Khon Mangrove Forest Conservation, Samut Songkhran Province, Thailand *(Photo by M. Ebarvia)*

5. Charting the Right Course to Recovery, The Blue Economy Way

"The recovery from COVID-19 must lead to an economy focused on building inclusive and sustainable economies that are more resilient in facing pandemics, climate change, and the many other global challenges."

António Guterres, UN Secretary-General

The COVID-19 crisis has brought with it what is by many measures the largest economic shock in history. This has in turn called forth an unprecedented economic response from governments around the world - initially in the form of triage and stabilization, followed quickly by bridging stimulus packages of various kinds, and later, a range of (variably) ambitious economic recovery packages aimed at 'building back better' than before.[14] While addressing the immediate health demands and the socioeconomic impacts of COVID-19, this crisis also provides an opportunity to implement needed structural reforms (**Box 2**), and become more sustainable, inclusive, and resilient.

As pointed out by the International Monetary Fund (IMF, 2020): "The global economic outlook is improving, but the recovery is partial, uneven, and uncertain. While advanced economies have deployed extraordinary policy support, developing and emerging market countries had more limited room to respond. The crisis will inflict long-lasting scars—from the tragic loss of human life to damage to the workforce and firms, heavier debt burdens, heightened financial vulnerabilities, higher poverty, and deeper inequalities. Many countries may not return to the pre-COVID path of economic activity for several years. With the pandemic still present in most countries, a resurgence of infections remains a key threat and uncertainty exceptionally high. **Bold action is needed to underpin the recovery, build more resilient economies, and help the most vulnerable.**"

This is a fortuitous chance to *build back better* according to the UN Secretary-General. The RSOC report (Volume 1) provides examples and details on the policies, best practices, and innovations in the EAS region. It shows how blue economy offers an alternative path to ensure the responsible and regenerative use of the ocean and coasts for sustainable and inclusive economic prosperity, food, water, and energy security, jobs and livelihood, resiliency and wellbeing, while preserving the health of the ocean ecosystems. The blue economy includes the following pillars:

- sustainable growth of the ocean economy, jobs and livelihoods
- conservation of ecosystems and biodiversity and sustainable use of the ocean resources
- GHG emission reduction, wastewater and solid waste management, and circular economy
- inclusive social development
- science, technologies, and innovations
- sound ocean governance, including integrated ocean management, evidence-based policy- and decision-making, sustainable ocean financing and investments, stakeholder participation, capacity development, and knowledge sharing

[14] Hopkins and Greenfield, 2021. For details on analytical frameworks for phases of the COVID policy response, see OECD. 2020. Tax and Fiscal Policy in Response to the Coronavirus Crisis, or GEC. 2020. Green Economy and COVID-19: The Policies.

5.1 Manage the Crisis and Mitigate the Socioeconomic Impacts

An expedited global solution to suppress the virus is a prerequisite for a durable economic recovery. The immediate priority is to develop, produce, and distribute medical treatments and vaccines. In a pandemic, the global economy is only as strong as its weakest member, and an uneven rollout of medical solutions would dampen the recovery. Hence accelerating universal access to such solutions is in the interest of all countries (IMF, 2020).

In the EAS Region, countries contained COVID-19 through a *combination* of stringent mobility restrictions (i.e., lockdowns), testing and contact tracing strategies, and information programs to encourage precautionary behavior, such as mask wearing, frequent hand-washing, and keeping physical distance.

The initial successful containment of the disease in some countries resulted in a revival of domestic economic activity. However, this was short-lived as the virus mutations and slow roll out of the vaccines led to another round of restrictions on mobility and economic activities. With the vaccination and lower number of cases, countries in the region have started to ease the restrictions in 2021.

Most governments responded immediately to the pandemic by using disaster relief and social protection measures to minimize the impacts of COVID-19. Efforts included extending lump sums and/or periodic cash transfers, food relief, solidarity funds, social insurance (such as sick leave, unemployment benefits), economic stimulus and grant programs. However, such government aid remains low and inadequate, especially in the developing countries.

5.2 Advance Sustainable and Inclusive Blue Growth

Governments, in partnership with private sector, NGOs,and coastal communities, can create **nature-based job programs**. Recovery funds could prevent furloughs by hiring people to:

- restore coastal ecosystems, such as coral reefs, mangroves, seagrass and beach areas, given the massive return on investment that such ecosystems deliver to blue tourism, fisheries, shoreline protection, and blue carbon as well as carbon markets;
- establish and manage fish sanctuaries, marine parks, marine protected areas (MPAs) and locally managed marine areas (LMMAs) more effectively.

Stimulus packages, low-interest loans and incentives can be provided to key industries for a blue recovery and much-needed **sustainability upgrades** that can make them more competitive, cost-effective, environmentally sound, and disaster and climate resilient:

- **Fisheries and aquaculture:** modernization of fisheries and aquaculture to make them more sustainable and climate-smart, establishing fish sanctuaries and MPA networks, setting up fish ports and post-harvest facilities to prevent losses and wastage, and creating value-adding industries to increase income and job opportunities

- **Tourism:** installation of energy- and water-saving fixtures in hotels and resorts; investing in solar panels and LED lights, compact wastewater treatment with reuse (or connecting to existing sewerage system), plastic use reduction and solid waste management; support for conservation of key habitats and endangered species in tourism sites. Green Hotel awardees and zero-carbon resorts show the monetary and environmental benefits gained from these measures.
- **Ports and shipping:** installation of energy- and water-saving fixtures, solar panels, waste heat recovery system, shore reception facilities, etc.; digitalization and automation to improve efficiency. There are best practices and lessons learned from the Green Ports and Green Ship awardees.
- **Shipbuilding of the Next-Gen ships:** See **Table 5.1** for some solution options.

Fisheries and aquaculture under the blue economy incorporates the natural capital in its development and throughout its production cycle as well as providing sustainable and decent employment, and high-valued commodities for exports (UNCSD, 2012). Policymakers and coastal and fishery resource managers are increasingly challenged by the need to ensure food security in the context of increasing human pressure on the marine environment and changing climate, and dwindling fish stocks, but the COVID-19 restrictions provide opportunity to shift to integrated, ecosystem-based approaches based on the best available science in a precautionary context. This includes establishing closed fishing season for certain species and marine protected areas (MPAs) to restore fish stocks, reducing stock density in aquaculture to appropriate level, using sustainable alternatives to fishmeal/feeds, etc. The RSOC Report (Volume 1) and NSOC Reports called attention to some of the best practices in the region.

As pointed out by the UNWTO, sustainable tourism should:

1. Make optimal use of environmental resources that constitute a key element in tourism development, maintaining essential ecological processes and helping to conserve natural heritage and biodiversity.
2. Respect the socio-cultural authenticity of host communities, conserve their built and living cultural heritage and traditional values, and contribute to inter-cultural understanding and tolerance.
3. Ensure viable, long-term economic operations, providing socioeconomic benefits to all stakeholders that are fairly distributed, including stable employment and income-earning opportunities and social services to host communities, and contributing to poverty alleviation.

Another way to fast-track the reopening of the blue economy is to direct stimulus investing towards renewable energy, decarbonization, wastewater treatment with reuse facilities, integrated solid waste management systems, including recycling of plastic waste, packaging materials, e-waste, and other recyclables; and climate proofing infrastructure, including low impact development, and nature-based, green infrastructure. A portion of the benefits from the ocean economy can be re-invested to these initiatives.

Turn waste into resource. Huge capital costs and recurring operation and maintenance costs have prevented local governments from investing in needed wastewater management systems. Instead of being an investment dead end, there are options for cost recovery. In addition to collecting tariffs, the wastewater treatment plants (WWTP) can also turn waste into resource and earn additional revenues.

For example:

- Treated sludge can be used as organic fertilizer or soil conditioner.
- Biogas from digesters in rural areas in Cambodia, Lao PDR and Vietnam are being used for lighting and cooking. Biogas from a WWTP in Kobe, Japan is used to fuel buses, garbage trucks and other vehicles, and as city gas in the distribution network of Osaka Gas. This WWTP contributes to the reduction of 2,700 tonnes of GHG emissions per year.
- Treated wastewater can be used for irrigation and non-potable uses, and even as drinking water like in Singapore.

The countries in the EAS region have very high material footprint, including plastic footprint. Transitioning to a circular economy, including reducing plastics use, recovering their post-use value, recycling, and increasing the reusability of products, involves having an effective solid waste management system and more sustainable consumption and production. The circular economy also presents opportunities for green jobs and community-level solutions.

It is important to assess where recycling can be done. There are benefits to be gained from recycling. For example, the Philippines recycled only 28 percent of key plastic resins in 2019, resulting in lost material value upwards of US$ 890 million per year (World Bank, 2021c).

Nevertheless, solution options should go beyond the reduction of plastic use, recycling, and reuse. It is crucial to consider the whole lifecycle of plastic products, from product design to infrastructure and household use, and find or shift towards plastic alternatives. Hence, support for research and innovation is essential to accelerate new technologies, materials, and products to replace single-use plastics.

Another rising concern is mounting e-waste. As EAS countries rapidly industrialise, and their citizens enjoy higher income and living standards, the consumption and disposal of e-waste will continue to increase. Properly handling end-of-life products is not only an environmental benefit, but it also protects the public's health, which is negatively impacted by improper recycling practices that emit hazardous substances. Proper handling also preserves limited resources essential for the production of high-tech products. Japan and RO Korea have formal collection and recycling infrastructure and relatively strong enforcement while Singapore collaborates with producers to manage e-waste through public-private partnership. China, Philippines, Malaysia, and Viet Nam have a mix of formal and informal elements in an evolving ecosystem in terms of collection and recycling infrastructure.

5.3 Promote Low Carbon Footprint and Foster Resiliency

5.3.1 Marine Renewable Energy

Another significant, untapped renewable energy source exists: the world's oceans. It is estimated that harnessing just two one-thousandths of the oceans' untapped energy could provide power equal to current worldwide demand (American Society of Mechanical Engineers, 2019). Some EAS countries

have attempted, with varying success, to tap ocean energy as it occurs in waves, tides, marine currents, thermal gradients, and differences in salinity to reduce dependence on fossil fuels. Ocean energy offers an alternative to fossil-fired power plants. It has considerable long-term potential for economic growth, energy security, and job creation.

Offshore wind power. Despite the numerous challenges brought about by the COVID-19 pandemic, the additions of wind capacity are expected to reach 5.3 GW in 2020, although this is 13% less than the growth in 2019. This forecast remains possible as the offshore wind industry has been largely shielded from the ongoing pandemic crisis (IEA, 2020). The increased speed of construction to complete projects before the phase-out of subsidies has pushed China to account for over half of the global onshore wind capacity growth in the year 2020 (IEA, 2020). For offshore wind power generation, China has total installed capacity of 2,146 MW as of mid-2021. China supports feed-in tariffs (FiTs) for electricity from renewable energy, charges energy-intensive industry higher rates for electricity, and has piloted an emissions cap-and-trade scheme that incentivizes low-emission energy generation technologies.

Other offshore wind projects in the EAS region are in Vietnam (105MW), South Korea (99MW), and Japan (56MW). Meanwhile, the coastal wind farms in the Philippines have become tourist attractions.

Although the Asian energy sector continues to experience energy disruptions for certain asset classes amidst the COVID-19 pandemic, its adoption of renewable energy has great potential due to the availability of capital and activity (Mallo, 2020). With the vaccination roll-out and easing of restrictions in 2021, the pent-up demand has resulted in increases in consumption and energy demand. This can push CO_2 emissions to a new high. Thus, new policies targeting a sustainable recovery should include stimulus for renewable energy, fuel efficiency, conservation of energy and water, etc. to curb a rebound in emissions. Moreover, putting a price on carbon emissions (through carbon tax and emissions trading schemes) can accelerate the decarbonization of economies. The total value of global carbon markets grew by >20% in 2020 (McKinsey, GIC and Singapore, 2021).

5.3.2 Fisheries

The full carbon footprint of fisheries — including GHG emissions from fishing vessels and supply chain emissions, such as transport, refrigerant loss, and waste disposal — are often excluded from global GHG assessments. Nationally Determined Contributions (NDCs) can serve as the entry point for governments to quantify and include non-fuel related emissions from motorized and non-motorized vessels as part of their national targets. According to WRI (2021), the options for including fisheries in new or updated NDCs involve:

- Expanding and increasing the ambition of existing economy-wide GHG targets by including emissions reductions from fisheries, including aquaculture, wild capture, and processing.

- Defining energy efficiency targets to improve postharvest production, including cold storage and ice production.
- Committing to incentivize fishing vessel and gear improvements to increase fuel efficiency while constraining catch to sustainable levels.
- Committing to removing fuel subsidies for fishing fleets and incentivizing the transition to low-carbon or zero-emission fishing vessels.

5.3.3 Marine Transportation

There are noteworthy innovative opportunities for decarbonization in the marine transport sector. **Table 5.1** shows some of the solution options to ensure compliance with international agreements and enhance efficiency (and therefore profitability). Financing research and development (R&D), technology transfer, and deployment for the transition to zero-emission passenger and freight transport is crucial, and governments can provide the enabling conditions, including incentives.

Table 5.1: Green Shipping Solutions to be Compliant and More Efficient.

International agreements (IMO)	Solution options
Reduction of the sulphur content to 0.5% in ships' fuel oil	• low sulfur fuel oil (LSFO), • marine gas oil (MGO), • liquid natural gas (LNG), • scrubbers on the exhaust stacks
Cut in shipping's GHG emissions by at least **30% by 2025 and 70% by 2050** compared with 2008 levels	• LNG fuel for propulsion • wind energy: sail and kite propulsion system; rotor sails • Battery-powered boats • Reduce fuel consumption – streaming bubbles – speed nozzles to save fuel – proper waste heat recovery system – more efficient steering gears – submarine robot cleaners
Ballast water management	• mid-ocean ballast water exchange • ballast water treatment using onboard treatment technologies • minimizing the uptake of organisms and sediments during ballasting • ballast-free system

Sources: PEMSEA 2021; Campbell 2019; Park and Clenfield 2019.

5.3.4 Blue Carbon

The coastal and marine ecosystems have an important role in climate change mitigation and adaptation. The carbon sequestered in mangroves, seagrass, and salt marshes has been termed "blue carbon". Studies show that mangroves and coastal wetlands annually sequester carbon at a rate **ten times greater** than mature tropical forests, and store **three to five times more** carbon per equivalent area than tropical forests.[15] Thus, the ocean ecosystems serve as the largest carbon sink

[15] NOAA. Coastal Blue Carbon. (https://oceanservice.noaa.gov/ecosystems/coastal-blue-carbon/)

in the world. They are available, effective, and cost-efficient **nature-based solutions** (NBS) that can contribute to the mitigation required to keep global warming well below 2°C. **NBS could account for 65-85 percent of total supply potential by 2030, with much lower mobilization costs than technology-based removal solutions** (McKinsey, GIC and Singapore, 2021). Developing Blue Carbon offset projects could provide a funding mechanism and incentive to strengthen conservation efforts and more sustainable land-use alternatives to slow, halt and even reverse losses of these ecosystems. An initial estimate of the blue carbon value of mangroves and seagrass in the region amounts to US$ 68 billion, and US$ 20-40 billion, respectively (PEMSEA, 2021). Despite this potential, only a few countries include these coastal and ocean ecosystems in their national GHG inventories and NDC targets. WRI (2021) pointed out the options for incorporating blue carbon ecosystems in new or updated NDCs:

- Expanding and increasing the ambition of existing economy-wide and sectoral GHG reduction targets by including blue carbon ecosystems.
- Committing to specific improvements in accounting capacity to include blue carbon in NDCs and associated national climate plans and strategies, such as additional national data collection, science, and technical capacity.
- Reforming fiscal policies to invest in and incentivize restoration and protection of blue carbon ecosystems.

The challenges associated with incorporating and implementing blue carbon into the NDCs of some countries in Asia-Pacific include a lack of data and standard methodology; weak technical capacity; a lack of coordination between government agencies and other sectors; overlapping mandates and inconsistent policies; the increasing degradation of coastal wetland ecosystems; as well as funding constraints for developing and implementing policies and practices in programs focusing on the conservation of blue carbon ecosystems (Pham Thu Thuy and Le Thi Thanh Thuy, 2019).

Box 2. Aligning Policy with Structural Change: Key Specific Actions

- Commit to putting the right price on carbon and rapidly eliminating fossil-fuel subsidies. This could include consideration of an international carbon price floor among large emitters, such as the G20, and border adjustments for energy-intensive trade-exposed sectors.
- Lead in the global energy transition by setting targets for zero-carbon power and road transport: investing strongly in clean energy and energy efficiency at home and in developing countries; phasing out unabated coal power generation domestically by 2030; ending support for fossil fuel investments, starting with coal power generation; and defining a clear phase-out strategy for fossil fuels other than coal in line with the goals of the Paris Agreement. Foster and share R&D in renewable energy and beyond.
- Commit to a 'just transition': ensure that the benefits and opportunities are shared widely; protect those that are most vulnerable to economic losses.
- Step up green R&D and bring innovations to market rapidly through direct public support, risk capital, and open markets.

Source: Stern, 2021; Hopkins and Greenfield, 2021.

5.4 Forge Ahead with Innovations and Digitalization

The reopening of our blue economy can also be fast-tracked by directing stimulus investing towards digitalization and frontier technologies. However, this has raised concerns globally about competition and consumer protection in the digital economy. There is a need to ensure effective consumer protection, promote and protect competition in the digital economy, and facilitate international cooperation between national authorities so they can deal more effectively with fraudulent and deceptive commercial practices and anticompetitive business practices in digital markets.

Science, technology, and innovation (STI) policies play a key role not only in COVID-19 recovery plans, but also in the Decade of Ocean Science and the Decade of Action to deliver on the 2030 Agenda for Sustainable Development. There are ongoing initiatives in using STI in COVID-19 responses, such as using data science and digital tools for tracing the virus and tracking the local production of sanitizers, PPEs, and medical equipment, such as ventilators. STI also plays a central role in fostering blue recovery, and future employment creation.

Marine biotechnology. This is a scientifically and economically expanding enterprise that is poised to harness the enormous but uncharted functional diversity of marine life, with its novel and rich array of biodesigns and biosynthetic capabilities. Marine biotechnology deals with:

- ocean exploration and marine bioprospecting for the development of new pharmaceutical drugs, chemical products, enzymes, and other products and processes
- deriving anti-infection, new cancer, and HIV treatments by copying compounds from marine organisms (e.g., sea snails, sponge, red macroalgae, etc.)
- the advancement of aquaculture and seafood safety, and has the potential to offer solutions to several problem areas in aquaculture
- advancing bioremediation for pollution reduction. Bioremediation uses micro-organisms to reduce pollution through the biological degradation of pollutants into non-toxic substances. This can involve either aerobic or anaerobic micro-organisms that often use this breakdown as an energy source. Bioremediation is not a new technique. It requires fewer resources and less energy than conventional technology, does not accumulate hazardous by-products as waste, and has therefore technical and cost advantages.
- developing bioenergy (e.g., microbial fuel cells) and biofuels (from microalgae and macroalgae) for alternative energy source, among others
- developing marine biomaterials technology (e.g., seaweed hydrocolloids, biopolymers to address the plastic threat, and nontoxic coatings that prevent the buildup of organisms that negatively affect ships and intake pipes that are used in power plants).

Fisheries. COVID-19 pushed more economic activities online. E-commerce can help in modernizing the fisheries sector while providing fisherfolk with opportunities for increased income and incentives for more sustainable practices. Apps can be developed to connect **sustainable and certified** fishers and aquaculture farms to local consumers when restaurants and markets are closed or to organizations

working on distributing food aid. Direct fish marketing, online selling and home delivery services have grown at an incredible speed, opening the door to a long-lasting trend of e-commerce. However, there is a need to develop the capacity of small-scale fishers and women, and bridge the digital divide.

Digitalization, remote sensing, drones, and other new technologies can enhance monitoring, control, and surveillance (MCS) systems to combat illegal, unreported, and unregulated (IUU) fishing.

Electronic catch documentation and traceability (e-CDT) is the system of documenting electronically key information about the harvest, processing, and transportation of a fisheries product to enable traceability of the fish or seafood product through each step of its journey—from point of catch to the consumer's plate. Doing so electronically enables this information to be more quickly and easily captured, shared, and managed. This is a key tool to ensure sustainable tuna and sardine fisheries.

Ports and shipping. As emphasized by UNCTAD (2019b), port and shipping operations can tap into the opportunities offered by digitalization, artificial intelligence (AI), the Internet of Things (IoT) and blockchain. These aim to promote efficient and secure trade, including by offering greater supply chain visibility, and the use of electronic documents, ultimately benefiting customers who rely on shipping industry services. The ports and shipping industry is increasingly taking advantage of digitalization and the key players are using joint collaborative platforms, thus, changing their business and partnership models. Improvement in liner shipping connectivity at the port level and passenger terminal services can be made possible by new technologies and innovations. The next-gen ships are also moving forward with more automation, and shifting to low carbon and low sulphur fuels and even renewable energy (e.g., wind and solar). These technological advances can help improve connectivity, efficiency, and productivity – key factors that influence port call selection – and going 'green' at the same time results in decreased emissions, less energy consumed, and further increased efficiency. Decarbonization plans in ports and shipping can also be included in the NDCs. Green Ports and Green Ships awards provide incentives and recognition of such initiatives.

The ships can also play an important role in ocean mapping, atmospheric, oceanic, and biogeochemical observations, measurements, ocean-climate system modeling, and forecasting.

Digital solutions and policies can help the world recover better from the COVID-19 crisis. Moreover, digitalization, IoT, and AI open opportunities for women to join the maritime industry as more on-shore jobs become available. Support for R&D and innovative activities as well as capacity building and skills development are therefore crucial to facilitate this transition.

5.5 Strengthen Governance, Coordination, and Partnerships

Make blue economy happen:

- Lay the foundation: **Promote a common understanding of blue economy**, its benefits, and the actions needed to promote inclusive and sustainable economic prosperity and protect ocean health at the same time.

- **Know, value, and manage what you have**: Institutionalize regular **ocean monitoring** (marine water quality, oceanographic features, primary productivity, fish stocks, coastal and marine ecosystems and biodiversity), and **ocean accounting** (gross value added or GDP of ocean economic activities, contribution of small-scale fisheries and women, valuation of ecosystem services, depreciation of ocean resources, environmental damage assessment, backward and forward linkages, trade impacts, multiplier effects, etc.).
- **Adopt and implement national ocean policies** that advocate integrated ocean management and sustainable, resilient, and inclusive blue economy development, with supporting institutional arrangements and financing. Harness ocean science and information from the ocean accounts to ensure evidence-based policy-making and planning, and develop measures needed to transform to blue economy and ensure healthy ocean and people.
- **Harmonize existing policies, procedures, incentives, and financing modalities** to provide for the sustainable use of coastal and marine resources and protection of ocean health. These include marine spatial plan and coastal use zoning schemes; habitat restoration; MPAs; blue carbon programs to enhance climate change mitigation and adaptation efforts; nutrient and plastic pollution reduction and circular economy; efforts to address overfishing and IUU fishing; etc. Policymakers should also implement policies to price in externalities and provide incentives for the transition to a blue economy.
- **Promote the equitable sharing of benefits** derived from the use of marine resources and biodiversity by (a) establishing clear rights of access, use, and ownership over marine space and resources, (b) leveraging traditional ecological knowledge, (c) encouraging benefit-sharing and co-management systems, and (d) recognizing the role of women, not only in fisheries and ensuring food security of families, but also in seafood processing and marketing, tourism, marine research and education, and in the digital transformation of maritime industries. Digitalization and frontier technologies offer a variety of opportunities for female empowerment and for a more equal female participation in labor markets, financial markets, and entrepreneurship.
- **Integrate environmental considerations into mainstream risk assessments**. Climate risks are now increasingly recognized as financial risks, although decades of evidence gathered by the scientific community should have prompted this movement much earlier. More destructive typhoons and extended droughts lead to the destruction of infrastructure, farms, and property and the disruption of livelihoods. For financial institutions, physical risks can materialize directly, through their exposures to corporations, households, and countries that experience climate shocks, or indirectly, through the effects of climate change on the wider economy and feedback effects within the financial system. The growth of sustainable finance and the integration of environmental, social, and governance (ESG) criteria into investment decisions across all asset classes demonstrate the increasing importance that investors attribute to climate change, among other nonfinancial considerations.
- **Increase public awareness and engage the various stakeholders**. Environmental degradation, habitat and biodiversity loss, overfishing, destructive fishing, and climate change cannot be prevented by laws alone. Public environmental awareness is a primary concern of the future of humanity. Ocean awareness means to understand the fragility of our ocean and the importance of its protection. Public participation is equally imperative with regard to environmental protection.

- **Adopt the Sustainable Blue Economy Finance Principles into decision-making**. More sustainable financing and investments are now needed to reverse the impacts of COVID-19 pandemic and from the degradation of ecosystems and changing environment and climate. Sustainable finance can contribute to climate change mitigation and adaptation by providing incentives for firms to adopt less carbon-intensive technologies, and specifically, by financing NBS and the development of new technologies to support the blue economy development.
- **Get the private sector as investors and partners in environmental investments**. Private sector can be (a) an investor providing the capital financing needed for environmental investment, climate resiliency, and biodiversity conservation, (b) service provider (design, build, operate, and/or manage facilities, e.g., waste collection and treatment, wastewater management, recycling, etc.), (c) industry or company owners (e.g., commercial fisheries, aquaculture farms, tourism establishments, shipping and shipbuilding companies, water and energy utilities, etc.), and (d) partner in co-management of conservation and protected areas. Private sector can fill in the gaps in financing, and technical and business expertise.
- **Ocean science and traditional knowledge: Apply these tools to transform to a better future**. Scientific research, experimentation, data collection, monitoring, and modeling provide the knowledge and frameworks needed to analyze the environmental consequences of ocean economic activities and other human activities, policy, and development proposals. Ocean science holds the solutions to many global issues—from blue carbon, healthier fish stocks, and undiscovered medicinal therapies to renewable energy, coastal resiliency, climate regulation, and improved forecasting—that impact the food, energy, water, economic, and national security of so many countries. In addition, protecting biodiversity through policies and plans that integrate traditional knowledge will protect and sustain livelihoods and ensure food security and resiliency. Many scientific studies of local ecosystems would not have been possible without the knowledge-base of indigenous people helping researchers.
- **Provide or access financing for research, development and deployment** (RD&D) and testbed platforms, and provide incentives for commercialization of new technologies that are crucial in transforming established ocean industries to become more sustainable, productive and efficient, and in advancing the emerging blue economy industries (e.g., ocean energy, marine biotechnology, next-gen shipbuilding, etc.) as well as decarbonization, plastic recycling, alternatives to plastics, and cost-effective technologies in wastewater treatment to allow reuse and recovery of water, energy, and nutrients. Assess how ocean-climate nexus financing, digitalization, big data analysis, drone and satellite imagery, sensors, IoT, AI, blockchain, etc. can be used as enablers of more efficient, sustainable, and resilient blue economy.
- **Collaborate with other countries and explore trade and development policies** that can be used to tackle the plastic pollution. Collective action among countries is necessary to put in place measures to reduce, substitute, collect, recycle, and sustainably dispose plastics with harmonized global rules worldwide. Cooperation on trade can play a big role in tackling the plastic pollution menace because "trade occurs at every step in the plastics lifecycle; from its fossil fuel inputs, to intermediate products, final goods and even waste."[16]

[16] UNCTAD Acting Secretary-General Isabelle Durant. See UNCTAD 2021b.

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