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Drivers of Blue Economy in Luzon, Philippines: Status, Threats, and Potentials for Development

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ABSTRACT

Blue economy refers to sustainable economic pursuits done in the marine environment, which include fishing and aquaculture, coastal recreation and tourism, maritime industry, energy industry, and offshore mining and quarrying. In Luzon, marine waters contribute 38.44% to the total national fishery production, host 44.6% of the total domestic trade by water transport, host 3 of the top 5 beach destinations in the Philippines, and has the only productive oil and natural gas fields in the country. Fishery, however, is described as unsustainable brought primarily by depleted fishery resources, degraded fishery habitats, intensified resource use competition, and conflict. The fishery resource side is described to have unrealized potential, with uncompetitive product quality, and inefficient post-harvest technology. The Maritime industry's potential is challenged by a fragmented maritime administration while the prospects of marine tourism are limited by the skills of local communities to take in tourists. Opportunities include optimization of aquaculture technology, sustainable financing schemes for aquaculture and tourism, infrastructure investments that promote sustainable fishing practices, sustainable financing scheme, enhancement of existing technology for the maritime industry, human resource development, and tapping ocean power potentials. Coordinated and integrated planning, considering skills of human resources, economic status of coastal communities, and scientific data would optimize blue economic development.

Keywords: fishery and aquaculture development; maritime industry; seabed mining; ocean energy; coastal and marine tourism; Department of Oceans and Fisheries

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Abbreviations: ARCDEV, Framework for Sustainable Philippine Archipelagic Development Revaluing Our Maritime Heritage and Affirming the Unity of Land and Sea; BFAR, Bureau of Fisheries and Aquatic Resources; CHED, Commission on Higher Education; CTI, Coral Triangle Initiative; DA, Department of Agriculture; DENR, Department of Environment and Natural Resources; DOT, Department of Tourism; FAO, Food and Agriculture Organization; GDP, Gross Domestic Product; ISGP, Industrial Sand and Gravel Permits; MARINA, Maritime Industry Authority; MDG, Millennium Development Goals; METI, Maritime Education and Training Institutions; MIDP, Maritime Industry Development Plan; MPAN, Marine Protected Area Network; NEDA, National Economic and Development Authority; NESC, National Ecotourism Strategy Committee; NIPAS, National Integrated Protected Areas System; PEMSEA, Partnerships in Environmental Management for the Seas of East Asia; POESA, Philippine Ocean Economy Satellite Account; PSA, Philippine Statistics Authority; RORO, roll-on-roll-off; SBSR, shipbuilding and ship repair; SGD, Sustainable Development Goals; SEAFDEC, Southeast Asian Fisheries Development Center; TESDA, Technical Education and Skills and Development Authority; UNCED, United Nations Conference on Environment and Development; UNEP, United Nations Environment Programme; WEPA, Water Environment Partnership in Asia; WBG, World Bank Group;

INTRODUCTION

The inclusion of Agenda 21: Sustainable Development during the United Nations Conference on Environment and Development (UNCED) meeting in Rio de Janeiro in 1992 promoted the Millennium Development Goals (MDG) as pillars of sustainable development (UN 1992). The text of the pronouncement, constructed from two decades of negotiations, committed state representatives to a carefully crafted statement that embodies principles of sustainable development. Policy pronouncements following the discussion snowballed policy and approaches to sustainable development with explicit inclusion of approaches to the development of the aquatic ecosystem. In the Philippines, the Earth Summit declarations prompted the drafting of the National Marine Policy in 1994, and the drafting and eventual promulgation of Republic Act 8550, known as the Fisheries Act in 1998, among others (Satizabal et al. 2020). Highlight on sustaining the aquatic environment was pushed by the archipelagic nations of Southeast Asia with the drafting of the Dongying Declaration in 2011 that scaled up integrated coastal management in building the ocean economy. The declaration was the culmination of several efforts within Southeast Asia, like the Blue Carbon Initiative organized by the Coral Triangle Initiative (CTI) in 2010; and the creation of the Southeast Asian Fisheries Development Center (SEAFDEC) in 2007. The Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), in support of a dedicated framework for the development of the oceans and seas, drafted the Seas of East Asia Knowledge Bank and the East Asian Seas Sustainable Business Network in 2015.

As the MDGs were succeeded by the Sustainable Development Goals (SDG) in 2016 with categorical mention of the aquatic ecosystem under SDG 14: Life below Water, a resolute development of the seas and oceans was called for (UNEP 2020). Sustainable financing schemes, sustainable asset management, and sustainable quality control and values became palatable keywords to investors who advocate sustainable development.

Optimization of the use of our marine resources in the context of blue economic development should underline the three pillars of the long-term development plan of the Philippines, AmBisyon Natin 2040. Under the plan, by 2040 Filipinos are envisioned to have a strongly-rooted (*matatag*), comfortable (*maginhawa*), and secure (*panatag*) life (NEDA 2016). Strategic to the attainment of *Ambisyon* 2040 puts priority on Housing and Urban Development, Manufacturing, Connectivity, Education Services, Tourism and Allied Services, Agriculture, Health and Wellness Services, and Financial Services. In congruence with the national vision of *matatag, maginhawa, at panatag na buhay,* the Department of Agriculture sets its target for inclusive economic growth by expanding and increasing access to economic opportunities.

The Blue Economy Discourse

The term blue economy was coined by Gunther Pauli that describes an economic model that is integrated, sustainable, low-carbon footprint, and science and technology-driven (www. theblueconomy.org, accessed on October 10, 2021). The term was picked-up to specifically refer to economic activities related to the oceans to delineate it from those in the terrestrial environment, called green economy (Olteanu and Stinga 2019). The color coding contrasts sustainable economic practices by business enterprises with those using detrimental economic approaches, called

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Figure 1. Luzon (orange cluster) is the largest inhabited island of the Philippines, which also six island provinces (map source: https://www.philembassy.org.au, downloaded on October 15, 2022).

brown economy. The concept of a blue economy, thus, is not new nor an additional idea from sustainable development; rather it is central to its implementation (Whisnant and Reyes 2015).

As a nascent economic agenda (Satizabal et al. 2020) that focuses on marine and ocean economic development fostering green values (Olteanu and Stinga 2019), the concept needs a framework to be able to translate into tangible results. The archipelagic nature of the Philippines underlines this need for a framework. The Framework for Sustainable Philippine Archipelagic Development Revaluing Our Maritime Heritage and Affirming the Unity of Land and Sea (ARCDEV) was initiated in 2004 to serve as the context for the development of the coastal and marine areas in the Philippines (DENR et al. 2004). It underlines five imperatives for sustainable development: 1) growth and equity, 2) sustainable resource management, 3) national integration and political unity, 4) securing a peaceful and stable external environment, and 5) good global citizenship and international cooperation. Translating the concept of the blue economy into tangible output takes consideration of the five major functional areas: 1) socio-economic uses, 2) environmental uses, 3) maritime safety and security, 4) territory and jurisdiction, and 5) science, education, and culture.

This paper will highlight the socio-economic development related to coastal and marine industries in Luzon, Philippines. The other functional areas will be used as context in the discussion of opportunities and threats and will discuss the potentials for development vis-à-vis *AmBisyon Natin* 2040.

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STATUS OF BLUE ECONOMIC DEVELOPMENT IN LUZON

Geographical Context

The Philippines' total marine territorial waters of 2.2 million square kilometers is seven times larger than its total land area (Mendoza and Valenzuela, 2017; PSA, 2018 (a)). Over 12% of the territorial waters is a coastal area and would extend 1 kilometer inland from the shoreline at high tide down to 200-meter isobaths (DENR et al. 2004). The larger 88% of the marine territorial waters is oceanic and includes the exclusive economic zone of the Philippines. In addition to the territorial waters is the 130,000 square kilometers Philippine Rise located about 320 nautical miles off the eastern coast of Northern Luzon (Barreto et al. 2020). The extent of the marine territorial waters of the Philippines highlights the archipelagic nature of the country.

The country is divided into three main island groups, Luzon, Visayas, and Mindanao. Luzon is the largest of the island group that includes mainland Luzon with 24 provinces, and the island provinces of Batanes, Palawan, Mindoro, Marinduque, Romblon, Masbate, and Catanduanes. Administratively, the 30 provinces are divided into 8 regions: Region I – Ilocos; Region II – Cagayan Valley; CAR – Cordillera Administrative Region; Region III – Central Luzon; Region IV-A – CALABARZON; Region IV-B – MIMAROPA; and Region V – Bicol. The National Capital Region, composed of 16 cities and one municipality, is the concentration of economic and administrative activities in the county and is also part of Luzon. Regions I to III and CAR are generally referred to as Northern Luzon, while Regions IV-A, IV-B, and V compose Southern Luzon.

Within the Luzon Island group are two major seas, 13 bays, two channels, four straits, and four passages (WEPA 2020; Han et al. 2008). Aside from being significant to the fishing industry, marine features around Luzon are also strategic to biodiversity management and tourism. The Verde Island Passage between Batangas and Mindoro in Southern Luzon is considered the world's center of marine shore fish biodiversity (Carpenter and Springer 2005). Together with San Bernadino Strait, these narrow in-between island waterways convey water from and into the Pacific Ocean and the West Philippine Sea (Jones et al. 2011; Han et al. 2008). The presence of sills on the ocean floor in these areas drives complex hydrodynamic features that affect the biology of internal seas. The Philippine Rise, a 13,000 square-kilometer underwater feature more than 300 nautical miles east of the coast of Aurora, is also part of Luzon.

In terms of ecosystems, the Luzon Island group has a total mangrove cover of more than 111,000 hectares from LandSat imagery (Table 1). The most extensive mangrove cover is in Palawan, with more than 56,000 hectares. It has presumably increased with the National Greening Program of the DENR, but no data on the project's accomplishments specific to mangroves is available. Together with coral reefs and seagrasses, mangroves are critical fishery habitats and important fishing sites for small-scale fishers. The coral reef area of the Philippines is estimated at 27,000 square kilometers.

Socio-economic Development

In 2018, ocean based-economy contributed 3.6% to the Gross Domestic Product (GDP) amounting to PHP 622.22 billion (https://psa.gov.ph/ocean- economy/release-id/144505, downloaded on October 15, 2022). Services contributed 37.6%, ocean-based industry share was at 34.2%, and fishing shared 21.9% of this value. Employment by the ocean economy is estimated at 2.8 million in 2018.

Fisheries and Aquaculture Industry

Fishery production in the Philippines is categorized into three: commercial, municipal, and aquaculture (FAO, accessed on October 6, 2021). Commercial fishing in the Philippines is confined to offshore waters with boat tonnage of more than three gross tons. On the other hand, boats with less than three gross tonnages plying within the 15-kilometer distance from the coastline are considered municipal fishers. Aquaculture refers to those the commercial grow-out of fish.

A total of 63,428 hectares of marine waters are considered important fishing grounds where commercial fishing boats ply (Table 2). Regions in Luzon contributed 38.44% to the total fishery production in 2018 (Table 3). Metro Manila, Palawan, and Quezon are the 3rd, 5th, and 9th most productive Regions in terms of commercial fisheries, each with percent contribution to national production at 8.87%, 3.86%, and 2.39% from 2016 to 2018 (PSA 2018 (b)). Palawan is the most productive in municipal waters fishery production, with an average contribution to the national production of 10.65%. The

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Table 1. Extent of mangrove coverage in coastal Provinces in Luzon (Data source: Long and Giri 2011).

Province	Area (ha)	National Percentage
Cavite	35.73	0.01
Metropolitan Manila	39.69	0.02
Ilocos Norte	127.53	0.05
La Union	144.18	0.06
Ilocos Sur	228.87	0.09
Bataan	238.59	0.09
Pampanga	251.73	0.1
Bulacan	391.14	0.15
Aurora	497.07	0.19
Batangas	508.95	0.2
Isabela	592.29	0.23
Romblon	792.45	0.31
Antique	945.9	0.37
Zambales	981.54	0.38
Albay	1,081.17	0.42
Pangasinan	1,206.63	0.47
Catanduanes	1,671.30	0.65
Occidental Mindoro	1,842.93	0.72
Marinduque	2,732.22	1.06
Oriental Mindoro	2,975.31	1.16
Camarines Norte	3,628.17	1.41
Sorsogon	3,895.74	1.52
Cagayan	5,175.27	2.01
Masbate	5,302.08	2.06
Camarines Sur	5,315.31	2.07
Quezon	14,170	5.51
Palawan	56,261.30	22.23
TOTAL	**111,033.09**	**43.54**

island province of Masbate, which came in 3rd has an average contribution to the national production of 4.88%. Palawan, Pangasinan, Pampanga, and Batangas also ranked in the top ten most productive provinces in aquaculture. Palawan is the most productive province in aquaculture, contributing 14.55% to the national output. Pampanga contributed 7% to the national production from 2016-2018, Pangasinan contributed 5.33%, while Batangas contributed 3.46%, ranked 4th, 5th, and 9th, respectively.

Utilization of the marine environment for fish production is highlighted by more than 90% contribution of regions in Luzon to the national brackish water fish pen and marine fish cage and pen production. The development of brackish water fish pens, as well as marine fish cages and pens, is very notable in Region 1.

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Table 2. Major fishing grounds in Luzon (Data source: PSA (b) 2018).

Province	Area (ha)	National Percentage
Seas		
West Sulu Sea	29,993	Palawan
Visayan Sea	3,096	Panay/Negros/Cebu/Masbate
Bays		
Lamon Bay	2,838	Quezon/Camarines Sur
Tayabas Bay	2,213	Quezon
Manila Bay	1,935	Manila/Bataan/Cavite
Imuran Bay	1,088	Palawan
San Miguel Bay	774	Camarines
Gulfs		
Ragay Gulf	3,225	Camarines
Lingayen Gulf	2,064	Pangasinan
Lagonoy Gulf	1,935	Albay/Camarines
Asid Gulf	619	Masbate
Albay Gulf	413	Albay
Channels		
Babuyan	3,612	Cagayan/Babuyan
Maqueda	129	Camarines
Straits		
Tablas Strait	3,870	Tablas/Mindoro Oriental
Mindoro Strait	3,426	Palawan/Mindoro
Passages		
Burias	1,393	Burias Island/Camarines Sur
Ticao	805	Ticao Island/Masbate
TOTAL AREA (ha)	**63,428**	

As of 2012, registered commercial ocean fishers were at 220, each about 20 people accounting for 8.9% of the total agriculture, fishery, and forestry-related industries (PSA 2016). By 2015, an estimated 1.6 people million people were employed by the fishing industry, 85% of whom were from municipal fisheries, 1 percent from commercial fisheries, and 14 percent from aquaculture (Lamarca, 2017). No segregated data is available per region.

Coastal Recreation and Tourism

There is no available data on the gross direct value of the coastal recreation and tourism industry by region; thus, tourism activity related to blue economic development cannot be estimated. Coastal tourism in Luzon, however, maybe considered vibrant when multimedia promotional information is considered. The Department of Tourism, for example, promotes three beaches within Luzon to be one of the top 5 beach destinations in the country (www.tourism.gov. ph, accessed on October 6, 2020). These include Pagudpod in Ilocos Norte (No. 2) and El Nido in Palawan (No. 4). Puerto Galera in Oriental Mindoro (No. 1), Anilao in Batangas (No. 2), and Tubbataha Reef National Park in Palawan (No. 7) are also promoted as top diving

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Table 3. Volume of fishery production across marine sectors in 2018 (Data Source: PSA 2018 (b)).

Sector	Total Philippine Production (mt)	Luzon Production (mt)	National contribution (%)
Total fishery production	4,356,874.77	1,674,968.76	38.44
Commercial Fishery	946,437.62	216,657.70	22.89
Municipal Fishery (marine)	941,870.86	370,567.82	39.34
Aquaculture	2,304,365.31	827,289.63	35.90
Brackish water fishpond	325,503.98	133,258.25	40.94
Brackish water fishpen	2,882.17	2,790.15	96.81
Brackish water fishcage	1,248.65	439.56	15.25
Marine Fish Cage	108,951.71	108,598.75	99.68
Marine Fish Pen	9,867.59	9,467.49	95.95
Oyster	28,708.15	1,046.86	3.65
Mussel	26,302.77	10,265.77	39.03
Seaweed	1,478,300.85	401,379.96	27.15

destinations (www.tourism. gov.ph, accessed on October 6, 2020). The Puerto Princesa Underground River is also promoted as a top World Heritage destination.

Other coastal recreation and tourism activities may include surfing and eco-tourism. Surfing had been promoted vigorously in limited sites in Luzon, particularly Aurora Province, Quezon Province, La Union, and Zambales (Go, undated). In ecotourism, major coastal and marine attractions include diving and snorkeling in Apo Reef Natural Park in Occidental Mindoro, Coron Island, El Nido Protected Area, and Tubbataha Reef Natural Park in Palawan; whale-shark observation in Donsol, Sorsogon; and beaching and swimming in Hundred Islands National Park in Pangasinan (NESC et al. 2002). Mangrove eco-parks, mostly established through community efforts, generate income for coastal communities and may be considered a potential eco-tourism niche.

The coastal recreation and tourism industry's gross direct value was PHP 19,195,000 in 2020 based on estimates by PSA (2019) employing over 24,000 people. The national gross domestic product in 2018, was up by more than 14% from the 2017 value (PSA 2020). However, no segregated data may be used to directly link it to the blue economy of Luzon.

Martime Industry

The maritime industry covers the sub-industries of ship crewing and manning, training and education of seafarers, port management, line operations, break-bulk and related services, shipbuilding, and maritime tourism (Ritcher, 2016). As an archipelagic nation, the Philippines calls to attention the need for a dependable and efficient maritime system (Austria 2003; Lorenzo 1998). Shipping is the primary means of interisland transport for commodities. As of 2018, the total domestic trade share of water transport from the national domestic trade was 99.91% (Table 4). Domestic trade within Luzon was at 41.5% of the total domestic trade done at sea, with the National Capital Region handling 18.95% of the national domestic trade.

To serve the local economy and transport people, the Philippines has 1,800 ports nationwide (PPA 2018). Of the total ports, 132 commercial ports servicing both roll-on-roll-off (RORO) and non-RORO vessels can be found within Luzon (PPA 2020 (d)). On top of these, the Philippine Ports Authority listed 103 private ports servicing specific industries like petroleum refinery and mining. These ports host more than 50% of all port traffic in the Philippines (Table 5).

Port calls by cruise ships started in 2017 and are considered to have great potential for revenue

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Table 4. Quantity and value of domestic trade by water transport, Luzon, 2018 (Data source: PSA, 2018 (d)).

Region	Quantity (t)	National Percentage	Value ('0000)	National Percentage
Total domestic trade by water transport	25,760,451	99.92	858,792,201	99.91
Luzon Total domestic trade by water transport	10,715,882	41.60	383,041,225	44.60
NCR	4,882,835	18.95	326,398,978	38.01
I - Ilocos	-	-	-	-
II - Cagayan Valley	-	-	-	-
III - Central Luzon	4,706,665	18.27	44,243,450	5.15
IV-A - Calabarzon	136,480	0.53	435,258	0.05
IV-B - MIMAROPA	595,390	2.31	3,130,018	0.36
V - Bicol	394,512	1.53	8,833,521	1.03

generation (MARINA 2018). As of 2019, more than 90% of the cruise ship embarkation in the Philippines was handled by NCR ports.

As of 2014, the Philippines supplied 30% of the international shipping industry, or about 440,000 seafarers, the second largest deployment overseas next to China (Ritcher 2016). Disaggregated data specific to regional deployment is not available.

The education of these seafarers is jointly regulated by the Commission on Higher Education (CHED) and the Maritime Industry Authority (MARINA) for 4-year programs, and the Technical Education and Skills and Development Authority (TESDA) for technical training, (Richer2016; EO 63 s.2018). As of 2014, there were 234 Maritime Education and Training Institutions (METI) around the county (Richer 2016). Luzon hosts 43 CHED- accredited METI, 38 TESDA-affiliated METI, and 75 MARINA-accredited METI, or 66.57% of all METIs nationwide. These training institutions contributed an estimated PHP 7.7 billion to the gross domestic product of the Philippines in 2014.

Luzon also hosts one of the three shipyards in the country that can build bulk carriers, tankers, and container ships, the Hanjin Heavy Metal Industries Inc., located at Subic, Zambales. As of 2017, Hanjin employed over 20,000 people (MARINA 2018). Aside from this, there were 113 shipyards registered with MARINA as of 2018 that are capable of building smaller boats with less than 130 meters in hull length. There were also 79 afloat repair companies and eight shipbreakers registered in the county. There is, however, no available disaggregated data on their locations.

Offshore Mining and Quarrying

Submarine metal and mineral deposits in the Philippines are still in the exploration stage (Aurelio undated). Anticipation of submarine metal and mineral deposits within the Philippine Exclusive Economic Zone facilitated the signing of DAO 2005 08 (www.mgb.gov.ph (a), accessed on October 6, 2020). The department order sets fees for offshore mining and exploration activities. The Philippine Mining Act also recognizes the probability of the future industry but sets the limit to the activity to areas with a depth of more than 30-meter and 1,500 meters from the mean low tide point of the coast (Batongbacal undated).

However, there is a good deposit of magnetite sand from the natural weathering of igneous and metamorphic rocks deposited in coastal areas as black sand (Chaussard and Geunther 2016). Magnetite sand is rich in iron in oxide form and is magnetic, which makes them valuable for media storage drive manufacturing. Black sand deposits along beaches in Northern Luzon had been exploited by sand quarrying companies using

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Table 5. Summary of port statistics for 2019 (Data Source: PPA 2020).

Particular	2019	National Percentage
1. Ship calls	155,651	31.07
Domestic	148,683	30.36
Foreign	6,968	61.94
2. Cargo Throughput (m.t.)	151,054,179	56.98
Domestic	56,947,827	54.89
Inward	29,431,848	51.45
Outward	27,515,979	59.11
Foreign	94,106,352	58.33
Import	80,262,662	80.50
Export	13,843,690	22.46
3. Container Traffic (in TEU)	5,502,472	69.96
Domestic	1,675,949	52.96
Inward	803,300	50.89
Outward	872,649	55.02
Foreign	3,826,523	81.41
Import	2,007,614	85.90
Export	1,818,910	76.97
4. Passenger Traffic	26,121,313	31.40
Disembarked	13,367,799	31.81
Embarked	12,386,339	30.24
Cruise Ships Passengers	185,380	92.59
5. RoRo Traffic	2,371,409	30.48
Inward	1,150,404	29.57
Type 1	80,414	9.77
Type 2	457,825	30.57
Type 3	215,722	41.06
Type 4	396,443	37.97
Outward	1,221,005	31.39
Type 1	93,095	11.10
Type 2	505,085	34.09
Type 3	140,152	32.15
Type 4	482,673	42.61
TOTAL	**529,156,314**	**42.61**

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their Industrial Sand and Gravel Permits (ISGP). The most notable cases are the canceled black sand mining permits in Caoayan, Ilocos Sur, and Gonzaga, Cagayan (coastalcare.org, accessed on October 6, 2021), both in North Luzon. While black sand mining cannot be directly considered an example of seabed mining as they exploit coastal magnetite deposits, the mineral exploitation activity is part of the blue economy being a coastal industry. Deposits of magnetite may also extend into offshore waters (Batongbacal undated).

SUSTAINABLE BLUE ECONOMY

Fisheries and Aquaculture

Among the industries under the blue economy, fishery and aquaculture do not stand on their own. Fish production depends on other resources like mangroves, coral reefs, and seagrass beds, as well as the physico-chemical conditions of the water. Issues and threats to fishery and aquaculture thus are complex environmental and social issues.

The Comprehensive National Fishery Industry Development Plan (DA-BFAR 2005) presented key challenges that face the industry (Figure 2). The overriding environmental issue is depleted fishery resources and degraded habitat. This is apparent with a decrease in commercial fishing production by 6.34% in 2017 with just and a slight increase of just 1.8% in 2018 (PSA 2018 (b)). On the other hand, marine municipal fisheries decreased production by 1.5% in 2017 and 2.5% in 2018. The decrease is despite the development of larger boats that can exploit more offshore areas. Several practices contribute to this decline. These include excessive fishing efforts facilitated by brighter lights, uncontrolled fish aggregating devices, and the use of fish detectors. The excessive effort results in the harvesting of immature fish stocks that cannot contribute to population growth. Destructive fishing practices, as well as illegal ones, are also factors in this decline.

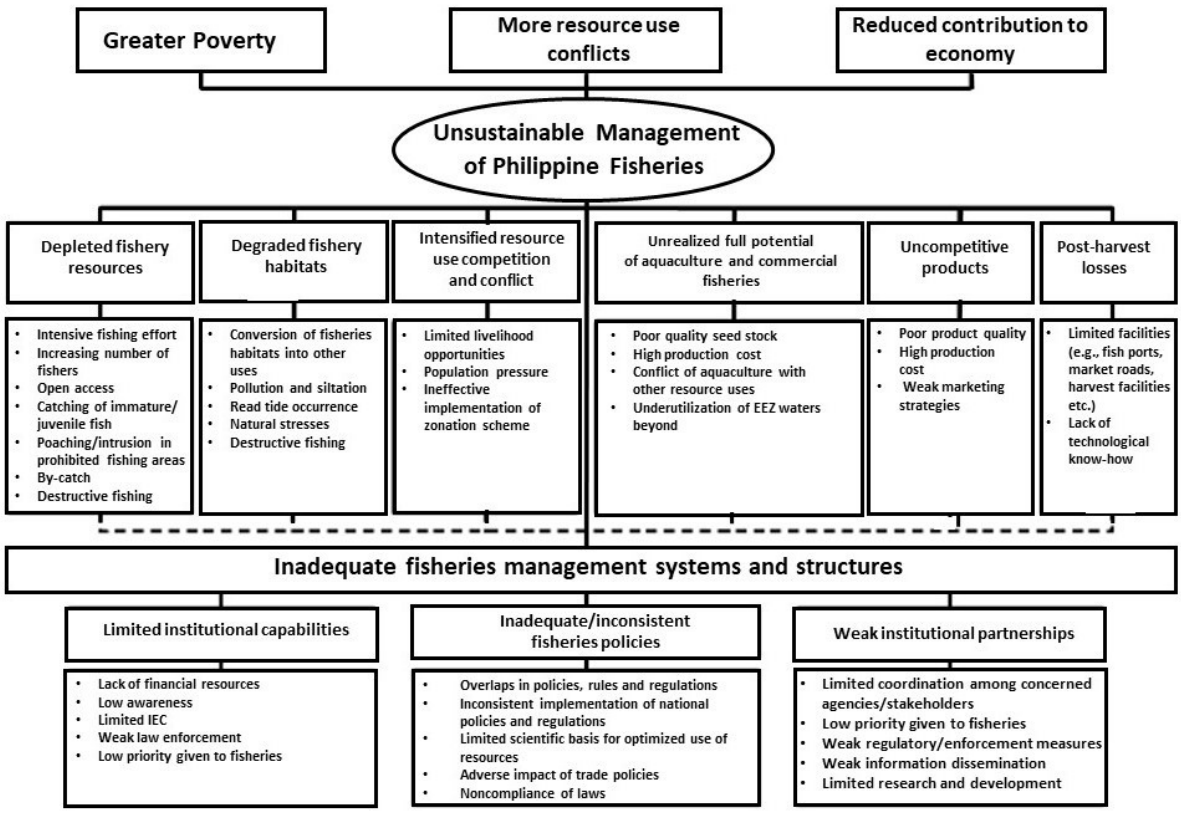

Figure 2. Key challenges confronting the fishery industry (Source: DA-BFAR 2005).

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Degradation of fish habitat also contributes to fishery stock depletion. Excessive conversion of mangrove areas into aquaculture ponds removes the natural ecosystem services of this ecosystem as fish nurseries. Conversion of mangrove areas results in resource use conflicts between fishermen and investors. Land-based activities like mining dump silt and pollute marine habitats destroying their productivity.

The evident decline in wild catch leads to the promotion of aquaculture as an alternative production scheme for the fishery. This option, however, is also challenged with low-quality stock and resource use conflict issues related to the conversion of mangrove areas to ponds. The high production cost entailed by aquaculture also limits the realization of the full potential of aquaculture.

Post-harvest fish production issues are also considered challenges to the development of the fishery industry. There is limited access to cold storage, with only two government-controlled cold storage facilities in operation, one in Casiguran, and another in Dingalan, both in the Province of Aurora. All other cold storage facilities being used in the fishery are privately-owned. Limited facilities result in production losses and poor-quality fishery products.

Underlying the social and environmental issues related to the fishing industry are inadequate fishery management systems and structures. One of the inadequacies in management systems is weak law enforcement resulting from fragmented efforts of different agencies. The Bureau of Fisheries and Aquatic Resources (BFAR) under the Department of Agriculture (DA) is the main agency that implements laws on fish production. On the other hand, law enforcement on habitats related to fishery production is regulated by the Department of Environment and Natural Resources (DENR). This duality in regulating agencies when it comes to marine development creates confusion and often violation of each agency's laws. A recent example is the release of tilapia fingerlings to some inland water bodies, which under DENR rule should have undergone an environmental impact assessment. BFAR, on the other hand, as mandated to create alternative livelihood options, went through without the prerequisite study.

The collection of pertinent data for policy and ecosystem management is also limited by this fragmented effort. Port management and development is under MARINA but is a necessary infrastructure for proper documentation of fish landing by BFAR. Luzon, despite its sizeable contribution to wild fish production, has only three major landing sites: Navotas, Lucena, and Sual. The majority of the fishing vessels still use traditional landing sites limiting the collection of data.

Maritime Industry

The Philippine shipping industry is largely inefficient (Austria 2003; Lorenzo 1998). Given that the Philippines is an archipelagic nation and thus considered a maritime nation, the contribution of the shipping industry to economic development is limited (MARINA 2018). This can be traced to the poor quality of sea transport, low productivity of the shipbuilding and ship repair industry, unattractive ship registry, and decreasing quality of maritime crews (Figure 3). Factors for these challenges are interrelated and integrated.

The general state of the maritime industry is overridden by a fragmented maritime administration. The industry is regulated by different government agencies, with various offices doing the registration, promotion, monitoring, and evaluation. For example, the registration of sea vessels is with MARINA, but the monitoring is with the Coast Guard. The limiting cost of ship acquisition and shipbuilding is also one factor that is dominant for both the quality of sea transport and the productivity of shipbuilding. Ship registration is also deemed expensive and cumbersome. Inadequacy of port and shipbuilding and repair infrastructures both affect the port operation and shipbuilding productivity. The low level of education attributed to non-compliance of METI to quality standards also affects the transport system and the quality of the shipbuilding.

Data on maritime incidents indicate an average of 526 boat accidents happened between 2011 to 2016 (MARINA 2018). Most of the time, these incidents occur during rough sea conditions aggravated by crew errors, poorly constructed boats, and inadequate navigational as well as shelter facilities for boats. Ancillary problems to these maritime incidents are pollution to the marine environment from oil and chemical spillage.

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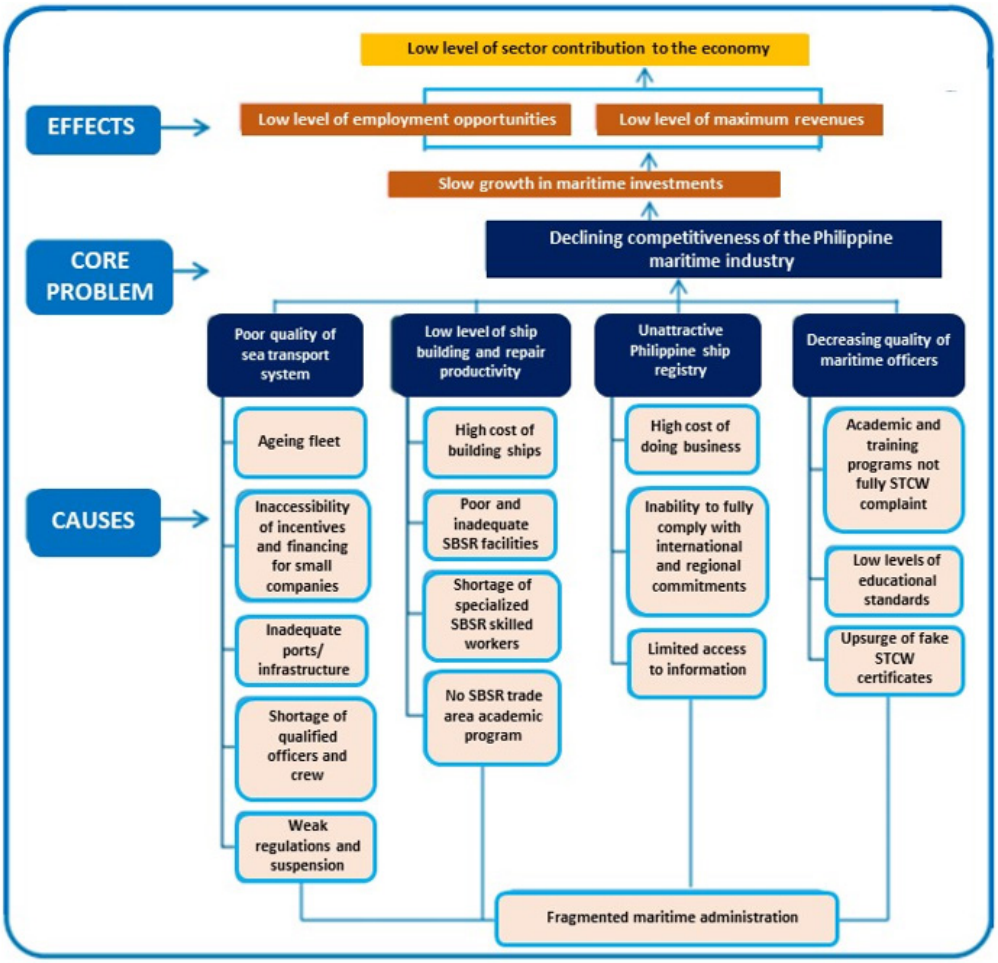

Figure 3. Problem tree analysis of the challenges faced by the shipping industry (Source: MARINA 2018).

Coastal Recreation and Tourism

In preparing the National Ecotourism Strategy in 2002, DOT presented data that beaches, together with golf and gambling, are the most frequent destination for arriving tourists (NESC 2002). In fact, beach-based tourism in the Philippines is typical. The data, however, is more than two decades old and no update is available. This deficiency in data may be considered a limitation to the presentation of a more profound contribution of the coastal area to the national economy.

Coastal and marine attractions like whale shark watching in Donsol, Sorsogon are considered the most successful ecotourism products in the Philippines (NESC 2002). As the activities are tightly linked to the natural resources present in the area, limitations to the development of the industry include illegal fishing activities that damage the reefs. Ecotourism may also put pressure on the iconic species of interest. In Donsol, for example, pressure to bring in more income from whale shark watching became disruptive to the whale sharks, with more people plopping into the water at the same time. In Oslob, Cebu, tourism pressure encouraged the unsustainable practice of whale shark feeding.

Limitations to the development of coastal and marine ecotourism also include the skills of the people involved. Scuba diving needs specific skills and training that in most cases, is deficient among local communities. This limits the benefits of the industry to the local people, which may generate struggles among local people.

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Offshore Oil and Gas

The Malampaya natural gas production started in 2001 and is projected to have exhausted the natural gas deposit by 2022 (Velasco 2020). Production began to decline in 2019, indicating the need to explore natural gas or petroleum deposits that will supplant its share of power generation.

Mining and Quarrying

The cancellation of the Ilocos Sur and Cagayan black sand mining presents a scenario that mineral exploitation in the Philippines is open to corruption due to loopholes in the mining policy (Batongbacal undated). Companies engaged in quarrying use their permits to exploit coastal magnetite deposits as a sand resource. This practice had created tension between the DENR and the Local Government Units, with the latter banning the activity permitted by the former. This resulted from incomplete information on mineral resources deposits within the areas of operation and poor monitoring of activities by the concerned companies.

OPPORTUNITIES FOR DEVELOPMENT

Fisheries and Aquaculture

The decrease in wild fishery production is augmented by increased production of aquaculture species (PSA 2018 (b)). As of 2018, aquaculture production increased by 3%, while 2017 production is 1.7% higher than in 2016. With issues on the depletion of wild stock, aquaculture is a viable option to meet the demand for fish and fish products.

The opportunity window in increasing output from aquaculture production needs technological know-how. As of now, there are eight developed technologies for various fish species, including 3 for marine species, five technologies for crustaceans, and 4 for mollusks. Three seaweed species are also known to be produced commercially using aquaculture techniques. However, refinement of existing technologies within local conditions is needed for their commercial application.

An alternative to the artificial grow-out culture of fishery species is the ecosystem-based culture of species. Sea ranching technology has been developed for sandfish and sea urchins (Juino- Meñez 2016; Nievales, Juino-Meñez and Bangi 2006). Natural stock enhancement had also been done with giant clams (Gomez and Mingoa-Licuanan, 2006) and top shells (Gonzales, Galon, and Becira undated). These ecosystem-based approaches are accompanied by community organizations that mostly involve small-scale fishers as well as artisanal fishers. Currently, however, this approach has been limited to invertebrates and has not been applied to marine bony fishes with the obvious limitation on movement. One challenge of sea ranching and restocking approaches is identifying proper sites and local environmental variables that should produce the desired results (Bartley and Bell 2008).

One limiting factor for aquaculture is the investment needed to put up infrastructures that are sustainable. In the Philippines, an investment by Blueyou in sustainable grouper production in Iloilo is a model blue economy investment (eascongress2018.pemsea.org). They designed an investment portfolio with a group of private companies that is community-based fish with strict adherence to environmental standards.

Other innovative financing schemes are being established worldwide. Credit Suisse, for example, has a Blue Impact debt instrument for investors (Drew 2019). The credit facility encourages government and non-profit organizations to pay for conservation outcomes and share in the savings they create as private investors fund initial investments. Together, collaborative funding can generate a long-term return in terms of conservation. Innovative fishery financing schemes would generate resources for the establishment, monitoring, and management of marine protected areas (MPA) that, in the long run, will protect and sustain fisheries (Alino et al. 2000; Weeks et al. 2010; da Silva et al. 2015).

Coastal Recreation and Tourism

The economic contribution of the natural marine ecosystems is always undermined by the indirect determination of their value in the monetary dimension. This is demonstrated by our coral reefs. Azanza et al. (2017) valued ecosystem provisioning services of the coral reefs at USD352, 249.00 per hectare per year. The value, however, is often lost with the non-market characteristics of the resources.

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As with innovative financing schemes in aquaculture, sustainable financing schemes are also available for the tourism industry that will translate ecosystem services into actual monetary value. One example is the Blue Finance program for the Marine Protected Area Network (MPAN) of Oriental Mindoro (blue-finance.org). The strategy is to form a collaborative management scheme involving the 52 square kilometer MPAN to finance conservation programs through innovative tourism models. The project is yet to commence, but the potential for success has been buoyed by experiences around the Philippines that community-based community efforts are successful in marrying conservation with economic return through sustainable financing schemes. One example is the conservation strategies of resort owners in El Nido, Palawan (environment. elnidoresorts.com, accessed on October 6, 2021). Their efforts range from information and education campaign to villages, support to research, monitoring of sites, and installation of green structures that lessens pollution inputs

Green financing is also available for big-ticketed projects that may benefit areas with reduced tourism potential due to pollution. The ARCOWA project in Manila Bay invites investors to water resource recovery by installing a wastewater treatment facility in conjunction with material recovery like methane and nutrients (ARCOWA 2018). The investment portfolio brings in financial institutions that will invest not only in resource recovery but also in water quality improvement.

Policy supports for sustainable financing schemes are existent. DAO 2016-24 sets a limit to the fees that can be collected in NIPAS areas (www.mgb. gov.ph (b), accessed on October 6, 2020). It has been a limitation that collected fees are not readily available to local entities managing the areas, but RA10629 allowed retention of 70% of the collected fees locally (www.bmb.gov.ph (c), accessed on October 6, 2020). This allows immediate availability of resources for conservation administration and management.

Maritime Industry

Population growth and increasing urbanization of the Philippines are projected to increase the demand for transport for goods and people and, thus, an opportunity for the development of the shipping industry. The current demand for low carbon-emission ships presents opportunities to the SBSR for investment in shipbuilding as well as technology development. New ships will also generate a need for capable human resources both for manning technologically adapted ships as well as maritime ancillary services.

The Philippines is currently the second largest supplier of seafarers, which presents the top opportunity for manpower development. With a growth rate of 6.6%, the demand for seafarers is estimated to be at 1.5 million by 2025 (BIMCO 2015). The emerging cruise ship industry also presents an opportunity for human resource development.

Building coastal and inland ports is also a maritime industry opportunity to decongest main thoroughfares. Development, revival, and promotion of ship routes like Manila-Bataan, Manila-Nasugbo, Manila-Batangas, Manila- Calapan, Oriental Mindoro, Manila-Subic, and Manila-Dagupan will remove sizeable traffic volume from the expressways. Revival of the Pasig River Waterway Ferry System will also develop the Manila-Laguna route.

Under the MIDP 2019-2028, MARINA indicated the need to establish a Maritime Training and Research Center that will address the technical as well as technological needs of the industry. The center is envisioned to offer a Master's Program for Maritime Courses. Other opportunities for its eminent establishment may be for the engineering and design of ferries, boats, and ships specifically adapted to the climate, sea conditions, and hazard probabilities of the Philippines. Low carbon-emission technology for boats and ferries may also be developed by the center. Technology on automated vessel monitoring control and surveillance may also be developed to facilitate monitoring and vessels.

Improvement of the maritime safety standards presents opportunities for the establishment of marine environmental safety standards. This can be supported by information and education campaign materials to increase safety awareness of the public. Implementation, review, and compliance to safety standards by ships and ferries should also be monitored.

Energy Industry

The Philippines is heavily dependent on imported oil both for power generation and fuel needs (ADB 2016). The Malampaya Natural Gas Project remains to be the

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largest indigenous contributor to the national energy needs. The potential that large oil and gas deposits are in existence in the Palawan Basin is apparent with the awarding of 11 exploration contracts to explore the Cuyo-Mindoro Basin and East Palawan Basin. This includes some areas in Red Bank which is also being claimed by China.

The many straits and passages around the Philippines present complex hydrodynamic processes that are both biologically invigorating for marine organisms, but also have the potential to be tapped as a source of energy. Power demand in Luzon is projected to increase by 4.78% annually from 2016 to 2040, with Visayas and Mindanao's power demand projection at a higher rate (ADB 2016). In the pipeline projects are anticipated to cover the projected power demand. As the country is vulnerable to climate change impacts, the utilization of renewable energy is supported by the enactment of the Renewable Energy Act (RA 9153).

As of March 2020, seven contracts were awarded to develop ocean power projects with 2 located in Luzon (www.doe.org.ph, accessed on October 6, 2020). The Cabangan Energy Project, in Cabangan, Zambales, is an ocean-thermal conversion project set to produce 5 megawatts of power. The other project in Matnog, Sorsogon is set to utilize tidal-in-stream energy conversion technology to tap the ocean current in San Bernardino Strait. Both projects are at the pre-development stage.

CONCLUSIONS AND RECOMMENDATIONS

Blue economy as an economic concept may very well be a case of "selling nature to save it" (McAffe 1999). This underlines the proper valuing of marine resources in monetary terms in order to finance their management and conservation removing the occurrence of the tragedy of the commons.

The establishment of the Philippine Ocean Economy Satellite Account (POESA) under the auspices of the Philippine Statistics Office to valuate the associated ocean activities in the Philippines initiates the needed data to manage and maximize the blue economy. As of 2015, ocean economic industries contribute 7% to the Gross Domestic Product (GDP) worth 11.9 B USD (Zafra 2022). Coastal and marine tourism contribute 20% to the value underscoring the need for a standardized inventory of resources as a basis for determining the carrying capacity of tourism areas. Carrying capacity estimates the maximum crowd that may be allowed at any given time so as not to compromise the natural processes in an area. The inclusion of conservation measures, such as embedding payment of ecosystem services, to any tourism activity will give equal value to conservation and resource use.

An issue that may limit the full exploitation of the ocean economy is the absence of a dedicated agency that ensures the inclusiveness of the economic value chain. Low competence in the shipping industry and a weak management system of fisheries are human resource issues that may be interactively addressed through multi-stakeholder venues. This underscores the possible need for the establishment of a separate agency to deal with marine environmental and economic issues. The National Academy of Science and Technology (NAST PHL), for one calls for the establishment of a Department of Oceans and Fisheries (www.nast. ph, accessed on October 6, 2020) but is hampered by the bulk of logistics involved. At the very least, a coordinating agency that harmonizes efforts for the development and management of ocean economy should be institutionalized.

The Development Plan of the DA calls for mapping of the agriculture investment area to underline the resources present and the investment needs. The commencement of the blue economic development of the country should also involve mapping out the blue economy investment areas. This will give focus on efforts on development as well as plan programs in a sustainable and equitable way. Fragmented development efforts may result in overlapping agendas in some sites that may not be compatible.

Following the mapping of blue economic development areas is building an attractive financing portfolio. Blue financing schemes for aquaculture, waste management, and tourism may be established for the mapped-out investment areas. A debt swap for blue investments may be arranged with creditors that will encourage blue investments by international creditors. In the case of World Bank Group (WBG), capital for sustainable ocean management policy development, use of data science in sustainable fisheries, and support to sustainable marketing and financing are offered to strengthen the ocean economy (https://thedocs. worldbank.org,

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downloaded on Sept. 23, 2022). Locally, incentives may be granted to coastal industries that are investing in waste treatment plants and other pollution-reducing installations. Sustainable financing schemes may also be explored using innovative tourism models and resource use fees. Encouraging tourists to contribute to conservation measures, however, need a change in value systems so that extra fees for conservation are appreciated.

Mapping will also allow proper valuation of resources that may become the basis for the assessment of justifiable fees and the criticality of the area. Valuation studies may also establish the carrying capacities of the areas to be developed. The study will put a limit to the pressure that can be exerted to make the resource sustainable. This may be more practical if blue investment areas may be set as zones where Programmatic Environmental Impact Studies are done in an integrative way before any activity or engineering design is done.

Finally, while the blue economic concept taxes the use of the marine ecosystem to save it, planning for development should not exclude communities. In the Philippines, 60% of the population lives in coastal areas (Azanza et al. 2017) which include the fisherfolks. Fishing communities are generally considered to be among the poorest of the poor and the most vulnerable population segment to natural hazards because of their location. Poverty in these communities is a complex of high population growth rate and high dependence on marine resources that exerts pressure on the marine ecosystem. An inclusive planning for blue economic development should consider these communities that are considering the ocean as their only resource.

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Conflict of Interest:

The author declares no conflict of interest in writing this paper.

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