



GEF Project Document *Cover Page*

Project Title:	Blue Horizon: Ocean Relief through Seaweed Aquaculture
GEF Project ID:	10573
WWF-US Project ID:	G0030
Countries:	Philippines, Viet Nam
Project Duration:	48 months
Project Type:	FSP
GEF Trust Fund(s):	GEF TF
GEF Focal Area(s):	International Waters
GEF Focal Area Objective(s):	IW-1-1; IW-1-3
Implementing Agency:	World Wildlife Fund, Inc.
Lead Executing Agency and Executing Partners:	Southeast Asian Fisheries Development Center (SEAFDEC), Bureau of Fisheries and Aquatic Resources (BFAR), Directorate of Fisheries (D-Fish)

GEF Project Cost:	USD 6,000,000
GEF Agency Fee:	USD 540,000
Project Co-financing:	USD 9,306,269

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ACRONYMS AND ABBREVIATIONS

AQD	Aquaculture Department of SEAFDEC
ASIC	ASEAN Seaweed Industry Club
ASEAN	Association of Southeast Asian Nations
ASSPP	ASEAN-SEAFDEC Strategic Partnership Program
AMA	Aquaculture Management Area
BAFS	Bureau of Agriculture and Fisheries Standards
BFAR	Bureau of Fisheries and Aquatic Resources
DA	Department of Agriculture
DARD	Department of Agriculture and Rural Development
DENR	Department of Environment and Natural Resources
D-Fish	Directorate of Fisheries
DoST	Department of Science and Technology
FASPS	Foreign-Assisted and Special Projects Service
GEF	Global Environment Facility
IMTA	Integrated Multi-trophic Aquaculture
IW	International Waters
MARD	Ministry of Agriculture and Rural Development, Viet Nam
MoF	Ministry of Finance, Viet Nam
MONRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
MSC/ASC	Marine Stewardship Council/Aquaculture Stewardship Council
MSP	Marine Spatial Planning
NITRA	Nha Trang Institute of Technology Research and Application
NPFC	Northern Palawan Fishers Cooperative
NSTD	National Seaweeds Technology Development Center
PMU, N-PMU	Project Management Unit; National Project Management Unit
PNS	Philippines National Standards
PPC	Provincial Peoples Committee
PSDC	Palawan Sustainable Development Council
RIA	Research Institute of Aquaculture (RIA 1,2,3). Viet Nam
RIMF	Research Institute for Marine Fisheries
SEAFDEC	Southeast Asian Fisheries Development Center
SIAP	Seaweed Industry Association of the Philippines
TESDA	Technical Education and Skills Development Authority
UP Visayas	University of the Philippines in the Visayas
UP MSI	University of the Philippines Marine Science Institute
WWF	World Wildlife Fund
VASEP	Viet Nam Association of Seafood Exporters and Producers
VASI	Viet Nam Administration of Seas and Islands
VSA	Viet Nam Seaculture Association

EXECUTIVE SUMMARY

The Project builds upon and contributes to the momentum of rising interest - globally and in Southeast Asia - in seaweed farming. In recent years scientific efforts have intensified to discover new uses and find ways to increase the value and utility of seaweed. Fueled by the results of science and technology, development initiatives have accelerated and spread out to devise programs that convert the intrinsic value of macroalgae into tangible benefits for society. In this context, the project contributes to the broad goal of enhancing the well-being of people based upon the environmental, social, and economic benefits that seaweed generates. It seeks to do so by *creating new sustainable seaweed value chains that will deliver ecosystem services and socio-economic benefits*. The ecosystem services include the assimilation of excess nutrients from coastal waters, with associated environmental benefits that include mitigation of ocean eutrophication and acidification as well as improvement of habitat for marine life. Downstream of the farming segment of the chain, additional environmental benefits will be derived from the deployment of biorefinery technology in the production areas and the manufacture of seaweed-based products that are biodegradable, such as bioplastics and those that either do not require much energy to produce or are substitutes of products that do. Social and economic benefits include the diversification of livelihood options, improved household and community revenues, improved local governance through the establishment of farmer collectives at the household level, and opportunities for equitable participation of women and men in the improved or new livelihood opportunities along the value chain.

The key to the generation of benefits is the achievement of intermediate objectives. These are the *expansion of production* in offshore areas assessed as suitable for farming and whose *access and use are facilitated by incentives and regulations and assured by law*; *the availability of technology, knowledge and guidance* and the *capacity of farmers to access and utilize them effectively to increase yields, achieve higher production volume and better quality harvest*; *the presence and effectiveness of governance mechanisms that enable farmers to obtain a higher and fair price for their product*; and *the presence of more income generating opportunities such as product value addition and the ability of the women and men in the farming household to engage in them*; and *the availability of and capacity of farmers to comply with guidelines for responsible farming*. These are intermediate objectives and shall be achieved with a range of enablers that include governance mechanisms, technology, material inputs, management and operational skills, capacity for participation in value chains, and various support services to the farmers and to the sector. The enablers are intended, and shall be designed and executed, to overcome the barriers to the achievement of the intermediate objectives. The project will address the numerous barriers, which are grouped under five types: limited coordination, knowledge sharing, and standards for seaweed value chains and seaweed value chain actors; poor enabling environment linked to barriers related to Marine Spatial Plans and development plans to promote expansion of seaweed farms and offshore seaweed farming; limited biorefinery technology for new seaweed products, which constrains market uptake; barriers related to a sustainable and responsible seaweed farming; and barriers related to the seaweed value chain and the equitable sharing of socioeconomic benefits generated along the value chain among members of seaweed farming communities.

The project objective “to create new sustainable seaweed value chains that will deliver ecosystem services and provide socioeconomic benefits” will be achieved through four components:

Component 1: Regional approach and capacity for seaweed value chains in SE Asia. Under this Component, the project will develop plans, tools, and trainings to build a supportive regional enabling environment for seaweed aquaculture. This will include development of a Regional Guide for Seaweed Aquaculture in the Region, to be adopted by the SEAFDEC Governing Council, a set of regional principles of responsible and safe seaweed aquaculture as basis for the development of standards of operational, environmental, and consumer safety (adapted from the Safe Seaweed Coalition), and trainings and capacity building to support both the plan and application of the principles in development of the safety standards, update or development of codes of practices, and update or development of best management practices. Such a regional approach will support the region's capacity to further expand, modernize and establish a strong influence in global seaweed value chains.

Component 2: Enabling Environment for Seaweed Aquaculture in Philippines and Viet Nam. Component 2 involves creating an enabling environment for seaweed aquaculture at the national level – in the Philippines and Viet Nam. A governance framework comprising policy, regulatory and technical guidelines for seaweed aquaculture will be developed. The project will support processes to identify suitable areas for seaweed expansion (such as in deeper off-the coast and offshore areas), and to formulate and operationalize management plans specific to such areas, with accompanying plans and coordination mechanisms (provincial/national/regional/global) to support this component.

Component 3: Seaweed Value Chains (production + processing + marketing). This Component requires working with producers (organized into associations or cooperatives) to pilot farms in areas farther than current sites (i.e. off-the-coast or offshore) that will serve as proof of concept for seaweed production in these environments. Demonstration farms will be established within national marine spatial plan (MSP) and provincial-level planning frameworks, and with the goal of advancing uniformly accepted risk assessment, rapid alert systems and data collection in order to develop safe modes of production, focusing on food safety, occupational safety and environmental safety. This is expected to overcome barriers of insufficient information that directly limit off-take agreements among global supply chain actors, contribute to the low level of regulations, and represent a barrier for insurability.

The project will also support seaweed value chain initiatives to address barriers to production and processing. This includes establishing processing solutions closer to the farming sites that add value to the raw seaweed. Markets will be developed or accessed for these products. The outcome is an increase in the livelihood benefits for coastal seaweed farmers. This is expected to encourage additional investments in seaweed aquaculture that then expands the farming areas and compounds the environmental benefits. Biorefinery solutions will be introduced to further add to the economic and environmental values generated by seaweed farming.

Collaboration with the private and financial sectors will be explored to support and scale up the results above (offshore seaweed farming, biorefinery solutions, value adding technology, etc).

Component 4: Knowledge Management, M&E, and IW Learn (regional). Under Component 4, the project will support knowledge sharing and monitoring and evaluation. Project activities will be monitored and communicated through multiple channels, including through IW:LEARN. In this way the project will utilize and expand on current baseline activities in the seaweed industry in the Philippines and Viet Nam to promote the interests of seaweed farmers and their communities, and grow the global market for seaweed in a sustainable and responsible fashion.

The project will be implemented in two sites in the Philippines and three sites in Viet Nam. The sites in the Philippines are in Palawan Province and in Zamboanga Peninsula in South-western Philippines. In Viet Nam the three sites are in the contiguous South-Central provinces of Ninh Thuan and Khanh Hoa. Four of the sites are marine waters and one site, in Viet Nam, comprises a mix of coastal farming and land-based ponds converted from shrimp to *Caulerpa lentillifera* culture. *Caulerpa* is a green species of seaweed that is consumed directly as food. The shrimp ponds have degraded and are becoming sub-optimal for shrimp production. There are vast areas of such ponds not only in Viet Nam but also in other shrimp producing countries in Southeast Asia. Attempts have been made to restore their productive capacity through substitution, rotation or integration with seaweed as well as other non-fed or extractive species like mollusks.

In addition to seaweed culture, the project will include pilot testing of value-adding technology and the establishment or strengthening of community-based value-adding SMEs to be operated by seaweed farmers. The farmers shall be organized; if already organized their organization will be strengthened and provided the essential support systems they need to farm and process responsibly, access and effectively utilize credit, technology, other resources and services, and participate effectively in the value chain of their products so that they receive a justifiable and equitable return to their investments. Their opportunity to invest in seaweed farming and product value adding, and security of these investments will be enabled and assured by a blend of progressive regulatory, market-based and voluntary governance mechanisms, which the project will support governments, communities, and organized farmer groups to devise and adopt. Zoning and area management plans that include good area management practices, user conflict mitigation and risk management, licensing and other regulations that are transparent will be supported. A set of regionally adapted principles of responsible and safe seaweed aquaculture will be developed that can be applied to guide the development and adoption of standards of product quality, environmental and operational safety applicable to Southeast Asia. Transparency and traceability mechanisms that allow regulators and buyers of seaweed products to confirm the farmers' compliance to or adherence with the governance instruments shall be installed as part of the support system. The expected outcome is confidence of stakeholders in the safety of the product and in the socially and environmentally responsible manner in which it was produced and handled.

The results from the Project including the technical information, investment prospects, management and operational experiences and lessons shall be shared widely across the Southeast Asian Region through the planned out-scaling provided in the regional strategy to promote sustainable seaweed aquaculture to be spearheaded by SEAFDEC, bolstered by the Projects' inclusion in the ASEAN-SEAFDEC Strategic Partnership Program. Through the Partnership, regional cooperation and uptake by ASEAN of the project results is expected to sustain the initiatives and follow up actions after the project terminates.

SECTION 1: PROJECT BACKGROUND AND SITUATION ANALYSIS

1.1 Project Scope and Environmental Significance

The project 'Blue Horizon: Ocean Relief through Seaweed Aquaculture' will work at the global, regional, and national levels to strengthen and develop seaweed value chains. The project will work in the South China Sea, and will be aligned with the Strategic Action Plan. More specifically, the project will work in the coastal and marine ecosystems of Viet Nam and Philippines, where significant potential for the expansion of seaweed aquaculture and seaweed aquaculture value chains exists. Seaweed farming is growing as a lucrative business in coastal provinces - farmed as a foodstuff, used in food processing, as well as cosmetics and medical industries. The livelihoods of the people who live in these coastal areas depend on the quality of water and habitat in these rich marine ecosystems.

Seaweeds can be grown with no external inputs, removing eutrophying nutrients from the water and turning them into valuable protein, oils, green chemical feedstock, and a range of industrial products. Producing large volumes of seaweeds for human food, animal feed and additives, pharmaceutical & medical, fertilizer and food additives could represent a transformational change in the global food security equation. A summary of ecosystem services from seaweed is presented in Table 1.

Table 1 Extrapolated ecosystem services from 500 million tons (dry weight) of seaweeds (WB, 2016)

Ocean area required	500,000 km ²	Based on average annual yield of 1,000 dry tons/km ² under current best practice. Equals 0.03% of the ocean surface area.
Protein for people and animals	50,000,000 tons	Assumes average protein content of 10% dry weight. Estimated value \$28 billion. Could completely replace fishmeal in animal feeds.
Algal oil for people and animals	15,000,000 tons	Assumes average lipid content of 3% dry weight. Estimated value \$23 billion. Could completely replace fish oil in animal feeds.
Nitrogen removal	10,000,000 tons	Assumes nitrogen content 2% of dry weight. Equals 18% of the nitrogen added to oceans through fertilizer.
Phosphorous removal	1,000,000 tons	Assumes phosphorous content 0.2% of dry weight. Represents 61% of the phosphorous input as fertilizer.
Carbon assimilation	135,000,000 tons	Assumes carbon content 27% of dry weight. Equals 6% of the carbon added annually to oceans from greenhouse gas emissions.
Bioenergy potential	1,250,000,000 MWH	Assumes 50% carbohydrate content, converted to energy. Equals 1% of annual global energy use.
Land sparing	1,000,000 km ²	Assumes 5 tons/ha average farm yield. Equals 6% of global cropland.
Freshwater sparing	500 km ³	Assumes agricultural use averages 1 m ³ water/kg biomass. Equals 14% of annual global freshwater withdrawals.

Seaweed farming provides livelihood resilience for communities, ecosystem services for biodiversity enhancement and generates revenues for emerging countries in order to alleviate poverty. Seaweed can be integrated into multi trophic systems which can strengthen economic resilience of coastal communities, all while providing benefits that stabilize and strengthen the health of the surrounding environment.

Key to making the seaweed industry a driver of environmental sustainability, poverty alleviation, livelihood resilience and shared prosperity is to add more value closer to the production areas, thus creating more and better jobs for low-income coastal communities. To this end, the proposed project is intended to: 1) connect rapidly evolving, cutting-edge science in the processing and use of seaweed to

practical production technology; 2) create a forum for partnering technology to investors in developing countries; and 3) establish norms of operation to ensure that production systems remain among the most environmentally positive economic activities.

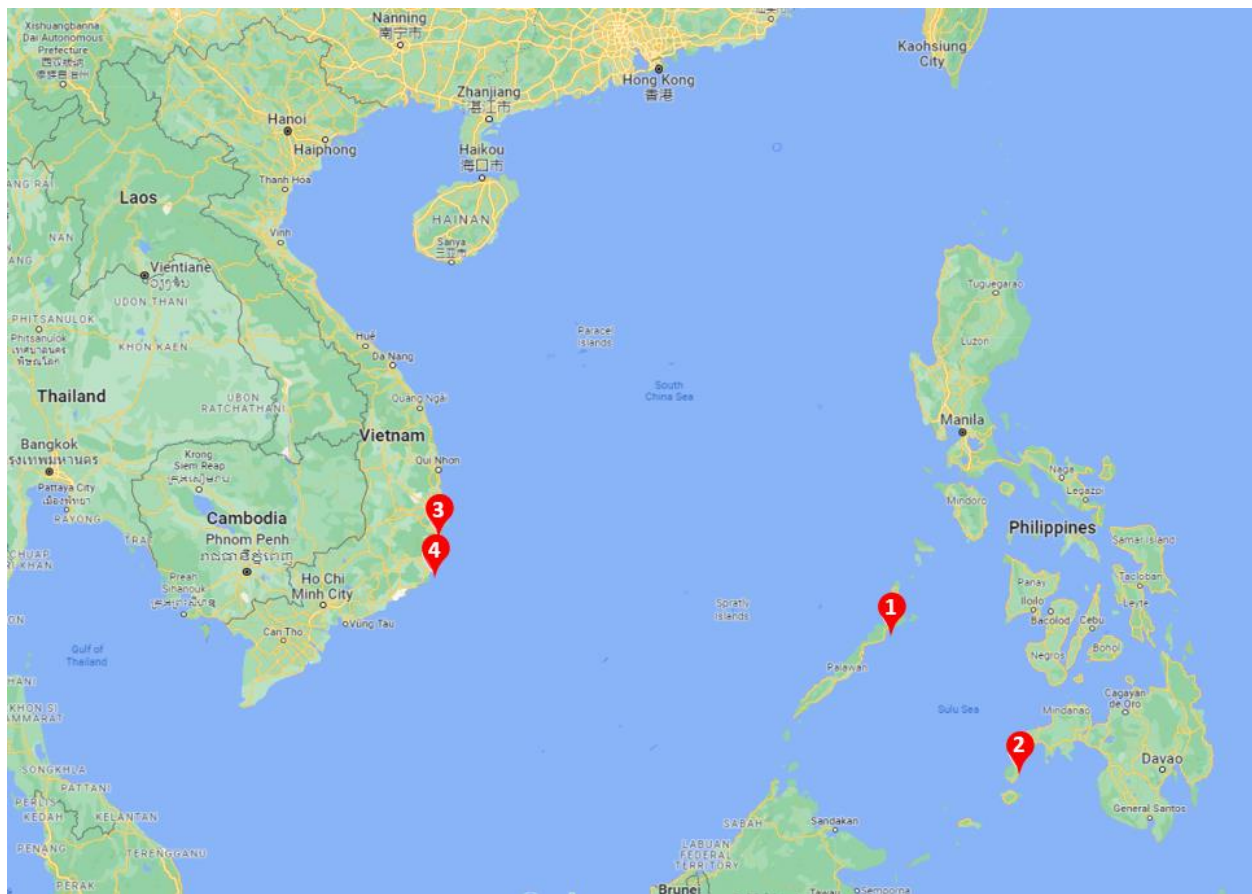
The project countries, the Philippines and Viet Nam, offer the context and experiences from which the Project can draw lessons that will be broadly applicable and relevant to the Southeast Asian Region. Their seaweed industries represent the range of social, economic, environmental and governance issues that the Project seeks to address. The Philippines, the third largest producer of seaweed in the world, has a well-developed and active seaweed industry with a scientific and governance support system that has been constantly developed to guide a dynamic industry, align it with national goals and accelerate its growth in a sustainable way. As such it provides a strong baseline for the Project to build on. However, the industry continues to face persistent problems and some emerging ones such as those spawned by climate change that it also poses challenges that the Project needs to meet to make its results highly useful and widely relevant. On the other hand, Viet Nam, while a major global supplier of farmed seafood (e.g. shrimp, pangasius), has a much smaller and younger seaweed industry compared to the Philippines. However, it has been steadily expanding and public and private sector interest in its potential contribution to social and economic development has intensified. To stimulate growth, the Government has recently initiated a long term marine aquaculture strategy that calls for the expansion of seaweed aquaculture, with significant targets that reflect Viet Nam's strong commitment to the expansion and development of the sector. The status of the industry, particularly its technological base and governance mechanism, represents a set of challenges that the Project needs to address, which would provide valuable lessons for countries seeking to expand from a smaller base and an earlier stage in the development of the industry.

The two sites in the Philippines are (1) off Green Island of the municipality of Roxas in Palawan Province and (2) the district of Buenavista in Zamboanga City, Zamboanga Peninsula in South-western Philippines. Eucheumatoid species (*Kappaphycus* sp. and *Eucheuma* sp. will be used, a major reason being that these are the most widely farmed species in the Philippines, the infrastructure for their seed supply and processing is well established, and farmers have had a long experience cultivating them. Their polysaccharide extract, carrageenan, dominates the global market for phycocolloids. The market size value was \$825 million in 2021 and projected to grow at a compound annual growth rate (CAGR) of 6.0 percent to reach \$1.248 Billion in 2028. Palawan is the top producer of eucheuma seaweed in the Philippines. Being an island, the regular water movement contributes to the favorable environment for seaweed farming. Palawan has been the site of a wildlife conservation project and being considered as the site of a reef conservation project. The Blue Horizon project could develop linkages around habitat enhancement with the former and environmental risk management with the latter. Zamboanga Peninsula is below the Philippines typhoon belt. It also ranks among the major seaweed producing areas in the country. Area farmed to seaweed in the Peninsula is now more than 12 000 hectares with a potential expansion area, including offshore, of 50 000 hectares.

In Viet Nam the three sites are in two neighboring South-Central provinces with a fairly significant seaweed production and history of seaweed farming: Ninh Thuan and Khanh Hoa. Farming of the *Kappaphycus* sp has been relatively stable in these two provinces. The two sites selected for piloting of *Kappaphycus* ("Zone D" seaweed planning area of Ninh Thuan and the Van Phong Bay seaweed planning area of Khanh Hoa) have been zoned for off-the-coast aquaculture development under current provincial planning. The first site is in Thuan Nam district, Ninh Thuan, the second in Van Ninh district in Khanh Hoa. A third site is for *Caulerpa* sp. in Ninh Hoa town, Khanh Hoa.

The sites for the pilot demonstration farms were selected and confirmed following stakeholder consultations at several levels – national, provincial and local (municipality or commune). The selection process was based on a set of criteria that included biological, natural, physical, social, institutional and local governance factors. Suitability of the site, presence of support systems to operate the project, expressed acceptance and support by the local stakeholders of the project, and its potential to contribute to the local economy, and risks to its implementation were assessed by the project preparation teams using available secondary information and firsthand knowledge by some of the team members and key informants. The maps indicate the selected locations of the pilot demonstration farms; Appendix 1 contains the coordinates. Appendix 2 has more details on the sites and the process and justification for their selection.

Figure 1 Map of Project Sites



PHILIPPINES

1. Green Island, Roxas, Palawan Province, Philippines
2. Buenavista, Zamboanga City, Zamboanga del Sur, Philippines

VIET NAM

3. Khanh Hoa, Province, Viet Nam
4. Ninh Thuan Province, Viet Nam

1.2 Environmental Problem(s), Threats and Root Causes

The ocean's foundation is literally eroding. Threats, drivers, and impacts are summarized in Table 2.

Table 2 Threats and drivers

Threat	Causes / drivers	Impact
Coral bleaching	Climate change, leading to more extreme water temperatures Pollution (e.g. nitrogen ¹)	Extreme increases in water temperature puts coral reefs under huge stress, making corals susceptible to disease and, if the temperature stays high, death. The destruction of coral reefs impacts the numerous marine life that depends on these ecosystems, as well as the associated ecosystem services.
Ocean acidification	Rising levels of carbon dioxide, which reduces the pH levels in the ocean	Ocean acidification impacts hard corals, making it difficult for these marine organisms to build their shells and endoskeletons. In some cases, severe acidification dissolves their calcium carbonate structures.
Nutrient pollution	Nitrogen and phosphorus run-off from agriculture, aquaculture and domestic activities	Eutrophication and Hypoxia. Harmful algal blooms (HABs) consume all the available oxygen to create dead zones, leading to major losses in biodiversity. HABs also cause health problems by contaminating seafood particularly mollusks.

Climate change (due to carbon emissions) and nutrient pollution (nitrogen and phosphorus) are accelerating/driving these threats. The combined impact of these threats is the degradation of the nearshore marine environment and related ecosystem services. At a global scale, this impacts the 3 billion people that depend on fisheries and marine/coastal biodiversity for their livelihoods. It is also impacting the nearshore environment of the Philippines and Viet Nam, both of which have long coastlines (36,219 km and 3,260 km, respectively) with coastal communities highly dependent on marine resources.

Viet Nam, for example, has been experiencing more frequent episodes of algal blooms (red tide) in coastal waters due to discharges of nutrients from two major rivers, the Red River and Mekong River, that drain into the South China Sea. Traditional farming areas in the shallow nearshore coastal environment are becoming less suitable for seaweed culture due to pollution brought by run-offs from land-based sources like agriculture and domestic activities; this applies to the Philippines as well. Viet Nam's coastline has experienced unprecedented development in the last two decades, with tourism, port infrastructure and other forms of commercial development competing for space and access to resources. Meanwhile, climate change is raising sea temperature, which has especially pronounced effects in shallow nearshore waters, the adverse impacts on cultured seaweed being lower yield and greater vulnerability to disease.

The challenge is to find ways of capturing the carbon as CO₂ to reduce ocean acidity and allow for greater capacity of the ocean to slow the rate of climate change. Moreover, the extraction of nitrogen and phosphorus, which are the key nutrients that cause eutrophication in marine environments, is necessary

¹ <https://www.pnas.org/content/117/10/5351>

to limit pollution and mitigate rising ocean temperatures. This is a global challenge and the solutions need to be tested and then scaled.

1.3 Barriers addressed by the project

While the seaweed industry has a significant untapped potential towards supplying high quality, cost competitive biomass for new international value chains, including the processing and delivery of sustainably produced fishmeal and oil replacement products to green the growing aquaculture sector, there are significant problems that impair the industry from reaching its potential. The structure of the current industry is characterised by high disease outbreaks (e.g. ice-ice disease) due to rising sea temperatures, pollution and low genetic variability of seedstocks; use (and loss) of Styrofoam, plastic ties, and other materials (such as empty plastic water bottles used for buoyancy); and lack of standards and protocols that adhere to an ecosystem approach to reduce the environmental footprint of production. Barriers to scaling seaweed aquaculture, and achieving corresponding environmental benefits, include the following:

Limited coordination, knowledge sharing, and standards for seaweed value chains and seaweed value chain actors

Seaweed farming is a growing sector and is gaining increased attention from a range of actors. While new seaweed initiatives are emerging, the seaweed value chain remains largely fragmented. In order to promote growth of the seaweed value chain, coordination and collaboration among value chain actors is needed. The lack of direction across the current industry implies lost opportunities towards developing blue economy solutions that deliver against today's compounding environmental challenges.

An additional barrier is the lack of regionally harmonized standards and metrics guiding seaweed farming. (Not all seaweed growing countries in Southeast Asia adhere to a standard, much less any formal certification scheme). In order to increase scales of production, the quality of seaweed biomass needs to be standardized (in terms of product safety, environmental safety, and operational safety) and agreed to by actors along the value chain. This requires linking good practices for seaweed farming and processing, and harmonizing global seaweed demands and market requirements for standards with the national seaweed farming industries of the region.

Barriers related to Marine Spatial Plans and development plans to promote expansion of seaweed farms in zones farther than nearshore, i.e. off-the-coast and offshore.

The sustainable growth of seaweed farming is constrained by a lack of proper marine spatial plans and operationalization of these plans, particularly in zoning for the various uses and the development of aquaculture management areas. The current industry in the tropics is mostly based on inshore and intertidal areas where multiple users compete for space and resources (i.e. tourism, aquatic animal culture, fishing, navigation, energy production, etc.). In addition, current seaweed farming is operating in small-scale systems. Moving production beyond these traditional and increasingly crowded and possibly polluted areas offers reduced competition for coastal resources and less disease and climate change impacts (for instance, the water temperature is lower). As cultivation in this area is less intensively spaced, disease and parasites spread less readily, allowing greater space for seaweed farming growth potential. On the other hand, seaweed farms in areas farther from the coast and deeper than the traditional sites face a more dynamic growing environment that includes faster currents, larger waves and stronger winds. It would thus be useful for planners involved in seaweed expansion to be familiar with the conditions and

attributes of two expansion areas beyond the nearshore. Table 3 provides a broad set of criteria -- what to expect in deeper waters -- for defining coastal, off-the-coast and offshore mariculture.

Table 3 General criteria for defining coastal, off-the-coast and offshore mariculture²

Parameters	Coastal mariculture	Off the coast mariculture	Offshore mariculture
Location/hydrography	<ul style="list-style-type: none"> · <500 m from the coast · <10 m depth at low tide · within sight¹ · usually sheltered 	<ul style="list-style-type: none"> · 500 m to 3 km from the coast · 10–50 m depth at low tide · often within sight · somewhat sheltered 	<ul style="list-style-type: none"> · >2 km generally within continental shelf zones, possibly open ocean · >50 m depth
Environment	<ul style="list-style-type: none"> · Hs¹ usually <1 m · short-period winds · localized coastal currents · possibly strong tidal streams 	<ul style="list-style-type: none"> · Hs <3–4 m · localized coastal currents · some tidal streams 	<ul style="list-style-type: none"> · Hs 5 m or more, regularly 2–3 m · oceanic swells · variable wind periods · possibly less localized current effect
Access	<ul style="list-style-type: none"> · 100 % accessible · landing possible at all times 	<ul style="list-style-type: none"> · >90 % accessible on at least once daily basis · landing usually possible 	<ul style="list-style-type: none"> · usually >80 % accessible · landing may be possible, periodic, e.g. every 3–10 days
Operation	<ul style="list-style-type: none"> · manual involvement, feeding, monitoring and more 	<ul style="list-style-type: none"> · some automated operations, e.g. feeding, monitoring and more 	<ul style="list-style-type: none"> · remote operations, automated feeding, distance monitoring, system function
Exposure	<ul style="list-style-type: none"> · sheltered 	<ul style="list-style-type: none"> · partly exposed (e.g. >90° exposed) 	<ul style="list-style-type: none"> · exposed (e.g. >180°)

¹ Hs = significant wave height, a standard oceanographic term, approximately equal to the average of the highest one-third of the waves.

Source: Modified from Muir (2004).

To ensure a national enabling environment for seaweed farming, coordination is needed among various actors including government agencies, seaweed associations, seaweed clubs, and private sector where applicable – for the development of seaweed development plans and Marine Spatial Plans that are further translated into zones and area management plans. For seaweed development plans, the links to regional and global value chain market forces must be considered. Such plans rely on buy-in from multiple government agencies and seaweed associations and farmers for success.

Limited biorefinery solutions for new seaweed products, which constrains market uptake

Biorefinery systems need to be developed (ideally on-site to avoid the cost of transporting wet seaweed) in order to extract the various seaweed compounds for multiple applications. Seaweed products linked to market demand will encourage more demand for seaweed biomass, and this greater demand will make cultivation profitable for farmers.

Key barriers to overcoming constraints on biorefinery solutions largely relate to:

- Limited analysis of potential seaweed products, including links to demand markets and price points. There is a paucity of new “bridge” markets for seaweed to absorb the increased amounts of biomass and promote increased growth of seaweed farming
- Potential biorefinery solutions are emerging but still have much untapped potential. In particular, new methods for downstream biorefinery processing are needed for pre-treatment, fractionation, extraction, and purification.

In some cases, seaweed products are known, but support and promotion for commercialization is lacking. There is as yet limited private investment in biorefinery solutions for new, market viable seaweed products.

² <https://www.fao.org/fishery/docs/CDrom/P24/i3530e/index.htm>

Operational barriers related to seaweed farming

There are numerous challenges related to seaweed farming. Small-scale coastal seaweed farming has been taking place for a long time; however, technologies for seaweed farming have remained fairly rudimentary, and production systems often utilize plastics and polluting equipment (nylon, polystyrene and polypropylene wastes). New technologies and types of anchors, buoyancy systems, ropes, harvesting vessels and transportation are not always commercially available and affordable to farmers and cooperatives, which is needed to grow the sector in a more sustainable and safe way.

Offshore seaweed farming is relatively nascent. While such a system, adaptable to a wide variety of conditions, both temperate and tropical, and species, both red and brown, has been developed by Seaweed Seed Supply A/S in Denmark and Seaweed Energy Solutions A/S Norway for mostly temperate species, it has not yet been deployed in tropical conditions³.

Offshore seaweed farming brings additional challenges, including higher levels of investments relative to traditional aquaculture infrastructure, increased insurance costs due to operations in exposed conditions, low nutrient availability, lack of knowledge about the farmed species and their behavior, and ensuring workers' well-being in demanding environments. Protecting the safety of food, employees and infrastructure will be a challenge in difficult conditions and remote areas that are hard to reach and monitor from land (Seaweed Manifesto 2020)⁴.

A serious concern is the potential marginalization of women, at least in the care and harvesting of the crop, because they would have more difficulty accessing the offshore, deeper seaweed sites (which also pose greater risks) than they have now to the nearshore, shallow and at most chest deep growing areas.

Biological constraints persist, including “ice-ice” disease, epiphyte infestation, bleaching of seaweed affecting the quality and price of Raw Dried Seaweed (RDS), stunted growth and deformities because of decline in genetic vigor of seed. Overall, seaweed farming needs to be linked to new and ongoing technology development in species and strain selection, population genetics, and disease management to ensure resilience and better productivity.

Barriers related to the seaweed value chain and socioeconomic benefits for seaweed farming communities

In the Philippines, farmers often receive limited income from their crop. Traders/middlemen control the price that seaweed farmers receive as well as access to financing (such as loans). The real profit in seaweed goes to middlemen further up the seaweed value chain. This presents a barrier to improving seaweed production, upgrading in the value chain as well as improving the lives of the seaweed farmers. There remains, generally, very little value addition by seaweed farming communities to the farm harvest through the production of consumer products.

In Viet Nam, engagement among small-scale seaweed farmers in the value chain is relatively low. Challenges include outdated harvesting, preservation, and processing technologies that would ensure good product quality. While there is a growing local demand for seaweed for use in various food preparations, much of the harvest is exported as raw dried seaweed with very little value added. However,

³ <https://seaweedsolutions.com>

⁴ <https://www.lrfoundation.org.uk/en/news/seaweed-manifesto-launch/>

Caulerpa sp. is consumed directly as food and has an attractive price in domestic markets. Some processed product forms are also being exported.

The prevailing market governance in the value chain of raw dried seaweed from carrageenophytes (the major species grown in Southeast Asia, Zanzibar and India mostly by small-scale farmers) is characterized by an “arm’s length” transaction between buyers and sellers with little or no formal cooperation among the participants. There are many small sellers, there is much spot selling, farm development is hardly assisted by funds from traders and processors, and farm improvements and expansion are largely from farmers’ own financing. Some support comes from aid and assistance programs, and processors have proliferated (at least in the Philippines and Indonesia). This governance mechanism puts the farmers at a disadvantage; they have a weak transaction capacity for prices of inputs and products even as their products hardly have any value added. A desirable market governance of the value chain is called “relational”, characterized by farmers being organized into farming enterprises and therefore having fewer but organized sellers transacting directly with processors. The processing sector is also consolidating, farm development is driven by integrated aquaculture systems, the market for raw dried biomass is diminishing in importance and new product lines with added value are developing, and there is an increasing regionalization (if not globalization) of the value chains.⁵

1.4 Regional, National and Sectoral Context

There is an active and growing seaweed sector. From 1.1.m tonnes in 1969, global farmed seaweed production by 2019 had reached 34.7 million tons wet weight. (This was 97 percent of total production). The farmed output generated a first-sale value of USD 14.7 Billion, which mainly paid for wages and supported the livelihoods of the coastal households engaged in its cultivation. Downstream activities such as post-harvest handling, distribution, processing and marketing generate more income and employment. Global export of seaweed and seaweed-based hydrocolloids (by 98 countries) was USD 2.65 Billion (USD 909 Billion of seaweeds and USD 1.74 Billion of seaweed-based hydrocolloids (FAO 2021)⁶

Some 85% of seaweed production is used in food while 40% of extracts are used in the processing of food products. Carrageenan, the most popular seaweed extract, is used in pet food, dairy industry, meat industry and in pharmaceuticals.⁷

REGIONAL

Asia contributes the majority of farmed seaweed, with China, Indonesia and the Philippines representing the top seaweed producing countries by volume (FAO 2018).⁸

The Southeast Asian Fisheries Development Center (SEAFDEC) is an intergovernmental body that supports fisheries development in the region. It has 11 member states: Brunei Darussalam, Cambodia, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam. SEAFDEC has extensive experience in Southeast Asia in setting up and helping to operationalize seaweed farms and processing facilities. Other than Indonesia and the Philippines, the SEA countries with

⁵ Iain C. Neish and SEAPlant Net. 2008. Seaplant monograph No HB2F 1008 V3 GAP. “Evolution of RAGS Value Chain, page 13

⁶ <https://www.fao.org/documents/card/en/c/cb5670en>

⁷ <https://www.fao.org/in-action/globefish/publications/details-publication/en/c/1154074/>

⁸ Ibid.

a thriving seaweed industry are Malaysia, Viet Nam and Thailand (and Timor Leste). There is good potential for expansion of the small seaweed sectors of Cambodia, Brunei and especially Myanmar with its long coastline. Singapore focuses on high tech commercial production of seaweed for food (i.e. *Caulerpa*). Laos has wild freshwater seaweed species used in food preparations as well as with medicinal properties.

PHILIPPINES

The Philippines is the world's third largest producer of seaweed. Four species are farmed but the major species are *Kappaphycus alvarezii* (trade name "cottonii") and *Eucheuma denticulatum* (trade name "spinosum"), collectively called eucheumatoids and are sources of carrageenan. (The others, in much smaller quantities, are *Caulerpa* and *Gracilaria*). Production is concentrated in four areas in the country: Autonomous Region of Muslim Mindanao or ARMM (40%), Region IV-B (27%), Region IX (13%) and Region VII (6%). Over 500,000 people earn income from seaweed farming, with an additional 10,000 jobs generated for processing, trading and other activities along the value chain.

Seaweed represents the largest aquaculture product of the Philippines by volume. It was 1.47 million MT (wet weight) in 2020. Currently 60,000 hectares of coastal waters are farmed for seaweed. The potential for expansion is 200,000 ha of farmable area along coastlines and 500,000 ha of farmable area in deeper offshore waters.

The value of seaweed products from the Philippines has been estimated at around the USD 200 million. The exports largely comprise precursor materials, for the manufacture of higher value products, such as Philippine Natural Grade used as a food additive, refined and semi-refined carrageenan (SRC) and, in some cases, raw dried seaweed. This suggests a large potential for domestic manufacture of the higher value forms.

The industry consists of more than 200,000 farm families, more than 130 nursery operators providing planning materials, 20,000 to 30,000 traders, and a processing sector of 5 multinational-owned and 9 locally owned plants with a total rated capacity of 38,000 MT biomass. The processing plants handle the marketing (mostly exporting) of their products. There are also 10 firms solely engaged in international trading of seaweed products. The value chain is short: seed banks or nurseries (mainly government-operated) provide the propagules; seaweed farmers plant the propagules, and often use young cuttings from the existing crop as planting materials for the next three to four crops; the farmers dry the harvest and sell the dried biomass (RDS or raw dried seaweed) to local buyers who may or may not be agents of a consolidator operating from an urban center. The consolidator sells the raw materials to processors. Processors in the Philippines produce for export (some for local industries) value-added carrageenan building block products or blended ingredient solutions rather than raw, dried seaweed.⁹ The major export market is the USA. Others are EU, China, Australia, Russia, Mexico, Argentina, UAE, Chile, Thailand, Malaysia, Indonesia and Viet Nam (Note: All the information in this subsection on Philippine seaweed are from incumbent SIAP Chairman, Alfredo A. Pedrosa III, 2017).¹⁰

⁹ Neish, Iain, SEAPlant.net Monograph no. HB2B 0808 V2

¹⁰ Pedrosa III, Alfredo. 2017. Current Status of the Phil Seaweed Industry. Regional Scientific Meeting Attaining Sustainable Development Goals: Philippine Fisheries and Other Aquatic Resource 20/20. Davao City, Phil. March 13-14, 2017. <https://nast.ph/index.php/downloads/category/108-day-1-march-13-2017?download=346:4-plenary-2-mr-pedrosa-iii>

Institutional Policies and Mandates

The institutional support system for the seaweed industry includes the following agencies and institutions: Department of Agriculture (through BFAR), Trade and Industry, Science and Technology, Natural Resources and Environment, Interior and Local Government, and Technical Education and Skills Development Authority.

The Department of Agriculture is responsible for the promotion of agricultural development by providing the policy framework, public investments, and support services needed for domestic and export-oriented business enterprises. Relevant to the project are two of its agencies, the Bureau of Agriculture and Fisheries Standards, which has issued a Philippine National Standards Code of Good Aquaculture Practices (as well as a quality standard on raw dried seaweed). The code of practice covers the compliance requirements from Siting and Design to Labor and Community; and the Bureau of Fisheries and Aquatic Resources (BFAR), which is responsible for the development, management and conservation of fisheries and aquatic resources (including seaweed). It operates the National Seaweed Technology Center. Among its functions are applied research and development work in seaweeds including the products that are derived from them, coordination of seaweed research stations, training of extension workers and entrepreneurs; and conduct of studies to formulate or support the execution of policies and plans. BFAR has provincial and municipal offices with development and regulatory functions.

The Department of Trade and Industry (DTI) conducts market studies of Philippine agricultural products in certain markets and if the products have a good potential in these markets, its Export Marketing Bureau provides assistance to producers to make them export-ready and connect them to foreign buyers. One of several agricultural products the DTI has assessed of their potential in the EU market was seaweed; the assessment considered the natural ingredients of products whose demand is driven by healthy lifestyle choices. The Board of Investments, an attached agency of DTI, leads the promotions of various industries and investment opportunities in the country. It also extends assistance to Filipino and foreign investors on due diligence, business registration and facilitation and aftercare service.

The Department of Science and Technology (DOST) is the premiere science and technology body in the Philippines charged with providing central direction, leadership, and coordination of all scientific and technological activities, and formulating policies, programs, and projects to support national development.

The Department of Environment and Natural Resources (DENR) is responsible for the formulation and implementation of policies, guidelines, and rules related to environmental management, as well as the management and conservation of the country's natural resources. Among the 9 agencies attached to it are: Environmental Management Bureau and the Palawan Council for Sustainable Development and Natural Resources Development Corp. The Department developed a national Integrated Coastal Management Program which was adopted through Executive Order 533 as the national strategy for the sustainable development of the country's coastal and marine environment and resources; the Order provided for the establishment of supporting mechanisms for its implementation. In 2016, the DENR initiated a program, after consulting with SIAP, UP MSI, seaweed farmer groups, PEMSEA, DA, National Fisheries R and D Institute and the Department of Agriculture, to identify areas where local production of seaweed can be either started or increased, both as a livelihood measure for coastal communities and as an effective measure against the impacts of climate change.

The central government has shifted many coastal management responsibilities to local government units (LGUs) and fostered increased local participation in the management of coastal resources. In their delivery of integrated coastal management (ICM) as a basic service, many local governments have achieved increasing public awareness of coastal resource management (CRM) issues. Continuing challenges are financial sustainability, inadequate capacities, weak law enforcement, and lack of integrated and collaborative efforts. To address these challenges, a CRM certification system was developed to improve strategies and promote incentives for local governments to support ICM¹¹.

The Technical Education and Skills Development Authority (TESDA) includes Training Regulations For Seaweed Production Qualification. Qualification consists of competencies that a person must achieve to operate and maintain seaweed nursery, grow-out seaweed, produce raw dried seaweed and market it. These competencies are required of an individual who will be engaged in seaweed production at economic scale, handling at least one-fourth to one hectare of seaweed farm.

The UP-MSI and UP Visayas and regional universities such as University of San Carlos and Palawan State University conduct biological, environmental, social and economic research programmes in marine products, including seaweeds, and on coastal and marine ecosystems. The SEAFDEC Aquaculture Department (AQD) has ongoing studies on the development of superior and disease resistant planting materials as well as training of extension workers and seaweed entrepreneurs.

The Seaweed Industry Association of the Philippines (SIAP) has a membership composed of processors/exporters, traders, and some farmers associations. It plays a role in marketing farmers' produce. It cooperates with international seaweed organizations like MARINALG International and the International Seaweed Association in addressing major problems in marketing, especially non-trade barriers imposed on food and food additives. On quality standards, SIAP is responsible for monitoring on quality needs of the markets and disseminates it to all manufacturers for strict compliance.

VIET NAM

Commercial seaweed cultivation in Viet Nam dates back several decades and is widely distributed along the coast; however, farming is mostly concentrated in the South Central Coast from Da Nang southward to Quang Nam, Binh Dinh, Khanh Hoa and Ninh Thuan provinces.

The seaweed industry in Viet Nam has been steadily growing (Table 4). In 2020, total seaweed cultivation area represented about 15,000 ha with 135,000 tons of production, wet weight. Assessments have highlighted a potential seaweed farming area of 900,000 hectares (for nearshore), and while no fully offshore seaweed farms have been operationalized, the recent national aquaculture strategy (Decision 1664) includes specific targets for offshore seaweed aquaculture to 2025 and 2030, namely 10,000 tons and 100,000 tons respectively. The Strategy also calls for an expansion of nearshore seaweed aquaculture output to 170,000 tons (2025) and 400,000 tons (2030). These targets illustrate an increased recognition by the Government of Viet Nam of the potential for seaweed farming, and the growing national interest in expanding this sector.

¹¹ <https://www.tandfonline.com/doi/abs/10.1080/08920750600686687?journalCode=ucmg20>

Table 4. Seaweed production and area in Viet Nam, 2010-2019

	Unit	2010	2015	2019	Average growth (%/year)
Seaweed	Tons (Fresh)	19,256	63,000	120,000	22.5
	Ha	3,960	25,000	10,150	11

Source: GSO and D-Fish, 2010-2019

The main seaweed species farmed include *Gracilaria*, *Caulerpa*, *Eucheuma*, and *Kappaphycus*. Historically, seaweed in Viet Nam has been used in traditional food preparations. More recently it is increasingly used in higher value-added food products such as snack food and candies. Exports have also been rising. In 2019 Viet Nam exported 2,843 tons of seaweed, valued at USD \$4.47 million, a 138 % increase from 2018. There is an increasing number of enterprises/companies involved in the business of seaweed processing and marketing seaweed products, such as: Viet Nam Seaweed Co., Ltd, Capital Seaweed Consumer Viet Nam (CSC-Viet Nam), Tri Tin company and others.

A processing plant in Long Hai produces jelly from carrageenan (raw material is *Kappahycus* sp) using old technology. It has a rated capacity of 6,000 tonnes a year.¹²

Institutional Policies and Mandates

Responsibility for the seaweed sector is distributed horizontally among sectoral ministries and their local/provincial branches. Ministries that have authority and responsibilities over the seaweed industry include:

The Ministry of Agriculture and Rural Development is an agency of the Government performing the state management function in the following sectors and fields: Agriculture, forestry, salt production, fisheries... In the field of fisheries, MARD's mandates include directing, guiding and supervising the implementation of policies on fisheries development, which include aquaculture, capture fisheries, aquatic resources conservation and development, fisheries resources surveillance. Under MARD, the Directorate of Fisheries (D-Fish) provides advisory and assistance to the minister of MARD in the implementation of the fishery laws nationwide. For aquaculture (including seaweed), D-Fish has these tasks: guide, direct and inspect the implementation of regulations on aquaculture planning and scheduling of crops, breeding, and the organization of production in aquaculture. In addition, D-Fish assesses the performance and appoints aquaculture certification bodies; organizes, examines, evaluates, designates as well as revokes the designation of aquaculture laboratories (based on regulations); and issues permits for certain activities in aquaculture. The National Standard on Good Aquaculture Practices in Vietnam (VietGAP) was developed by D-Fish and approved by MARD in 2014. D-Fish designates VietGAP (in aquaculture) certification organizations and supervises their activities.

The National Agro-Forestry-Fisheries Quality Assurance Department (NAFIQAD) is directly under MARD. NAFIQAD advises and assists the Minister in the enforcement of standards of quality and food safety of agricultural, forestry and fishery products, including tracing, warning, preventing, stopping and managing violations of food safety regulations and standards.

¹² Nguyen Van Nguyen. 2017. "Seaweed Industry in Viet Nam", presentation at the 9th Meeting of the ASEAN Seaweed Industry Club on ASEAN Cooperation in Agriculture and Forest Products Promotion Scheme. 1-3 Aug 2017, Danang, VN

At the subnational level, the Provincial People's Committees (PPC) and, under them, the district councils, are responsible for developing and managing fishery and aquaculture at provincial scales. MARD directly manages only responsibilities that cross provincial lines. Local authorities have varying capacities for planning and management. The Provincial Department of Agriculture and Rural Development (DARD) is under the administrative authority of the Provincial Peoples Committee (PPC). DARD is also a provincial department of MARD and thus accountable to MARD in the state management functions. Among the local agencies under DARD are the provincial Branch of Fisheries; the Branch is accountable to both DARD and D-Fish in reporting lines and state management of the fishery sector. PPC coordinates all departments in provincial planning. DARD assists and reports to PPC in fishery planning, including inputs into provincial Socio-economic Development Plans.

The Ministry of Natural Resources and Environment (MONRE) is responsible for national-level marine spatial planning (in conjunction with the Ministry of Planning and based on the 2018 Planning Law) and environment protection. Under MONRE, the Vietnam Administration of Seas and Islands (VASI) is the state unit responsible for the management of seas and islands, including coasts. VASI has been assigned the responsibility for developing the National Marine Spatial Planning (together with the Ministry of Planning and Investment) and the Master Plan on sustainable exploitation and use of coastal resources in the 2021 - 2030 period, with a vision looking to 2045 (to be harmonized with the Planning Law). In cooperation with MARD, MONRE oversees environmental protection, management of land and marine aquaculture sites, marine spatial planning, and guidance for allocation of sea areas for mariculture. MONRE sets and enforces conservation, biodiversity, climate change, remote sensing, and environmental regulations related to seaweed aquaculture. It also issues policies on water resource management, sea use planning, permits of sea use rights, and marine spatial planning. At the provincial level is the Department of Natural Resources and Environment (DONRE). Ministry of Finance (MoF) imposes fees/charges according to relevant regulations on fisheries and aquaculture. In addition, MoF cooperates with MARD in managing the transport of fishery products through ports and the logistical services at ports under the Agreement on Port State Measures.

Ministry of Public Security (MPS) cooperates with MARD in the management of fisheries. Viet Nam Marine Police (Coast Guard) provides surveillance, enforcement, protection (such as security to fish cages and pens, fish farms including seaweed farms) and assistance to fishers and aquaculture farmers, as necessary.

Ministry of Planning and Investment (MPI) screens and approves investments in all economic sectors. It provides the plan and budget for sector development projects and programmes. MPI - through the 2017 Law on Planning (effective on the 1st of January, 2019) - also provides the legal foundation for integrated multi-sectoral planning, including marine spatial planning. The national planning system for the period 2021-2030 will replace previous master plans with (i) the national level master plan, (ii) inter- provincial master plans, and (iii) provincial master plans. MONRE is responsible for coordinating with MARD, MOIT, MOC and other related ministries to develop the national level overall master plan and submit to the Government for approval.

Ministry of Science and Technology (MOST) is engaged in appraising and setting of technical standards of breeds, farming technology and product quality. MOST sets the national program for aquaculture innovation and technology development. Ministry of Industry and Trade (MoIT) has policy and regulatory mandates over seaweed processing and trade, market surveillance, export development and food safety of seaweed products during processing, storage, and distribution. The Ministry also resolves trade barriers for seaweed products and is in charge of the development of offshore wind power generation projects, which may accommodate the integration of offshore seaweed farming.

Ministry of Health (MoH) is the main line agency responsible for hygiene, food safety, and health of

consumers related to seaweed or seaweed-based products.

In addition to the state management bodies, there are agencies and organizations such as research institutes and commodity associations playing a supporting role in seaweed management and development such as Research Institutes for Aquaculture I, II and III, Research Institute for Marine Fisheries (RIMF), Viet Nam Institution of Fisheries Economics and Planning (VIFEP), Universities and Colleges (Nha Trang University, Hanoi Agriculture University); Viet Nam Fisheries Association (VINAFIS); Viet Nam Association of Seafood Exporters and Producers (VASEP); National Agriculture Extension Center (NAEC).

The Research Institutes, Nha Trang Fisheries University and others have fisheries and aquaculture curricula and biotechnology laboratories. The Vietnamese Association of Seafood Exporters and Producers (VASEP) has a wide membership of enterprises engaged in producing, processing, and trading of fisheries products (however, it does not as yet include seaweed in its portfolio because of the relatively small production and export volumes compared to Pangasius and shrimp). It coordinates and links the members' operations to improve value, quality and competitive capacity of Vietnamese seafood, enhances sources of materials for seafood export, and represents the legal interests of members.

While the current aquaculture cooperatives are mostly organized around shrimp, Viet Nam Seaculture Association (VSA) is a recently formed organized national body whose mandate has direct relevance to marine aquaculture including seaweed. VSA is a non-governmental organization currently with 208 institutional and business enterprise members, including universities, R&D institutions, and organizations and individuals engaged in various types of activities in the value chains (seed production, farming, preserving, processing, transporting and marketing) of marine species, including seaweed. The aim of VSA is to integrate efforts of members, enhance linkages, build partnerships among stakeholders for developing a modern and sustainable sea culture industry, creating products of high economic value, and developing the marine economy. VSA is advocating Integrated Multi-trophic Aquaculture (IMTA) with seaweed and integrating industrial scale seaweed farming with the offshore wind farms.

1.5 Baseline Scenario

In addition, the project will build on a number of planned and ongoing seaweed interventions at the global, regional, and national level, each of which is pivotal in advancing the overall objective and the components, outcomes and outputs of this project: There is a range of initiatives of various entities on which the project can build on, contribute to, or draw support from. Collectively they cover the entire value chain of seaweed. Some focus on the governance requirements – mandatory, market-based and voluntary -- for an industry that is expected to expand rapidly, some on innovations and good practices in seaweed farming, others on the development of new and higher value product forms, the new technologies to produce them and investments into these new technologies. A number of specific initiatives include selection of sites within a specified mariculture zone, development of management plans for the selected sites, genetic improvement for quality planting materials, biosecurity, better farm practices, standards for environmental, food and operational safety, certification for responsible farming as well as management of wild seaweed resources.

GLOBAL AND REGIONAL BASELINE

At a regional and transboundary level, the project will build on the South China Sea Large Marine Ecosystem Strategic Action Plan and the Sulu Celebes Large Marine Ecosystem Action Plan (section 1.6).

The South China Sea SAP includes strategic priority actions and targets for seagrasses, mangroves, and coral reefs, and identifies nutrient loads as a threat to both coral reefs and seagrass beds. The Sulu Celebes Large Marine Ecosystem Action Program's objective is to build the Sulu-Sulawesi into a marine ecoregion that is ecologically healthy and delivers ecosystem services that provide equitable socio-economic and cultural benefits by 2025. Specific actions that the project will build on or contribute to include integrated coastal management plans, and actions to address transboundary problems, including climate change and marine pollution.

The project will also build on the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA) Implementation Plan 2018-2022, which includes both large marine ecosystems. Specifically, the project will build on the following priority management programs included in the Implementation Plan:

- Biodiversity Conservation and Management: Management plans/zoning schemes developed, adopted, and implemented; pilot sites for blue carbon projects
- Climate Change and Disaster Risk Reduction and Management: Mainstreaming climate change adaptation and disaster risk reduction and management into programs at the national and local levels
- Pollution Reduction and Waste Management: Reduce marine pollution loadings, including plastics and nutrient pollution

The project will also build on the Implementation Plan's governance program, which includes an emphasis on regional knowledge management and capacity building, as well as investments in blue economy projects through the Ocean Investment Platform.

Standards and Platforms for Seaweed Production

There are several standards/principles that are available for seaweed production. The Aquaculture Stewardship Council (ASC) and Marine Stewardship Council (MSC) have created 5 guiding principles for sustainable seaweed production: (1) protection of wild populations from over-exploitation., (2) harvesting and farming activities that allow for the maintenance of the structure, productivity, function, and diversity of the existing ecosystem, (3) effective management such that the system in place respects local, national, and international laws, (4) social responsibility, and (5) community relations and interaction.

The Safe Seaweed Coalition has developed standards to guide consumer safety, environmental safety, and operational safety. The Safe Seaweed Coalition has more than 600 members across the seaweed value chain. Their Seaweed Manifesto, launched in June 2020, outlines a vision for scaling seaweed that also delivers on the sustainable development goals.

Finally, SEAFDEC's mandate covers seaweed aquaculture, and provides an intergovernmental platform for guiding seaweed aquaculture in the region. At a regional level, SEAFDEC supports communication across its members. Seaweed is among the commodities in which research on seed production, refinement of culture techniques, socio-economics, and climate change adaptation is being conducted at SEAFDEC's Aquaculture Department (AQD) under various Thematic Programs (5-year term and renewed thereafter). There is a Seaweed Biotechnology Unit at AQD's Laboratory for Advanced Aquaculture Technologies.

National standards for seaweed also exist (see Philippines' baseline).

Global Investments in production, processing, and biorefinery solutions for seaweed

There are many global investments in seaweed production, processing, and biorefinery solutions. World Wildlife Fund (WWF) has made several investments in seaweed. With the support of the Jeremy and Hannelore Grantham Environmental Trust, WWF-US made a \$850,000 impact investment in Ocean Rainforest, a seaweed farming operation in the Faroe Islands, to “accelerate and scale growth of global offshore seaweed production....” The investment also aims to improve yields and advance the market potential for seaweed as livestock feed. WWF made a second impact investment in Oceanium, a company looking to operate globally that is developing novel technology to refine seaweed for packaging and other high-value extracts. In addition, WWF has received a grant from the Bezos Earth Fund for advancing seaweed value chains (2020-2023). While the investments are largely for North America and Europe, the technologies and products developed can provide important baseline (technological and social application) for this Project. Relevant investments under this project (contributing to the project, and undertaken through a range of partners) include: quantifying ecosystem services of seaweeds; developing whale-safe composite lines for kelp cultivation (University of New Hampshire; this technology may be applied to the project as, in Philippines, it has been noted that dugongs sometimes get entangled in seaweed lines); communication products on the benefits of seaweed aquaculture (which helps to raise awareness on the sector as a whole), best practices around social license to operate farms, and development of seaweed strains that are high yielding, tolerant to higher temperatures, and resistant to diseases.

Companies are exploring biorefinery technologies for seaweed. Brabender GMBH & Co. KG. is developing technology to make pellets out of seaweed biomass for manufacture into biofilms for, among other uses, bioplastic packaging, in collaboration with the University of the Philippines Marine Science Institute, and a private enterprise. The technology will be ready for pilot testing in a years’ time or sooner. Brabender will undertake a pilot test, a study of the product’s global value chain and development of seaweed-based bioplastic downcycling as fertilizer to increase the raw material valorization.

FAO and World Bank have been developing business planning models for seaweed aquaculture in Sri Lanka and the Caribbean that could be adapted to a wide range of systems. This could provide a useful template for the business models to be developed under the project.

- i. The World Bank and PROBLUE have been developing market and case studies for seaweed expansion and novel products that would increase seaweed demand.
- ii. The US Department of Energy’s ‘Advanced Research Projects Agency - Energy’ (ARPA-E) has invested \$40 million into seaweed aquaculture research as potential biofuels. It has also developed site selection software that supports proper investment locations for optimizing seaweed growth. ARPA-E has also devised seaweed cultivation and harvest equipment methods. Several demo projects are ongoing in collaboration with private sector entities.

Carbon Credits

Oceans 2050 is currently undertaking an analysis of the carbon capture potential for various seaweed strains. The global effort (although not including Viet Nam and Philippines) seeks to quantify seaweed carbon sequestration and provide evidence and methodology to validate and monetize the carbon sequestration impact of ocean farming. The intent is to use this as a basis for a carbon credit market. Based on the results of the study and development of the carbon credit model, the project will assess opportunities to build on the results (linking to carbon credits). Other than Oceans 2050, the Task Force on Scaling Voluntary Carbon Markets (TFSVCM) is a private sector initiative that aims to develop a carbon market. The task force could link carbon credit “sellers” to buyers.

VIET NAM BASELINE PLANS AND ACTIVITIES

Policies and Planning

Viet Nam has a growing seaweed industry.

In 2021, the Government approved the 'Strategy for Development of Viet Nam's Fisheries by 2030 with Vision Towards 2045' (Decision No. 1664/QĐ-TTg dated 04/10/2021). Under MARD, the general objective is to develop marine aquaculture into a large-scale, industrial, synchronous, safe, efficient, sustainable commodity industry, and protect the environment; create branded products for domestic and export markets; create jobs, improve socio-economic conditions, and raise incomes of coastal communities. Seaweed has been prioritized as a key commodity under the Strategy. The strategy includes the following targets: for nearshore seaweed aquaculture, 170,000 tons by 2025 and 400,000 tons by 2030; for offshore seaweed aquaculture, 10,000 tons by 2025 and 100,000 tons by 2030. The government will assess seaweed growing areas nationwide to support these targets. This strategy is a key government priority that the project will support.

The Directorate of Fisheries is undertaking three projects to achieve this Strategy: (1) development of seaweed production for export up to 2030; (2) developing technologies for seedling production and cultivation of a number of economic-valued seaweeds; and (3) environmental monitoring, fishery extension, and trade promotion. The government is also setting up projects on seed production infrastructure (2021-2030), including for seaweed in Khanh Hoa, Ninh Thuan, and Binh Thuan provinces.

The Ministry of Natural Resources and Environment – through the Viet Nam Administration of Seas and Islands (VASI) - and the Ministry of Planning and Investment (MPI) are leading a Marine Spatial Planning (MSP) process, originally planned to be implemented in 2021-2022, based on a new Planning Law instituted in 2019. Whilst experiencing Covid-related delays, the MSP is expected to provide for more detailed and integrated multisector planning, and includes the coastal waters up to six nautical miles from the coast. A national marine plan for the sustainable exploitation and use of coastal resources, developed by MONRE will be streamlined with the national MSP process in accordance with relevant provisions in the Planning Law. Accordingly, provincial-level coastal planning – developed and approved by the relevant Provincial Peoples Committee in consultation with sectors - is expected to be guided by the national MSP.

The Integrated Coastal Zone Management Strategy has been implemented with the Program on Environmental Management for the Seas of East Asia (PEMSEA). It was started in 2000 and supports over 10 provincial programs on integrated coastal marine resource management.¹³ However, on-the-ground results of ICZM planning have been limited at best, and coastal decision-making remains largely sector-based. There is an urgent need for provincial-level coastal planning to be more robust, integrated, and focused on aligning growth in coastal areas with climate change risk mitigation strategies. Accordingly, it is expected that the new MSP/National Marine Planning under VASI/MPI will supersede previous ICZM strategic planning.

Provincial level

¹³ World Bank (2019). *Situation Assessment of Integrated Coastal Zone Management (ICZM) in Viet Nam*. Hanoi: World Bank

Ninh Thuan province pioneered the commercial cultivation of seaweed in Viet Nam, introducing *Kappaphycus alvarezii* in the 1990s. During the period 2011-2015, *Kappaphycus* expanded rapidly, exceeding 200 ha of off-the-coast farming and producing approximately 3,500 tons per year, providing a significant source of livelihood for poor communities. However, production in 2020 – impacted by sub-optimal market conditions, poor weather, predation and competition from tourism – dropped to only around 500 tons. Government and private sector in Ninh Thuan hope to mainstream more stable and steadily expanded seaweed cultivation. In the draft provincial plan, two off-the-coast zones have been earmarked for mariculture, including “Zone C” (1,260 ha) for lobster, marine fish and seaweed, and “Zone D” with 100 ha allocated for *Kappaphycus* farming. This provincial plan is expected to be approved in 2022. In Phuoc Dinh commune – the main ward engaged in seaweed farming in Zone D – there are 107 households farming seaweed during peak season, with a total production of around 30 tonnes of fresh seaweed. Together with adverse weather and rising water temperature, market fluctuations remain a major challenge (with prices between 3,000 – 6,000 VND/ kg fresh biomass.). Current production cost is 50 – 60 million VND per ha, including material for farming, seedling (50% of input costs) and hired labor. Gross revenue is around 125 mil – 150 million VND (i.e if the market price is 5,000 VND/kg of fresh biomass), representing an average annual profit of around 50 – 70 million VND/ha/year (approximately \$3060 USD/ha/year).

Adjacent to Ninh Thuan, Khanh Hoa has favorable conditions for seaweed farming, including *Kappaphycus* and *Caulerpa*. In 2020, there were 47.4 ha of seaweed farming area with a production of around 414 tons. *Caulerpa* farming is concentrated in Ninh Hai commune, Ninh Hoa town. According to provincial planning for the 2020-2025 period, only 80 ha are planned for seaweed farming – an unambitious target largely emanating from current challenges with supply chains and price fluctuations, as well as competition from tourism and other coastal development. However, provincial authorities support the expansion of seaweed supply chains in the province, especially for *Caulerpa* due to that species’ relatively high yield (20 tons/ha/year), higher market value and current domestic and global market trends.

Private Sector

There are several private seaweed companies that the project could engage for activities along the value chain. Hoa Trinh company, located in Ninh Thuan province, buys fresh and dried *Kappaphycus* from farmers for pre-processing. The company provides microfinance to local farmers who then sell their harvest to the company. Son Hai Carrageenan JSC, located in Ninh Thuan province, is a small processing company that extracts carrageenan from *Kappaphycus*. The company buys dried *Kappaphycus* from Hoa Trinh and other agents. Long Hai Co., Ltd, located in Hai Duong province (an industrialized province in the Hanoi Capital Region) is the nation’s biggest seaweed processing company, specializing in processing and trading of carrageenan and value-added products such as jellies and juices. VINABS, located at Vạn Lương commune, Vạn Ninh district, Khánh Hoà province, works on *Kappaphycus* seedling production and distribution in a number of provinces. Super Truong Phat Plastic Joint Stock Company, located in Ha Noi, is an input supplier company. It has projects in open sea aquaculture including seaweed farming in Ninh Thuan and Khanh Hoa, Vung Tau provinces.

There are around 20 SMEs working on fresh and processed seagrape product in the project area. Tri Tin (Khanh Hoa) and Hai Nam Okinawa (Binh Thuan) export products to Japan, USA and EU. They process raw materials produced in their own farm and sourced from surrounding farms. Sabudo Sea Grapes (Khanh Hoa) produces seagrapes under their “King Umibudo” brand, using seed sourced from Japan. GCAP Viet Nam Ltd (Khanh Hoa) specializes in farming, processing and trading in fresh and powdered seagrapes.

Tri Tin has started to establish a supply link with farmers but the scale is still limited. They will implement three pilot models of seagrape culture in collaboration with the Project:

- i. A model of seagrape cultivation in earth ponds
- ii. A model of seagrape cultivation in earth ponds integrated with sea cucumber
- iii. A model of seagrape cultivation in the open sea, in nearshore leases near earth pond operations

Research and development

There are several research and academic institutions in Viet Nam that provide the scientific and technology support to the industry's development.

The Nha Trang Institute of Technology Research and Application (NITRA) – under the Viet Nam Academy of Science and Technology (VAST) - conducts scientific and technology-based research related to seaweed aquaculture and its application to the production process. Seaweed-related studies and applications are focused on a range of research areas, from investigation of bioactive ingredients and pilot-scale fucoidan production, to modelling floating cage seaweed cultivation and studying the potential for new macroalgae products (e.g. probiotic fermented beverages). NITRA has also recently conducted studies on floating cage seaweed cultivation in the open sea. NITRA will be engaged in the project in piloting the application of innovative farming materials and value-adding processing methods, assessment of seedling selection and operation of seedling nurseries.

The Research Institutes of Aquaculture (there are three) are state research facilities assigned by the MARD to conduct research on national aquaculture development. RIA's research – both pure and applied - has focused on aquatic seed production, improvements in aquaculture technology, and improvements in the preservation of aquatic products. RIA3 (in Khanh Hoa province) - and its affiliate branches (Centre for Monitoring of Aquaculture Environment and Diseases; National Marine Seed Production Centre) - have conducted various experiments on seaweed within their wet lab facilities, most recently investigating seaweed disease and treatment methods, with a focus on Ice-Ice, epiphytes diseases on *Kappaphycus alvarezii*, and parasitic disease on Sea grapes (*Caulepa lentillifera*), working with samples collected from farms located in Ninh Hoa (one of the project pilot sites). RIA3 has also been researching integrated farming of seaweed with fish and other species, such as shrimp, snails, green mussels and sea cucumber, as well as other basic research on *Kappaphycus alvarezii* production in marine cage culture and the use of seaweeds as bio-filter in shrimp culture. RIA3 will collaborate with the project in assessment of technical and economic performance of pilot farms, and technical advice on seedling selection and nursery operation.

The Research Institute of Marine Fisheries (RIMF) is a leading research organization under MARD, carrying out scientific research, technology transfer and advisory services in marine conservation, fishing technology and marine products processing. RIMF will be a key research partner in the project, including engagement in the Expert Working Group and technical inputs into national seaweed planning.

Nha Trang Fisheries University (NTFU) is engaged in varied research on seaweed cultivation and development, often closely affiliated with NITRA and other organizations. It is anticipated that NTFU will engage with the project in sourcing of planting material, training, application of results into academic curricula, and establishment and operation of the seedling nursery. Also located in Nha Trang, the Institute of Oceanography (NIO) is a public research institute with extensive expertise and datasets vital to long-term planning and development of seaweed aquaculture. NIO may potentially engage in the project's

technical working group, conduct of baseline studies and provision of technical inputs in the formulation of the national seaweed plan.

PHILIPPINES BASELINE PLANS AND ACTIVITIES

The Philippines has a well-developed and active seaweed industry, providing a strong baseline for the Project to build on.

Policies and Planning

The Philippines has several plans that guide the seaweed industry:

- i. BFAR's Seaweed Industry Roadmap (2016-2022; updated for 2022-2026) has guided seaweed production in the Philippines over the past five years, and is structured around three key components: (1) improved production; (2) organized seaweed farmers; and (3) promotion/commercialization of seaweed products. It has been updated for the period 2022-2026 and is awaiting approval by the Department of Agriculture. Strategies and interventions include, among others, the expansion of seaweed farming in traditional areas, introduction of seaweed farming in non-traditional areas, adoption of technologies to increase productivity, improvement of post-harvest technologies, and research and development to address the identified problems in production technology, processing and value adding and marketing.
- ii. The Carrageenan Industry Roadmap. Developed by Department of Trade and Industry and the private industry sector, the roadmap for this subsector sets a production and marketing strategy to be realized through action programs. The programs have an implementation guideline and a monitoring mechanism.
- iii. In addition to national-level plans, BFAR has updated the Philippine National Standards (PNS) on good aquaculture practices and raw dried seaweed; there is now a final revised draft (PNS/BAFS 85 2021). It covers practices that aim to prevent or minimize the risk associated with aquaculture production in any culture environment. It covers food safety and quality, environmental integrity and socio-economic welfare. The ultimate aim is to gain greater confidence in consumers' expectations that the Philippine Seaweed products are safe, sound and fit for human consumption. The PNS for Dried Raw Seaweed aims to provide common understanding on the scope of the standard, quality requirements, classification according to quality, tolerances, contaminants, hygiene, packaging, marketing or labeling, sampling, and definition of defectives. It prescribes quality specifications and safety requirements of dried raw seaweed of the class Rhodophyceae (red seaweed) such as but not limited to Kappaphycus spp. and Eucheuma spp.

Seaweed production and processing

There are numerous initiatives taking place in Philippines to advance seaweed production and processing. A number of institutions provide training, manuals, and extension services to support seaweed farmers and seaweed cooperatives/associations in the Philippines:

- i. A National Seaweed Program, led by BFAR, supports implementation of the Seaweed Industry Roadmap. Activities under this program include developing a nationwide network of seaweed farmer/fisherfolk cooperatives. Through this network, BFAR is providing trainings on cooperative management and seaweed production and marketing to seaweed farmers. To date, more than 40 seaweed cooperatives have been officially established and now operational.
- ii. Training for seaweed farmers is also promoted as part of the Technical Education and Skills Development Act (TESDA) of 1994, in which seaweed training regulations are provided. ESDA

Seaweed Production NC II provides competency standards and training for seaweed farmers “to operate and maintain seaweed nursery, grow-out seaweed, produce raw dried seaweed and market seaweed.

- iii. The University of San Carlos has developed seaweed manuals translated into 10 dialects. These are available to BFAR, SIAP and NGOs working with farmers.
- iv. The Bureau of Agriculture and Fisheries Standards (BAFS) will continue to host seminars and trainings on the seaweed standards mentioned above. BAFS also collects data on industry practices that include use of fertilizers and chemicals, plastic materials, as well as workplace conditions.

The Philippine Rural Development Project (\$1,102.17 million; 2014-2025) was recently extended (with additional financing) and represents another important baseline initiative; it is led by the Department of Agriculture and is jointly funded by the World Bank, National Government and Local Government Units. The project “aims to increase rural incomes and enhance farm and fishery productivity in targeted areas by supporting smallholders and fishers to increase their marketable surpluses and their access to markets.”¹⁴ The project includes several sub-components focused on seaweed. A National Value Chain Analysis for Seaweeds has been undertaken as part of the project. As of May 2021, value chain analyses of seaweeds in three regions (Regions 4b, 8 and ARMM) has been carried out. And 47 mostly small scale enterprise projects on seaweed were approved for a total funding of almost PHP 190 million (USD 4 million), with 17 still underway.

Coast4C is a social enterprise launched by the Zoological Society of London (ZSL) in 2020 to drive ocean and climate restoration through inclusive value chains for regenerative seaweed and end-of-life fishing nets. Coast4C supports several ongoing projects with seaweed communities in the Philippines. These projects include: community-based activities aimed at building social infrastructure, financial inclusion, spatial planning and integrating into marine protected areas; building community-level infrastructure (e.g. guardhouses, solar drying facilities, enforcement facilities); and facilitating and supporting marine protected areas. They conduct capacity building activities such as training, provide financial support or facilitate access to financial services (e.g., credit, insurance, etc.) to farmers, and promote product development. Their program seeks to eliminate negative environmental and social impacts of seaweed farming and ensure that it is regenerative and supports community development.

Finally, SEAFDEC Aquaculture Department (AQD) conducts ongoing studies on the development of superior and disease resistant planting materials as well as training of extension workers and seaweed entrepreneurs.

Provincial level

Palawan is one of the top seaweed producing provinces of the Philippines, contributing 24% of the country’s production. Its coastline is 2000 km long. Of its 23 municipalities, 20 are seaweed producers. One of these is Roxas which has administrative authority over one of the two project sites: Green Island. Seaweed farming was introduced to this island in 1978 by a private company, Marine Colloids. Green Island has a zoning map developed by the Palawan Council for Sustainable Development, which guides marine resources use in the seascape. Areas off Green Island have been mapped and designated for seaweed farms. A fishers cooperative is active in the area. The Northern Palawan Fishers Cooperative has a membership of more than 130, almost all of them seaweed farmers. The Palawan State University has

¹⁴ <https://projects.worldbank.org/en/projects-operations/project-detail/P132317>

an ongoing two-year (2021 – 2022) project on seed improvement (as well as capacity building of the local farmers' association they are working with) on Green Island; the University's experimental seed farm, which shall be turned over to the association and continue producing planting materials, can be the source of seedlings for the project demonstration farm. The demonstration farm could serve as a further test bed for the performance of the strains in a more dynamic deep-water environment. Also on Green Island, the municipal government will continue to provide farmers with materials for improving their livelihoods and has acknowledged the importance of improving seaweed farming and value adding.

Zamboanga Peninsula is the third top seaweed producing region in the country, contributing 13.8% (or 202,606.31 MT) of fresh seaweed in 2020. Total area planted was 11,728 hectares with an additional 17,120 hectares for expansion. The Peninsula has 26,850 seaweed farmers, 126 seaweed farmer associations and cooperatives, 147 traders and 3 seaweed processing plants. Zamboanga provides important baseline for the project, especially for offshore seaweed farming. Currently, 20 units of climate-resilient deep-sea seaweed farms are being piloted in the Zamboanga Peninsula by DA-BFAR Regional Office IX. The seaweed lines are made of polyethylene (PE) ropes with a dimension of 100m x 25m for a total area of 2,500 sq.m. (1/4 hectare).

Research and Development

The Department of Science and Technology (DOST) has various projects on seaweed to support research and development initiatives for seaweed value chains. The following is underway:

- i. Carrageenan as fertilizer: after successful field trials of a carrageenan fertilizer additive, DOST will partner with the Agriculture department to promote its use. Field trials showed that carrageenan, when added to fertilizer, can increase rice yield, resistance to diseases, among others
- ii. Establishment of a Seaweed R&D Center in Tawi-Tawi. The past 10 years saw declines in the income of farming communities because of issues on quality, storage, processing and trading. The Seaweed R&D Center supports farmers, traders and processors with the opportunity to use high-quality seaweed stocks, guaranteeing a 35-percent increase in monthly income.

Processing technology, for example for noodle production, is being developed or improved at the National Seaweeds Technology Development Center (NSTDC).

1.6 Coordination with other relevant GEF & non-GEF Initiatives

The project will coordinate with GEF and non-GEF projects being implemented in Philippines and Viet Nam focused on coastal and marine resource management. The project will build on key baseline projects and initiatives (see section on baseline) and coordinate with key stakeholders and partners (see stakeholder section) to: i) benefit from lessons learned; and ii) effectively leverage relevant activities to maximize efficiency and impact.

In particular, the project will coordinate with and ensure integration with the following investments by GEF and large multilateral organizations:

- i. Implementing the Strategic Action Program for the South China Sea and Gulf of Thailand (UNEP; 2017-2023; GEF financing: \$15 million). UNOPS and SEAFDEC are executing this project in China, Cambodia, Indonesia, Philippines, Thailand, Viet Nam. Its objective is "to assist countries in meeting the targets of the approved Strategic Action Programme (SAP) for the marine and coastal environment of the South China Sea (SCS) through implementation of the National Action Plans

in support of the SAP, and strengthening regional co-ordination for SCS SAP implementation.” The Inter-Ministry Committee (IMC) includes representatives from each of the countries. The project aligns well with the South China Sea SAP, which clearly identifies unsustainable aquaculture as a key threat to the SCS region (for example, on mangroves and seagrass, as well as coastal pollution).

- ii. Build on action plans of the Sulu–Sulawesi Marine Ecoregion, which includes the Philippines, Indonesia, and Malaysia. Outscaling the results of the project to this ecoregion would contribute to the marine biodiversity objectives of the SSME Conservation Plan.
- iii. Towards Sustainable and Conversion-Free Aquaculture in Indonesian Seas Large Marine Ecosystem (ISLME) (ADB; GEF ID: 10867; GEF financing: \$4,449,542). This has two sub-projects: Shrimp in Indonesia and Seaweed in Timor Leste. The seaweed project is focused on “increasing Post-harvest Capabilities to Enhance Seaweed Aquaculture Livelihoods in Timor-Leste.” One of its proposed outcomes is “Seaweed aquaculture and capture of nutrients from the ocean expanded” which will be achieved by, “quantification of ecosystem services through methodologies developed by the GEF 7 Blue Horizon project and adopted in Timor-Leste to facilitate new approaches to quantifying and compensating for ecosystem services.” The proposed project also expects to apply the lessons from the Policy and Regulatory gap framework analysis undertaken by the Blue Horizon Project to generate policy recommendations including zoning, mooring, prevention of marine mammal entanglements, carrying capacity, etc. Thirdly, the Timor Leste project will engage the GEF 7 Blue Horizon project to assist in international market engagement by cooperating with the private sector engaged in the Blue Horizon project. It also intends to seek engagement in the Safe Seaweed Coalition. The Blue Horizon Project can strengthen the post-harvest and marketing aspects through a cross-learning arrangement.

The Timor Leste project is advocating a market-oriented strategy with these guidelines: seaweed as a solution is only as good as the markets that the farmers can access; enhance farm value to maintain farmers in the supply chain; if livelihoods are not successful, the ecosystem services of seaweed aquaculture are lost. It seeks to identify ways to amplify ecosystem services of seaweed aquaculture by generating better marketing conditions. Among these are (i) Improved post-harvest handling facilitated by a center of excellence for post-harvest handling of seaweed and then developing and demonstrating, in remote settings, solar-powered post harvest solutions such as portable dehydrators, mini cool-cold storage facilities, and first stage extractors; (ii) Development of farmer associations and empowering existing cooperatives to equip them with the knowledge and technologies to not be beholden to traders and middlemen for information; (iii) Better connectivity with international markets; (iv) Understanding the marketing aspects of the ecosystem services of seaweed and how to quantify these for better market penetration.

- iv. Coral Reef Rescue (CRR) (WWF; GEF ID: 10575; GEF financing: \$7,000,000). This GEF project contributes to the Global Coral Reef Rescue Initiative (CRRI), a global multistakeholder partnership aimed at protecting the health of coral reef ecosystems in the face of climate threats. CRRI focuses on coral reefs identified through a global analysis as having substantially lower exposure to climate change stress due to local oceanographic conditions such as currents and upwelling. Areas prioritized for site-based action under the proposed CRR GEF Project include 8 municipalities in Palawan. These are near the Blue Horizon Project site on Green Island in Roxas town. The Project’s activities on marine spatial planning in Roxas could contribute to the CRR project by incorporating

coral reef considerations and ensuring that seaweeds are placed in an ecologically friendly way (e.g. not intruding on coral reefs).

The Project will also coordinate with or seek cooperation with these entities:

- i. The Nature Conservancy. TNC has been working in communities in Indonesia and Belize on seaweed aquaculture as an alternative livelihood to fishing, focusing on reducing environmental impacts, improving production, and creating sustainable livelihoods for farmers. They have produced a guide for seaweed farmers, seaweed purchasers and conservation organizations. The Indonesia Guide “Coastal Conservation and Sustainable Livelihoods through Seaweed Aquaculture in Indonesia”¹⁵ provides information on how seaweed buyers can increase the sustainability of their supply chains, how conservation organizations can work within seaweed aquaculture for environmental and social gains, and how farmers can improve their environmental and production practices.

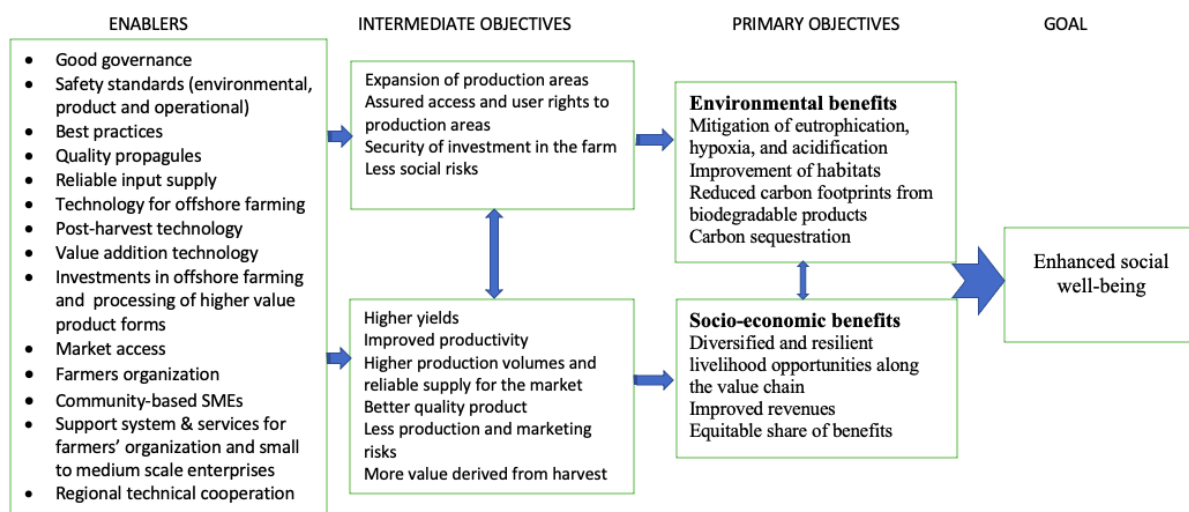
¹⁵ https://www.nature.org/content/dam/tnc/nature/en/documents/Indonesia_Seaweed_Guide_FINAL.pdf

2.1 Project Objective and Theory of Change

The objective of the project is “to create new sustainable seaweed value chains that will deliver ecosystem services and provide socioeconomic benefits.” The Diagram below provides a succinct representation of the linkages and components of three major elements – enablers, intermediate objectives and basic objectives.

The result of the Project is enhanced well-being from the environmental, economic, and social benefits generated by the Project. Environmental benefits come from the enhanced ecosystems services provided by the seaweed farms, that include mitigation of acidification of the sea, oxygenation of coastal waters, mitigation of eutrophication of marine waters, mitigation of harmful algal blooms and improvement in the conditions for aquatic biodiversity.

Figure 2 Diagram illustrating Expected Benefits



Economic co-benefits accrue from enhanced and diversified livelihood opportunities, which will improve incomes through the production of more and better-quality biomass, production and sale of traditional product forms, participation in the production and sale of higher value products, and should it prove feasible, the prospect of additional income from carbon credits. Some higher value products based on seaweed would also impart environmental benefits. Bioplastics, for instance.

Social co-benefits are in the form of a secure livelihood, more employment generated by the production of and trade in traditional and new consumer products, improved food security. There are also the multiplier effects of higher income from a seaweed enterprise: farmers can use the increased revenues to invest in micro- or other small-scale enterprises (such as a small convenience store). A higher and stable family income enables better access to health care and support to children’s education. An intrinsic social benefit is the enhanced self- and collective esteem from being a participant in the development of a progressive, self-reliant community.

The result for the seaweed farming communities and actors in the value chain is secure and sustainable livelihoods and enhanced livelihood assets. And a sustained as well as expanded seaweed farming enhances the ecosystems services of seaweed aquaculture.

To achieve this status a mix of interrelated policy, science and technology, market support as well as self-management (voluntary) mechanisms are needed that will create or facilitate the conditions and provide the means for:

- Large scale sustainable production - availability and access to suitable areas for large scale nearshore and offshore farming, better farming technology and practices, availability of high yielding and robust and healthy propagules, biosecurity measures to maintain health of plants and mitigate grazing.
- Post-harvest processing – drying facilities that improve quality of raw dried seaweed, technology for on-site extraction of colloids from fresh harvest, and technology for utilization of biomass after colloid is extracted.
- Community-based production of consumer products -- technology is available for production of consumer products, trained personnel for production, establishment of community-based enterprise for production and trading of the consumer products, organization of cooperative or association to manage and operate the enterprise, product quality standards, and market access for the products.
- Commercial scale production of higher value products -- a pilot production plant is established and product quality and processing standards designed.

The supportive actions to create the conditions and provide the means are:

- For production: marine spatial planning, zoning and designation farming areas and development of area management plans. Training in better farming practices and risk management; seed improvement, multiplication, and distribution program.
- For postharvest processing, durable and efficient drying structures, community-based small to medium scale production of consumer products, an on-site or at least community-based biorefinery (e.g. multi-stream zero emission) technology to extract colloids from fresh harvest and use almost 100 percent of the plant, and high-value products manufacture; technology, enterprise development and management, policy support, business models for financing, and incentives for investments in bio-refinery and processing enterprises, value chain development

But these strategic actions and support mechanisms are constrained by numerous barriers:

- Sites are poorly identified, unsuitable because risks to farms are not clearly assessed, not clearly designated and potentially subject to future resource use conflicts, and therefore security of farmers' investments in the farm is not assured. Factors contributing to these barriers include lack of institutional capacity for marine spatial planning, zoning and area management, overlaps or gaps or unclear responsibilities over coastal areas by various government agencies as well as by communities, ill-defined or unclear access or rights to mariculture areas, and lack of clear licensing requirements or, on the other hand, complicated and excessively stringent requirements.
- Limited or no on-site post-harvest processing (i.e., zero-waste) technology, biorefinery solutions, and higher value product processing facilities.
- Lack of tested technology and limited expertise in large-scale deep-water offshore farming.
- Unreliable supply of viable, high yielding and disease tolerant planting materials.

- Power asymmetry in the value chain of raw dried seaweed; weak transaction capacity of primary producers; lack of value addition skills and facilities in seaweed farming communities.

To overcome these barriers, the Project will adopt these strategic actions:

- Participation in the global Safe Seaweed Coalition
- Provision of technical inputs in the updating of the National Seaweed Development Strategy and Action Plan (of the Philippines and Viet Nam).
- Development of a regional guide to outscale project results and promote the expansion of a sustainable seaweed aquaculture industry.
- Technical support to marine spatial planning and zoning, and the development of area management plan for zoned seaweed aquaculture sites.
- Technical inputs to national policy and decentralized regulations that aim to clarify farmers' access and user rights to seaweed farming areas and grant considerable control of seashore utilisation into the hands of the coastal communities.
- Facilitating the formation of Inter-ministerial coordination groups, and linkages with global, regional, and national seaweed organizations and industry associations.
- Sharing of technology and best practices in culture and post-harvest; sharing in the technology of producing and maintaining superior planting materials and training in culture technology and processing
- Providing technical assistance in better farming practices and risk management to existing shallow water seaweed farms, if any, in the project area.
- Establishing and operating pilot demonstration farms for off-the-coast or offshore seaweed culture.
- Assessing the feasibility of an identified bio-refinery technology, developing an investment model for a pilot plant based on the technology, and working with government, agricultural development banks, and private sector to encourage investments into a commercial scale bio-refinery facility or a higher-value product processing plant.
- Developing a Carbon credit model
- Promoting and providing technical inputs to the organization of cooperatives/associations of farmers and small-scale processors, and developing a support system for these farmer organizations that include better access to material, technical and financial inputs, and access to market.

In summary:

- *If* there is a guide to a regional seaweed development that SEAFDEC member states commit to, and
 - *If* a regional code of good practice is established that all SEAFDEC member states commit to,
- *Then*, the development of the seaweed industry of the region receives a strong impetus from a closer technical cooperation among the member countries; the Guide will be the framework for a cost-effective pooling of national R and D resources and sharing of results, lessons, and expertise. Under this technical cooperation framework, the members with an emerging seaweed sector and aspire to expand it will benefit from the experiences and expertise of the ones with a more advanced industry. The result of this technical cooperation, guided by an industry code of good practice, is a well-governed, orderly expansion of the developing national industries and a collective strengthening of the region's capacity to further expand, modernize and establish a strong influence in global seaweed value chains.

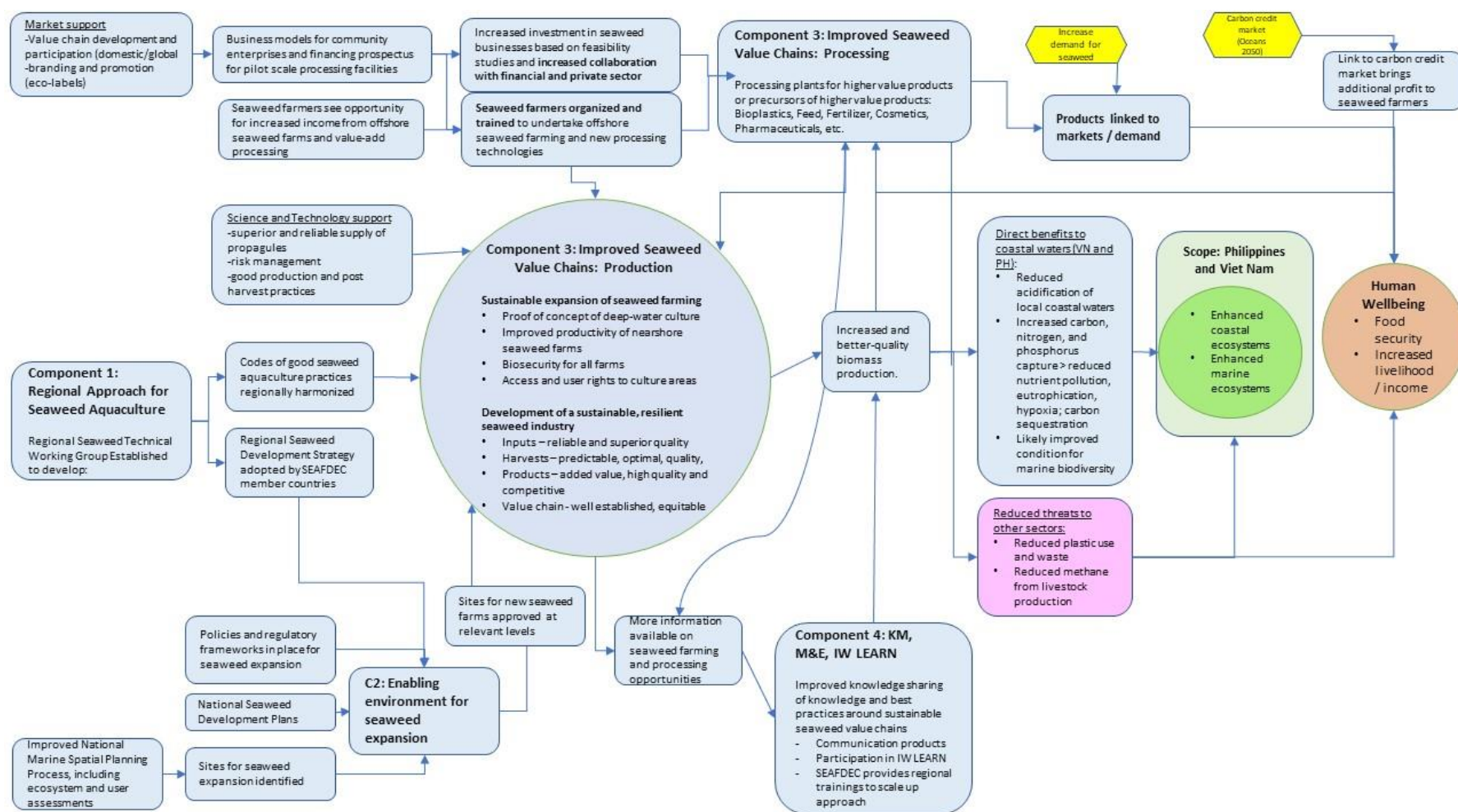
- *If* ecosystem and user assessments are done at a national and site level, then suitable areas for seaweed expansion can be identified, and;
 - *If* policies, regulations, and plans are in place to guide seaweed expansion and develop seaweed value chains in a sustainable way,
- **Then the enabling environment (regulatory, planning) will be in place** to support expanded areas for nearshore, off-the-coast, and offshore sustainable seaweed production (Component 2).
- *If* a reliable supply of quality propagules from technically equipped seaweed nurseries are available, *then* this would allow seaweed biomass quality to increase, and decrease vulnerability to disease and climate change, and;
 - *If* offshore seaweed farming technologies are successfully tested and piloted in different scenarios, *then* there would be proof of concept, which would expand the areas suitable for seaweed farming, and;
 - *If* seaweed farmers are trained in offshore seaweed farming, in culture technology and processing, and in biosecurity risk management, and are provided with superior planting materials, and *then* capacities are in place to facilitate better seaweed production, and;
 - *If* standards are in place for seaweed production and adhered to by farmers, then biomass quality can be ensured,
- **Then seaweed farming and production will be strengthened**, with robust and healthy propagules, increased yields, better quality biomass, and seaweeds less vulnerable to disease and climate change impacts.
- *If* post-harvest processing technology is assessed for on-site extraction of colloids, and technology for utilization of biomass after colloid is extracted, and
 - *If* community members are trained in this technology, and community-based enterprises are established or strengthened to trade these products (with a focus on empowering women), and;
 - *If* these products are linked to markets, and;
 - *If* business models are in place and facilitate investments in these bio-refinery and processing enterprises,
- **Then seaweed processing will yield higher-value products**, which increases seaweed farmer incomes and provides an incentive to expand seaweed production (which would lead to expanded environmental and socio-economic benefits).
- *If* technical feasibility and economic viability of value addition processing technologies (such as bio-refinery) are assessed, and
 - *If* investment models in new value adding technology (i.e. biorefinery) and manufacture of seaweed-based products are developed and shared with prospective investors via investment seminars and 1:1 engagement,
- **Then this would promote public and private investments** in the development of the seaweed industry.

Overall - *If* the above strategies take place, **then** barriers to scaling the seaweed value chain will be removed and seaweed farming will be scaled up. The result for the local coastal ecosystem is enhanced productivity from mitigation of acidification, eutrophication, and oxygen depletion. The result for the planet is the mitigation of hazards from climate change through CO² sequestration and carbon assimilation by seaweed and ocean waters. In addition, seaweed has the potential to yield environmental benefits in other sectors: biodegradable seaweed-based products (such as biofilms) could replace plastics and therefore reduce plastic

pollution. In addition, seaweed can be used in aquaculture feed and livestock feed (swine, cattle and poultry), and therefore provide a low-input and low-emission alternative to land-based plant production. There would be less carbon emission from the processing of more food and other consumer products and use of seaweed-based feed and fertilizer, and reduced plastic pollution from biodegradable seaweed-based products (such as bio-plastic packaging). In addition, improved business and marketing skills, and value-adding technologies for seaweed farming communities will increase income and contribute to diversified and secure community livelihoods in seaweed farming communities.

The Project Theory of Change is depicted below:

Figure 3 Theory of Change



2.2 Project Components, Outcomes, Outputs and Implementing Strategy

The project objective “to create new sustainable seaweed value chains that will deliver ecosystem services and provide socioeconomic benefits” will be achieved through the following four components:

Component 1: Regional approach and capacity for seaweed value chains in SE Asia. Build a supportive regional enabling environment for seaweed aquaculture, through a regional approach expected to support the region’s capacity to expand and modernize its seaweed industry and establish a strong influence on global seaweed value chains.

Component 2: Enabling Environment for Seaweed Aquaculture in Philippines and Viet Nam. Create an enabling environment for seaweed aquaculture at the national and local levels with a governance framework comprising policy, regulatory and technical guidelines.

Component 3: Seaweed Value Chains (production + processing + marketing). Operate, with organized producers - pilot farms in areas farther than current sites (i.e. off-the-coast or offshore) that will serve as proof of concept for seaweed production – thus expansion -- in these environments. Introduce value adding technology and organize and train community based small to medium scale enterprises (SMEs) in the production and marketing of the products. Then seek prospective financing of upscaled offshore farming models and value adding enterprises as well as for development support. (i.e. grants and loans) to national programs to expand and modernize the seaweed industry.

Component 4: Knowledge Management, M&E, and IW Learn (regional). Lessons learned and experiences from the project will be shared widely in regional and international forums. Project results will be widely disseminated through various media including a website created and dedicated to the Project. The activities will be monitored, evaluated and the lessons communicated to stakeholders.

The expected outcomes and outputs from each outcome will be achieved by the strategy below.

Component 1: Regional approach and capacity for seaweed value chains in SEAsia

Outcome 1.1 Regionally adopted plans and principles to harmonize seaweed aquaculture in SE Asia

The project will support regional plans, principles of responsible and safe seaweed aquaculture, and trainings to strengthen seaweed aquaculture in Southeast Asia. Component 1 will be implemented by SEAFDEC, an intergovernmental organization whose members include all ASEAN countries and Japan. SEAFDEC will develop the plans and principles (and the toolkit to guide the application of the principles in developing standards of product, environmental and operational safety applicable to SEAsia aligned with those of the Safe Seaweed Coalition) to support a sustainable seaweed industry in the region; these will be endorsed by all member countries to ensure a harmonized approach to seaweed development in the region. Trainings will strengthen the capacity of SEAFDEC member states in implementing those plans and standards.

Output 1.1.1. Regional Seaweed Technical Working Group, constituted and formally mandated by SEAFDEC Governing Council

To support development and implementation of the outputs under this component, a regional Seaweed Technical Working Group (S-TWG) will be constituted and formally mandated by the SEAFDEC Council. The outputs/deliverables the S-TWG will support are: (i) a 'Guide to Promoting a Sustainable Seaweed Industry in the SEA Region' (Output 1.1.2) and (ii) 'Regional Principles of Responsible and Safe Seaweed Aquaculture' and complementary Toolkit (Output 1.1.3).

The S-TWG will have several key functions during project implementation. First, it will provide expertise and integrate the current state of knowledge on seaweed into the regional plans and standards. Second, it will be responsible for coordinating, developing, validating, and supporting the regional adoption of the Guide and Principles. Third, it will represent a platform for awareness, networking, coordination, and knowledge-exchange among key authorities and organizations focused on seaweed development. Fourth, it will facilitate regional technical cooperation to address specific and shared concerns.

Experts from member states and an expert from the SEAFDEC Aquaculture Department (AQD) in the Philippines will compose the membership; one expert will be designated by each member state. Experts from other organizations, particularly those with a technical engagement in the project, shall be invited to participate in the S-TWG forums.

The PMU, with the technical support of AQD and the Secretariat, will execute the following activities:

- Develop a Draft Terms of Reference of the S-TWG
- Obtain Governing Council's approval of the draft Terms of Reference of the S-TWG, its formation and giving it a formal mandate.
- Obtain nominations from each government for a member in the S-TWG
- Identify key institutions and invite experts from them to participate in S-TWG forums
- Convene the First Meeting of the S-TWG to agree to the Terms of Reference and develop a work program for developing the Guide and Principles, and a plan for out-scaling and sustainability of project results.

The project will host two meetings per year for the S-TWG to support development of the Guide and Principles. S-TWG meetings and workshops will be conducted in a hybrid mode, i.e. in-person and on-line. Should it be necessary, additional meetings will be convened. The meetings will be led by the PMU with technical support from AQD and the Secretariat

Table 5 Meeting Schedule of Seaweed Technical Working Group

Meeting #	Purpose	Year
1	Develop the program of work of the S-TWG that includes a schedule of subsequent meetings and workshops and the purposes and outputs of each forum, and agree to S-TWG ToR.	1
2	Define the scope of the Guide , develop an outline, define tasks and responsibilities, and set a timeline. Review ToR for a consultant to assist in drafting the Guide.	1
3	S-TWG and invited experts and resource persons meet and initiate work on the Principles of Responsible and Safe Seaweed Aquaculture.	2
4	Review draft Guide	2
5	Validate the draft Guide	3
6	Review the Principles and Toolkit and initiate work to finalize the drafts	3
7	Validate the Principles and Toolkit	4
8	(1) Finalize the Guide , develop recommendations, and submit to SEAFDEC Governing Council for adoption and (2) Finalize the Principles and Toolkit, develop recommendations and submit	4

	to Council for adoption	
	PMU to organize an online regional workshop to launch the Guide and Principles	4

1.1.2: Guide to Promoting a Sustainable Seaweed Industry in the SEA Region, endorsed by the SEAFDEC Governing Council

SEAFDEC will develop a ‘Guide to Promoting a Sustainable Seaweed Industry in the SEA Region.’ This Guide will essentially be a blueprint for accelerating and expanding the seaweed industry in SEA, and managing its development in a manner that is orderly, inclusive, and equitable. The Guide’s strategic direction will consist of social, economic and environmental considerations. The social considerations will include, broadly, equitable access to and management of resources, participation in community development plans and decision-making, and equitable sharing of benefits. Specific considerations will be on gender equity and empowerment along the seaweed value chain. Key result areas will be established and management and technical measures — guided by a set of agreed principles — prescribed to achieve them. The Guide will incorporate the relevant parts of Output 1.1.3 (Principles for environmental, food, and occupational safety) and shall be supported by trainings under Output 1.1.4. Enabling policy measures, as needed, will be recommended to the Council of Directors along with the submission of the Guide for adoption by the Council at their annual meeting.

The following activities will be executed under this Output by the PMU with the technical support of AQD and the Secretariat:

- Draft ToR and contract a consultant to support development of the Guide.
- Host meetings for S-TWG to review the Draft at key intervals (see meeting schedule under Output 1.1.1).
- Guide and recommendations to be submitted to SEAFDEC Council for adoption.
- Finalize, publish, and disseminate the Guide, including an online workshop to launch the Guide.

Training modules and information packages related to the Guide will be developed and implemented under Output 1.1.4.

1.1.3. SEA Regional Principles for Responsible and Safe Seaweed Aquaculture, including toolkit for applying principles, aligned to the Safe Seaweed Coalition

The project will develop regionally applicable principles for responsible and safe seaweed aquaculture. These principles will be aligned to the Safe Seaweed Coalition principles around food safety, environmental safety and operational safety. An accompanying toolkit will be developed with best practices and supporting guidelines for the application of the principles.

The application of the principles will contribute to the sustainability of the industry and the reputation of SEA seaweed industry as a responsible industry. This will enhance domestic and global market access. The principles can be applied by the SEAFDEC member states by integrating them into the development or upgrading of their own national standards, codes of practice, and best management practices.

Activities will be undertaken by the PMU, assisted by AQD, and include:

- Develop the work plan for the development of the Principles and Toolkit including time frame, tasks and personnel responsible for working on them. Designate a lead person.

- Undertake desktop assessment to inform the development of principles and criteria. This will include a review of existing principles on seaweed aquaculture, codes of good seaweed aquaculture practices, and standards in SEA countries and global standards.
- Host meetings for S-TWG to review the Principles and Toolkit at key intervals (see meeting schedule under Output 1.1.1).
- Principles submitted to SEAFDEC Council for adoption.
- Finalize, publish, and disseminate the Principles and Toolkit, including an online workshop to launch the Principles (same workshop as Guide).

AQD will organize the webinars and conduct the trainings under *Output 1.1.4* to promote the application of the principles by national governments, standard authorities, and industry groups.

1.1.4. Training modules and information packages to support a sustainable seaweed industry in South East Asia

To raise capacities to support sustainable seaweed development in the SEAsia region, and support implementation of the ‘Guide to Promoting a Sustainable Seaweed Industry in the Region’ (Output 1.1.2) and Principles and Toolkit (Output 1.1.3), the project will deliver a number of training modules and information packages.

The following activities will take place, with AQD taking the lead in their execution:

- Shortlist topics for the regional trainings to support a sustainable seaweed industry in SE Asia. Topics will be shortlisted based on interest/demand from SEAFDEC members, information/best practices available, and links to project results under Component 2 and 3 (for up-scaling).
- Engage consultants to produce training modules and information packages in print and electronic format for the ‘Guide’ (*Output 1.1.2*), Principles and toolkit (*Output 1.1.3*), and 3 priority subjects selected from the shortlist above
 - Organize and deliver 5 trainings/webinars based on the training modules and information packages developed above:
- One webinar on the ‘Guide,’ focused on policy recommendations and implications on development planning. It will include the critical need for inclusive policy and plans that address social inequities and disempowerment. The webinar will target policy and program planning and management officers and will include lessons based on studies and industry experiences in promoting gender equity and empowerment;
- One webinar on the Principles for industry leaders, farmer leaders, processors, exporters and researchers to encourage uptake/integrating of standards into national codes of conduct, national standards, and industry practices;
- One training per priority subject identified (3 total), online or in person. The trainings will be delivered by the same consultants/facilitators with the support of AQD.
 - Conduct post-training evaluations to assess the training courses.
 - SEAFDEC will publish all the training modules on the project website (see Component 4)

Component 2: Enabling Environment for Seaweed Aquaculture in Philippines and Viet Nam

Outcome 2.1. Improved planning for seaweed aquaculture and capture of nutrients from the ocean

The project will fund plans and assessments to identify areas suitable for seaweed farming, taking into account ecosystem carrying capacity, climate change scenarios, and existing uses to minimize user conflict. These assessments will inform coastal and marine spatial maps for seaweed aquaculture expansion. For suitable areas, the project will support site specific development plans to ensure the enabling conditions are in place for seaweed farms. In addition, the project will support National Seaweed Plans and industry roadmaps. In Viet Nam, the project will support D-fish and MARD to develop a 10-year Seaweed Development Plan. In the Philippines, the project will support BFAR in adapting and translating the provisions of the Seaweed Industry Roadmap into local regulations (i.e. municipal ordinances) and good practice guidelines.

Output 2.1.1. Marine spatial planning that integrates more sustainable seaweed farming

PHILIPPINES

This Output will deliver a marine spatial plan for Roxas that identifies zones with specific uses attached to them (including proper siting of sustainable seaweed farms and support facilities). The purpose is to ensure that the seaweed farm established under the project is sited in a socially and ecologically sustainable way.¹⁶ An MPA borders Roxas, which will also be considered in the MSP process.

Coast 4C has developed a marine spatial planning approach called iMPA that leverages opportunities within the Fisheries Code and the synergies between seaweed farming and marine conservation to mutual benefit. They have facilitated the legal establishment and implementation of 8 iMPAs managed by 10 *barangays*. On average these iMPAs are 720 hectares in size, 50 times greater than the national average marine protected area, with 282 ha zoned for sustainable seaweed farming, and 2,188 ha zoned for no-take 'replenishment' zones that includes corals, seagrasses and mangroves. They have shown that integrating seaweed farming in an appropriate zoning system within marine protected areas benefits both seaweed farmers and marine protected areas: sensitive habitats such as coral reefs are not impacted by seaweed farms¹⁷; and as seaweed farms locally mitigate eutrophication and ocean acidification and provide habitat, the farms support rehabilitation of the habitats and marine biodiversity¹⁸. 65% of people surveyed from these *barangays* reported increased CPUE in fish catch within 2 years of implementation. In turn iMPAs have provided a healthier environment for seaweed to thrive and help to increase safety and reduce production risks for seaweed farmers. Coast 4C will extend the iMPA approach to incorporate deep water seaweed farming.

¹⁶ Overall, the project should expect to see coral reefs in the area covered by the MSP improve and/or continue to thrive. There are multiple mechanisms within the MSP to deliver benefits for corals which can all be linked to seaweed production indirectly (e.g. reduction of ocean acidification, reduction of nutrient and plastic pollution, reduction of fishing pressure or unsustainable fishing practices, increases in herbivores that can reduce detrimental species).

¹⁷ This helps to address the issue of allelopathy, a very common mechanism among benthic organisms in their competition (e.g. between corals, soft corals, seaweeds, etc). In addition, as seaweed farming over corals can produce negative effects – shading, mechanical trampling and anchoring – the MSP approach is important for ensuring proper siting of seaweed farms while accounting for the larger system

¹⁸ Some studies have shown that fish biomass in small stand-alone coral-reef no-take MPAs (i.e. those that are not under an MSP-type system) close to seaweed farms is often lower than biomass in similar MPAs farther from seaweed farms; this owes more to people frequently fishing around seaweed farms not under an MSP system, often using destructive methods, because seaweed acts as a fish aggregating device. This is one of the reasons why the MSP approach is critical to ensure that farms are adequately sited and proper management is in place.

Coast4C will undertake this output, and will facilitate a participatory marine spatial planning process in close coordination with the community, BFAR, the municipal government (LGU) and other relevant stakeholders. This process will follow an Environmental and Social Management System (ESMS) to ensure that it is fully participatory, follows principles of Free Prior Informed Consent, includes conflict assessment and includes safeguard mitigations as laid out in the Environment and Social Management Framework. As part of the process there will be an assessment of the social infrastructure particularly at the community level, and actions to strengthen this infrastructure to ensure equitable access, meaningful participation and representation. This follows the processes prescribed in Philippine legislation. The output will include knowledge products including a toolkit and trainings that expand iMPA to incorporate deep water areas for seaweed and integrate learnings from this project to facilitate replication.

Under this Component, Coast4C (C4C) will execute the following activities:

Phase I: Facilitate a planning process for a site-specific marine spatial plan for Roxas that incorporates regenerative seaweed

- Development of toolkits and training materials on the process of marine spatial planning, this will include a training of trainers and materials for FPIC. The target audience includes members of the MPA / Marine Management Council (MMC) and planning Technical Working Groups (TWGs) involved in implementing the MSP process (see later steps).
- Cross visits for key community members/leaders and relevant project management unit members (e.g., Project Manager/Cooperative Enterprise Development Specialist). Cross visits will be to other sites where similar spatial planning approaches have been taken that integrate seaweed in northern Iloilo and/or Bohol and will enable people to see how it works in practice and speak with community members and LGUs. This is essential part of FPIC, and can help catalyze the marine spatial planning processes.
- Social infrastructure strengthening and establishment of community level Technical Working Groups. TWGs will be established to lead various stages of the planning process. Typically, these are established by either the MPA/Marine Management Council or by an Executive Order from the Mayor. Membership will represent the municipal government or mLGU (MFARMC) and bLGU (village), community groups such as people's organizations, farmers' associations or/and cooperatives, other key stakeholders, and relevant technical experts, including those from Coast 4C and BFAR. Under the Magna Carta of Women (RA 9710) there is a requirement for a minimum of 30% female membership in the TWG. Members of the TWG are represent their respective groups and elicit input to and feedback on proposed plans. Members will be trained and supported by C4C utilizing the toolkits and trainings developed at step 1.
- Conduct baseline assessments, including socioeconomic profile of the community, marine resource use and environmental baselines and habitat mapping. Carrying capacity assessment for seaweed farming will be undertaken as part of this with the scientific input and participation of the European Space Agency.
- Facilitate the conduct of spatial planning by a Technical Working Group following an inclusive participatory process. Spatial planning process will lead to the formulation and adoption of an Ordinance, ultimately signed by the Municipal Mayor following due participatory processes and consultations.
- Formulation of the Ordinance based on the output of the spatial planning process. The TWG will actively be involved in the formulation of the Ordinance. Following consultation periods and readings, the Ordinance will be passed for endorsement to relevant bodies, and ultimately enactment. Enactment requires the signatures of the Sangguniang Bayan (Municipal Council)

and the Mayor. Once the Mayor has signed the Ordinance, they will sign another Executive Order to establish – if there is none currently existing -- a management body, the Marine Management Council, which will define the Implementing Rules and Regulations (IRR).

- Facilitate the management planning process by the MMC for a 5-year implementation plan of the Ordinance and IRR, including the development of a financial sustainability plan where financial commitments from the Local Government Unit and other stakeholders are identified. Following a participatory process and consultations, the management plan is ultimately approved by the Mayor. The management plan is reviewed and translated every year into an operational plan which is reviewed by the Municipal Fisheries and Aquatic Resources Management Council (MFARMC) and adopted by the municipal council, which triggers the release of approved budget amounts.
- Training and deputization of *bantay dagat* (“guardian of the sea”)
- Update toolkit and training materials with lessons learned and experiences from the project.

Phase II: Implement spatial management plans

Under this phase, key aspects of the management plan will be implemented. This will include the following:

- Site level infrastructure (guardhouses, patrol boat, buoys) will be implemented that demarcates the relevant zones, clearly communicates the rules and penalties for infringement, and provides the facilities with which to safely and effectively patrol and enforce the Ordinance and IRR, and protect people’s personal property (such as seaweed farms) within the appropriate zones. The guardhouse will be designed so that it can also serve as a drying platform for seaweed close to farms (this reduces transport time and costs and increases fuel efficiency). It will be set up away from sources of contamination. The guard house provides a safe refuge for both *bantay dagat* and seaweed farmers to deter poachers. It makes it more convenient for farmers to tend to their farms.
- SMART marine training and implementation. SMART Marine is a set of software and analysis tools designed to help with the management of marine areas. SMART Marine will be set up with the LGU so that data from enforcement and management activities can be centralized and feed into management planning processes.
- Training and mentoring of the relevant management bodies (MMC / TWG), their members and associated social infrastructure to ensure the continued smooth running of the MSP
- Monitoring and evaluating the socioeconomic and ecological impacts of the MSP. Management effectiveness will be monitored through locally adopted MPA Effectiveness Assessment Toolkit. Underwater Visual Census will be used to monitor habitat quality and fish biomass. Socioeconomic surveys will be used to monitor impacts on the community.
- Monitoring of catch per unit effort by fishers in the surrounding waters. This will allow the Project to determine any impact (positive or negative) of seaweed production on the food chain and fish stock and ensure that there are no negative effects on humans.
- Monitoring of primary productivity using satellite imagery provided by the European Space Agency, as well as monitoring of nutrient levels.
- Monitoring of entanglements, and changes to populations of Red Listed species that are known to be present locally (particularly dugongs and turtles).
- Monitoring of marine plastic pollution
- Update toolkit and training materials with lessons learned and experiences from the project

Note: In the second site, Buenavista, Zamboanga City, the offshore farming will take place in an area that is within the mariculture zone approved in the Comprehensive Land Use Plan (CLUP) of Zamboanga City. BFAR Region IX has submitted a request for a gratuitous permit for the exclusive utilization of the area by BFAR; it is under process. In brief, the MSP preconditions have already been met for Zamboanga.

VIET NAM

1. Seaweed zones mapped in 10 provinces to contribute to national level MSP process and provincial-level coastal planning (VN)

To support integration of seaweed considerations into the national-level MSP process (taking place through baseline) and related provincial-level coastal planning, the project will identify and confirm areas for seaweed culture in 10 coastal provinces with potential for seaweed.¹⁹ The project will also support D-Fish participation in MSP national planning processes. It will promote the participation of women and their representatives in the consultations required to develop the national plans.

Activities include:

- Technical assessment (desktop study and expert workshop) to identify potential areas for seaweed culture²⁰ and confirm the sites designated for seaweed piloting.
- Produce GIS maps (suitability maps) incorporating this information, to feed into provincial and/or national level MSP process
- Participate in national MSP planning meetings, provincial-level planning meetings and provide other contributions as needed.

Implementation will be led by the N-PMU²¹ with technical support from consultants (Seaweed Development expert and GIS technician) and D-Fish staff. Coordination with provincial sub-D-Fish and MONRE (i.e. MSP inputs) will be led by the Project Manager in consultation with D-Fish. The multi-sector Technical Working Group (Output 2.1.2 below) will provide an additional key platform for dissemination of results and coordination with MONRE.

2. Two (2) provincial seaweed development plans to guide pilot seaweed farms, with guidelines and trainings to upscale planning process to other provinces.

Currently the provincial level planning does not apply seaweed development planning processes. However, such planning is recognized as best practice to ensure the full potential for sustainable seaweed is realized. To deliver this output, the project will define a process for developing seaweed development plans. The provincial development plans will be informed, among others, by the process and results of the pilot demonstration farms (under Output 3.1.1). The results from the pilot farms will include guidelines incorporating lessons/best practices learned from their management and operation (technical,

¹⁹ Kien Giang, Phu Yen, Khanh Hoa, Quang Ninh, Hai Phong, Ba Ria - Vung Tau, Ninh Thuan and Binh Thuan, Binh Dinh, Ca Mau, as identified in Decision 339.

²⁰ Based on published literature and expert input, assessing key environmental variables (e.g. surface temperature, salinity, oxidized nitrogen, light, dissolved oxygen and chlorophyll) and constraints (wave height, bottom substrate, bathymetry etc.); classifying zones in provincial-level suitability maps as optimal, suboptimal and unsuitable for all species investigated (*Gracilaria*, *Kappaphycus*, *Caulerpaceae*, *Porphyra*)

²¹ Comprised of 1 Project Manager; 2 Project Technicians; 1 M&E/Safeguards/Gender expert and 1 finance/admin manager

operational and financial), as well as guidelines for developing a provincial seaweed development plan. To promote uptake in other provinces, the project will offer training courses and webinars to raise capacity on these guidelines. Based on the process defined for developing seaweed development plans, an expansion area for seaweed farming will be identified in another offshore environment (outside of the 2 pilot provinces) where *Kappaphycus* or *Caulerpa* is farmed.

Thus, the two (2) Provincial seaweed development plans will be developed through the following activities:

- Define key components/outline/process of the seaweed development plan based on existing best practice²² guides and consultation with key stakeholders.
- Undertake a study that includes the following assessments for the two pilot sites:
 - Carrying capacity assessment – including 1) total physical carrying capacity i.e. of all activities that can be supported by available area; 2) production carrying capacity (total resources that can be extracted sustainably) 3) environmental carrying capacity (what can be done without causing damage to the environment) 4) social carrying capacity (total economic development that can be achieved without inflicting harm to society or causing conflicts).
 - Risk assessment – including quantitative and qualitative information based on 2 main criteria: *likelihood* of a hazard and the *consequence* (i.e. the nature and magnitude of harm it inflicts) if it occurs.²³
 - Conflict assessment and potential mitigation measures – through analysis of current provincial SEDPs and/or sector plans; multi-stakeholder consultations
- Drafting of seaweed development plans for Ninh Thuan and Khanh Hoa, highlighting zones for seaweed development based on above assessments
- Developing guidelines and trainings for seaweed development planning
 - Draft technical guidelines for seaweed development plans based on lessons learned from above in consultation with relevant stakeholders
 - Develop training materials and tools for implementing the guidelines above, including case reports, fact sheets, and extension materials that incorporate lessons and practices in promoting gender equity and empowerment along the seaweed value chain.
 - Host trainings and workshops for provincial officers involved in the planning and management of seaweed aquaculture in the 10 provinces with documented potential for seaweed
 - Conduct webinars to ensure these training sessions are readily available and accessible

Implementation arrangement: Development of the two provincial seaweed development plans will be led by the N-PMU (Project Manager and 2 Project Technicians) with technical support from external consultants (for detailed assessments of pilot sites and development of training materials) and D-Fish staff. Coordination with provincial sub-D-Fish will be led by the Project Manager in consultation with D-Fish. The multi-sector Technical Working Group (Output 2.1.2 below) will provide an additional key platform for dissemination as needed. Drafting of technical guidelines and training materials will be led by the N-PMU in consultation with D-Fish and with support from external consultants. D-Fish will also support the implementation of training workshops (i.e. in liaison with provincial officers in the 10

²²<https://www.fao.org/3/i5004e/i5004e.pdf>; https://www.researchgate.net/publication/315696838_Aquaculture_zoning_site_selection_and_area_management_under_the_ecosystem_approach_to_aquaculture_A_handbook

²³ Risk Analysis can be based on FAO publication “[Understanding and Applying Risk Analysis in Aquaculture](#)”, which provides a comprehensive guide – from concept to process – to risk analysis.

provinces) and Chair these events, as well as organize webinars and include training modules in other MARD fora.

Output 2.1.2 National Seaweed Plan presented for adoption (VN) and National Seaweed Industry Roadmap (PH) adapted to local levels

PHILIPPINES

The output of the project in the Philippines is the adaptation and translation into local regulations of the provisions of the Seaweed Industry Roadmap. The revised Philippine Seaweed Industry Roadmap (2022-2026) has been finalized and is pending approval by the Department of Agriculture. (DA). The roadmap presents detailed strategic plans for the Philippine seaweeds industry to guide its progress towards the goal of regaining its position in the international seaweeds industry. The national policies and program support of DA will be communicated to different seaweed farming communities where coastal waters are under the jurisdiction of the municipality. To deliver the output, the NCU-SDP unit of BFAR will hold the following workshops in Roxas and Zamboanga City:

- 2 Workshops that include participants from BFAR, LGU, PCSD, and NPFC to (a) familiarize participants with the Philippine Seaweed Industry Roadmap, and (b) develop recommendations for implementing relevant portions of the roadmap in the municipality, e.g., good aquaculture practices and post-harvest processing to produce good quality RDS.
- 2 Consultation workshops with the same stakeholders to identify portions of the Roadmap that could be incorporated into a Municipal Seaweeds Industry Roadmap Ordinance, e.g., zoning of coastal areas and management of coastal resources.

The LGUs would then issue the relevant municipal ordinances based on the recommendations.

VIET NAM

1. Multi-sector Expert Working Group led by D-Fish is established, given the mandate and is functional

Supported by capacity building and technical outputs from Output 2.1.1, a multi-sectoral Expert Working Group (EWG) will be established under D-Fish – with defined terms of reference and work program - to review Viet Nam's National Seaweed Plan (NSP) and to support stakeholder consultation and input from a diversity of public and private actors.

Activities include:

- National Project Management Unit (N-PMU) and D-Fish develop the terms of reference and the work program of the EWG
- D-Fish designs the Expert Working Group (EWG) structure (sectors; departments; areas of expertise); individual departments designate representative members
- Organize and host two technical meetings per year.
- Collect, collate and disseminate products related to the SDP for EWG review

Implementation arrangement: The establishment of the EWG will be led and authorized by D-Fish, with advice from the N-PMU. D-Fish will determine EWG structure (sectors/departments to be included) in consultation with stakeholders (including via project Inception). Following design of EWG work program and ToR, individual Ministries/Departments will nominate representative staff. The Project's gender specialist will participate in the expert working group (EWG) to ensure that gender equity and women's

empowerment are duly considered and included in the EWG's work program and the National Seaweed Plan.

2. National Seaweed Plan is finalized for endorsement by MARD

Based on the strengthened information base (Output 2.1.1) and consultations with major stakeholders, including review and comments on drafts, a National Seaweed Plan (NSP) will be developed. The NSP will provide consolidated guidance on seaweed farm targets, priority areas, timelines, capacity requirements and implementation roadmap, and will be informed by - and consistent with - the national Strategy for Development of Viet Nam's Fisheries by 2030 with Vision Towards 2045. The NSP will be finalized by D-Fish with direct support from the N-PMU - including full stakeholder workshops and national consultations as required – and submitted to MARD for endorsement by the Minister.

Activities include:

- Conduct consultation meetings with major stakeholders about the results of Output 2.1.1 (technical assessments of seaweed potential; pilot seaweed development plans in 2 provinces; expansion opportunities)
- Series of technical working meetings of the EWG to define the outline and content of the NSP with N-PMU and consultants(s) working closely with technical staff at D-Fish and other relevant agencies (e.g. MONRE/Viet Nam Administration of Seas and Islands)
- Field mission to provinces to elicit direct feedback from local stakeholders to ensure NSP is aligned with the needs and realities of seaweed farmers
- Drafting of NSP by National Project Management Unit / consultants(s)
- Review period for comments from stakeholders; validation workshop
- Processing NSP for formal approval at D-Fish

Implementation arrangement: Technical support and stakeholder consultations will be led by the N-PMU, who will likewise lead the drafting of the NSP in coordination with the EWG and D-Fish. Some additional external technical expertise (consultant) is anticipated, possibly teaming up with the technical consultants assigned under Output 2.1.1. The NSP will be finalized and approved by D-Fish.

Outcome 2.2. Robust institutional and regulatory frameworks ensure that expansion of seaweed farming is sustainable, responsible, and equitable

The National Seaweed Plan developed through the project, and plans for seaweed expansion into offshore areas, may require new policies, regulations or guidelines to ensure a supportive enabling environment for the sustainable expansion of seaweed farming. The policy and regulatory gap analysis, already carried out and reported by the Project Preparation Team of Viet Nam, will inform a more detailed analysis by the Project. Based on this gap analysis and with government support, the project will support the development of specific guidelines or frameworks to address identified barriers to seaweed farming. A critical regulatory issue is access and user rights. Considered a strength in marine aquaculture is the decentralized control of coastal area and resources utilization by local authorities and the local people. This will be an important consideration in policy formulation or revision and translating national policy into local regulations and good sector management guidelines.

The project preparation Team of the Philippines made the determination that the existing governance frameworks of the country to manage the seaweed industry (that includes the Seaweed Industry Roadmap, Philippine National Standards' Code of Good Seaweed Aquaculture Practices) as well as those

that govern the broader aquaculture sector, are adequate for the tasks of planning and accounting for impacts of seaweed aquaculture. Hence, the Philippines will not undertake activities under Outcome 2.2. However, relevant results of the Project will be used by BFAR to inform the updating of existing policy and implementing rules and regulations and updating of national standards.

Output 2.2.1: Policy and Regulatory gap analysis and associated frameworks (e.g. Circulars; technical guidelines) to facilitate seaweed aquaculture planning, development and management

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1. Based on the National Seaweed Plan (developed under 2.1.2), assess and prioritize needs/gaps including barriers to expansion, constraints to enforcement and compliance, and human/financial resource needs; develop technical guidelines and other measures to address identified barriers and optimize NSP implementation.

Efforts to strengthen governance and improving the institutional and legal frameworks conducive for planning and accounting for seaweed aquaculture will not end with the finalization of an approved Plan. Further granularity will be required including a full assessment of what implementation guidelines, sub-laws (e.g. circulars) etc. may be needed to suitably implement the National Seaweed Plan and optimize its impact. Led by the N-PMU and with support of the Expert Working Group, priority policy gaps and needs will be identified and described, including barriers to market expansion, capabilities for and constraints to enforcement, and gaps in human and financial resources. Specific recommendations for guidelines and additional measures to address the gaps and barriers will be developed. Based on these, new policy and/or legal instruments will be drafted. In addition, voluntary measures and best practices for the seaweed industry will be identified, recommended and endorsed through a participatory process (stakeholder consultations and workshops). Activities include:

- With support of the Expert Working Group:
 - Review/verify policy gap analysis from PPG stage, identifying priority gaps and documenting needs (including human and financial resources)
 - Identify and characterize barriers to expansion of seaweed aquaculture, access to global markets and Viet Nam's competitive advantage in the global seaweed value chain
 - Analyze capabilities for and constraints to enforcement and compliance of regulations in the seaweed sector
 - Provide concise recommendations on:
 - policy, regulatory and technical guidelines to address the identified barriers to expansion
 - additional enabling measures (e.g. circulars) to support effective implementation of the NSP, including monitoring and evaluation, enforcement and work routines.
- Based on above, drafting of technical guidelines, circulars etc. to support implementation of NSP

Implementation arrangement: Flowing from the participatory development of the NSP, the identification of regulatory gaps and associated recommendations will be led by the National Project Management Unit in close consultation with D-Fish (including D-Fish legal department) and industry stakeholders. D-Fish will approve any new instruments (guidelines; regulations). Subsequent drafting of technical guidelines and/or additional regulations will be led by the N-PMU, with support from an external consultant (policy

expert). Approval of guidelines/regulations will rest with D-Fish as will internal processing of these documents.

2. Establish (in Ninh Thuan and Khanh Hoa provinces) a monitoring and evaluation system for enforcement of, and compliance with regulations on the seaweed value chain based on existing regulations.

Based on the NSP and associated regulations and guidelines, a monitoring and evaluation system will be developed and tested in the two pilot provinces. With the NSP anticipated to provide a solid foundation for M&E, and further supported by detailed guidelines, this work package is intended to provide practical field-level insight into how to optimally implement M&E for enforcement and compliance, documenting lessons learned and providing a scalable model that may be subsequently applied in other provinces.

Activities include:

- Assessment of M&E system requirements based on review of NSP and expert workshop(s)
- Design simple M&E system with focus on compliance with NSP and other relevant regulations
- On-site meetings and training of local provincial staff in implementing M&E
- Conduct annual M&E (Years 3 and 4); disseminate results

Implementation arrangement: The M&E system will be completed (and annual evaluations conducted) following completion of the NSP by the National Project Management Unit in coordination with D-Fish. Field coordination with two provinces (Ninh Thuan and Khanh Hoa) will include on-site meetings and training conducted by the National PMU and D-Fish. Findings will be documented annually by the National Project Management Unit (M&E manager) and results disseminated via Project (e.g. Component 4) and D-Fish communication and knowledge-sharing channels.

Output 2.2.2. An open source Information Management System (IMS) is in place to facilitate national and provincial-level planning and management of the seaweed aquaculture sector (VN)

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The deliverables and implementing strategy:

Through project development activities and consultations with D-Fish and industry, the need for an open-source Information Management System (IMS) was universally identified and agreed upon. An IMS is needed for a variety of reasons. It would ensure accurate and routinely updated data for monitoring and evaluation that can also be applied at the national and provincial government levels to support planning (including zoning/MSP). It may be utilized as a market-access tool, providing real-time market information as well as enhanced transparency in the supply chain, thus lowering risks to investors. It may also be linked to enhanced farm security (e.g. mitigate poaching), providing additional value and reducing risks. Moreover, the IMS can be used for more precise monitoring not only of the environmental benefits of farm systems (e.g. nutrient absorption, enhancement of habitat of marine life/increase in fish catch in seaweed farming areas), but also the impacts of environmental hazards, extreme weather events, fish predation, and any impacts on corals and on red-listed species (e.g. sea turtles), allowing for such data and information to be widely communicated and for mitigation strategies to be developed and applied in a timely way.

1. Engage IT and Information Management System Expert(s) to develop the IMS platform

To support the ongoing collection of updated data, monitoring, evaluation and learning that provides long-term added value to the sector, a dedicated open-sourced electronic Information Management System (IMS) on the seaweed aquaculture industry will be developed. An open-sourced platform that is fully accessible by the seaweed private sector as well as D-Fish and provincial fisheries, and allows all stakeholders to enter relevant data (including market data), will allow information to be built upon by all stakeholders and facilitate not only planning and management, but also value chain development. The initial step is to engage IT and Information System Expert(s) to develop the platform and architecture, supported by National Project Management Unit

Activities include:

- Developing open-source data sharing agreements/protocols
- Engaging IT and IMS experts to develop beta version of the seaweed IMS
- Finalizing agreed data elements for inclusion in the IMS
- Developing applications for integration in the IMS (e.g. calculating nutrient absorbed; assessing increase in marine fish and other aquatic animals in seaweed farming areas, market access tools; evidence-based policy formulation tools)

Implementation arrangement: Overall structure and content (e.g. data elements) will be established by the N-PMU in consultation with IT/IMS consultants and relevant D-Fish staff. Technical design and architecture of the seaweed IMS and other related apps will be led by IT/IMS consultants, supported by the N-PMU. Final approval of the IMS will be by D-Fish, facilitated by the N-PMU.

2. Training, capacity-building and learning for IMS development

In parallel, training and capacity-building activities will be conducted. These include workshops/seminars at national and (pilot) provincial levels, to make stakeholders aware of the IMS, and conducting training sessions for users of the IMS – including private sector actors - in the 2 pilot provinces and at the national level. To support ongoing adaptive management, learning and scalability, IMS evaluations (2 pilot sites and national status report) will be conducted - including review of system capability, usability and relevance of data elements; improvements on the system, if needed, will be proposed.

Activities include:

- Design of training modules and training program
- Organize workshops/seminars to make stakeholders aware of the IMS
- Develop and disseminate User Manual and awareness materials
- Practical training program at 2 pilot provinces and national level

Implementation arrangement: Design of training materials will be led by the N-PMU in consultation with IT/IMS consultants and relevant D-Fish staff. Local workshops will be organized by the N-PMU, with facilitation support and chairing from D-Fish. The User Manual will be drafted by IT/IMS consultants (together in a combined work package with IMS design). Practical training at provincial/national levels will be organized by the N-PMU with technical support from IT/IMS consultants and facilitation/Chair support from D-Fish.

3. Data and information collection; piloting full IMS in 2 provinces

Once the IMS platform is developed, a national survey project of a limited scope will gather data and information on key elements (natural, human and physical resources, economic and social status, value chain etc.) to be inputted and analyzed under the IMS. This would include data and information from

Outputs 2.1.1 as well as additional data collected from available scientific literature and/ provincial (DARD) sources. The data and information will be fed into the system as a basis for initial operationalization of the IMS, and to test the capability, usability and relevance of the IMS's structure and contents.

Detailed data will be fed into the IMS at the 2 pilot provinces, providing an opportunity to fully install and test the system at a local operational scale.

Activities include:

- National survey (desktop study and stakeholder survey)
- Installation at 2 pilot provinces
- Complete evaluations (2 pilot sites) and national status report, including review of system capability, usability and relevance of data elements
- Propose improvements to the IMS and/or recommendations for scaling up IMS/training in other provinces

Implementation arrangement: The desktop review and stakeholder survey will be led by the N-PMU, supported by D-Fish and provincial departmental staff (i.e. provincial offices of MARD and MONRE). Installation at 2 pilot provinces will likewise be led by the N-PMU in cooperation with DARD and facilitation from D-Fish. Annual evaluations will commence in Year 3, led by the N-PMU (including M&E manager) and results integrated into Project communication and knowledge-sharing platforms. Recommendations from evaluations (e.g. scaling up) will be highlighted by the N-PMU in consultation with D-fish, and acted on by the N-PMU.

Component 3: Seaweed Value Chains (production + processing+ marketing).

The project will target 5 sites under Component 3 (linked to site-level planning undertaken under Component 2). There will be 2 sites for *Kappaphycus* in the Philippines and 3 sites in Viet Nam (2 for *Kappaphycus* and 1 site for *Caulerpa* sp comprising two adjacent farms, an earthen pond farm and a nearshore coastal farm). The site locations and coordinates are Appendix 1. The justification for selecting the sites and species is Appendix 2.

3.1 Improved technologies and testing for seaweed value chains in PH and VN

A no conversion (mangroves etc.) and sustainable intensification approach will be at the core of growing the seaweed aquaculture sustainably. It will address near coastal barriers (including disease outbreaks and pollution) via a gradual move of seaweed production away from the shoreline and into the open ocean. Demonstration farms will established within national marine spatial plan (MSP) frameworks, and with the specific goal of advancing uniformly accepted risk assessment, rapid alert systems and data collection in order to develop safe modes of production, focusing on food safety, occupational safety and environmental safety. This would help overcome barriers of insufficient information that directly limit off-take agreements amongst global supply chain actors, contribute to the low level of regulations, and represent a barrier for insurability.

The project will support seaweed value chain initiatives to address barriers to production and processing. This may include new production or processing technologies that add value to seaweed closer to the farming communities and provide opportunities to increase the earning capacity of households, reduce work burdens of women, enhance women empowerment and promote gender equity along the value

chain; improving propagules to ensure they are resistant to disease and tolerant to higher water temperature; and supply chain transparency initiatives to better monitor against the Safe Seaweed Coalition's food safety protocols, provide quality assurance, and thereby connect to global markets and supply chain actors. Potential initiatives have been identified during project preparation. A few (likely 4) will be selected during execution based on supply chain assessments and consultations.

Output 3.1.1: Six demonstration farms to provide proof of concept of different seaweed farming options:

- **Four demonstration farms (of Eucheumatoid species) to provide proof of concept of off-the-coast or offshore scalable seaweed businesses (based on zones identified in 2.1.2).**
- **Two demonstration farms (*Caulerpa* sp), one in degraded former shrimp ponds and another in adjacent shallow nearshore area**

Table 6 Seaweed farm locations and species

	Location	Seaweed Species	Description
1	Aplaya Buenavista, Zamboanga City, Philippines	<i>Kappaphycus</i> spp.	Offshore Circular marine fish cage modified for seaweed culture
2	Green Island, Roxas, Palawan, Philippines	<i>Eucheuma denticulatum</i> , <i>Kappaphycus</i> spp.	Off-the-coast (Using traditional longline method with robust and fortified anchorage; tubular net for consideration)
3	Phuoc Dinh Commune, Thuận Nam District, Ninh Thuan Province, Viet Nam	<i>Kappaphycus</i> (1)	Off-the-coast (approx. 2 km from shoreline; 5+m depth) Zone D (5m); Floating net
4	Van Ninh district, Khanh Hoa, Viet Nam (Van Phong Bay)	<i>Kappaphycus</i> (1)	Off-the coast Floating net
5	Ninh Hoa town, Khanh Hoa, Viet Nam (<i>Caulerpa lentillifera</i>)	<i>Caulerpa</i> (2 farms considered as 1 site)	Earth pond and Nearshore coastal plot

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In the Philippines, two demonstration farms will be established to provide proof of concept of offshore seaweed farms for Eucheumatoid species - one in Roxas and one in Zamboanga. In Roxas, the deepwater demonstration farm is expected to produce a total of 150,000 kg of RDS based on 3 harvests per year. The traditional technology will be improved and adapted to the deeper (5-10m) and higher energy culture environment of the selected site. The traditional long line method will still be used but a robust anchoring structure will be built. In Zamboanga, the Norwegian circular fish cage system will be modified for seaweed cultivation in deeper (10-20m) offshore waters, which can withstand and afford more protection to the plants in the higher energy environment.

In **Roxas**, the demonstration farm will go through three phases:

Phase I: Plans in place for design and operationalizing the seaweed farm

- Undertake process to receive official approval for the farm site, following official protocols

- Host a workshop with BFAR, MAO, PFO, PCSD, MFARMC, BFARMC, and SB NPFC to build consensus and buy-in
- Submit application for farm site
- Contract an engineering consultant to design a blueprint for the seaweed farm on Green Island. The blueprint will showcase the technical/engineering drawing of the farm structures (anchoring and lines).
- Host a workshop to formulate the Farm Plan with key local stakeholders. The farm plan includes, location and design of the farm, farm implements and other materials needed, farm personnel and staffing schedule, qualifications of the partner cooperators to work in the farm, and health and safety protocols, among others.

Phase II: Demonstration farm established

- Host workshop for seaweed farmers to summarize the proposed plan for the seaweed farm, based on the Farm Plan and blueprint developed above (production structure, culture system, # of crops/ year, farm design, farm management plan, record keeping system, etc.). Seaweed farmers are consulted for their feedback and buy-in, and support for scaling-up.
- Recruit 100 cooperators (seaweed farmers), to operationalize the farm. This group will perform all the tasks from preparing the seedlings, setting them in the culture site, care and maintenance, and harvest and post harvest handling. Every seaweed farmer on Green Island is eligible to apply. BFAR will propose selection criteria, based on input from seaweed farms and the cooperative. BFAR and the cooperative will be responsible for selecting the seaweed farmers.
- Training for selected cooperators on the management and operation of the offshore farm and in the preparation, use and maintenance of the structures
- Establishment of the Demo Offshore Farm based on the Farm Plan and Blueprint. This includes:
 - Procurement of 2 boats (1 motorized banca and one flatboat)
 - Construction of a solar dryer and guardhouse. The solar dryer is a land-based structure for hanging and drying seaweed equipped with protective covering from the rain. The guardhouse is a floating structure set up close to the seaweed farm to be used as a patrol station and as a resting place for farmers.
 - Infrastructure built for the seaweed farm including: moorings, buoys, floaters, anchors, etc. according to blueprint
 - Procurement of seaweed propagules. This includes procuring the commercially cultivated cultivars from local farmers and newly developed cultivars i.e., healthy, disease-, epi-/ and endophyte-free cultivars developed through the selective breeding program of UP MSI.
 - Farm personnel in place. In Roxas, the 100 seaweed farmers will be supervised by a project supervisor, a farm in-charge and 4 farm workers.

Phase III: Demonstration farm operational

- BFAR and the NPFC will be partners in running the demo farm. In Year 1, BFAR's work will entail 80% while coop is 20%. In year 2, BFAR 60% Coop 40% and so on until Year 5 (post project) when the cooperative takes over and BFAR providing oversight. BFAR will assist the coop to sustainably manage the farm long term. For example, the farm anchors can last >20 years but the long lines last only about 2-4 years. In this regard, a percentage of the income equivalent to the depreciation value of the farm structure will be allocated to a sinking fund to finance repair and maintenance.

- The demo farm will be officially handed over to NPFC at the end of the project. NPFC, BFAR and WWF-GEF will execute and sign an exit strategy agreement by which NPFC commits to continue to operate the demo farm and ensure its economic viability.

In **Zamboanga**, the project will pilot the first offshore seaweed farm in the Philippines using the Norwegian fish cage design; it will be established further offshore than the currently cultivated areas. Current cultivation uses floating monoline or multiple lines using traditional mooring and are prone to attacks of herbivores especially during seasonal migration of siganids due to its location near the coral reef areas. This design will have a more robust mooring system which can withstand stronger waves and currents. Another improvement in the design will be the installation of a net to capture fragments of seaweed fronds that break off, which would otherwise be lost during the entire culture period.

Upon deployment of the cages, the members of the beneficiary cooperative will assume the responsibility of operating the farm, with BFAR9 supervision. Six crops will be cultivated per year (as specified in the BFAR9 project proposal). The structure can last 20 years but would require regular maintenance e.g., replacement of nets. Revenue from the sale of the RDS will sustain farming activities and pay for maintenance of the structure. At the end of the project, the cages will be turned over to the cooperative. BFAR9 will continue to supervise and provide technical advice. The demonstration farm goes through two phases:

Phase I: Demonstration Farm Established

Personnel from the Fisheries Production and Support Services Division (FPSSD) of BFAR9 will be assigned to the project to take the lead during the project implementation for the activities listed below. FPSSD will be assisted by personnel from the BFAR Zamboanga City Fishery Office in the entire project duration.

- Contracts will be awarded for the construction of the offshore seaweed farm infrastructure, and procurement of materials/propagules, according to the blueprint and Farm Plan.
- Farm personnel in place. In Zamboanga, the demo farm will be managed by a project coordinator, 3 technical personnel, one farm labor, and eight hired labors. These positions will be co-financing contribution of BFAR IX.
- Construction of elevated seaweed dryers as a post-harvest facility. The seaweed dryers will ensure that the harvested seaweeds from the offshore seaweed farms will be dried following the Philippine National Standards for raw dried seaweed. Good quality RDS produced from the project will address the quality issue on carrageenan in the global market.
- BFAR will conduct weekly monitoring of the project during the actual farm operation, with overall oversight by the Philippines project management unit (N-PMU)

Phase II: Demonstration Farm Operational

Once the seaweed association is organized as a cooperative (under output 3.2.2), BFAR will partner with them to operationalize the demo farm. The farm will be handed over to the cooperative at the end of the 4-year project. Once the cooperative takes over the farm, they will be responsible (using their own resources) for farm operation and maintenance, including labor, boat, fuel, documentation and record keeping, and farm planning and budgeting for the next cropping. They will produce a business and marketing plan supported by BFAR Region 9 to ensure efficient integration of the RDS produced into the seaweed value chain. For the turnover, a Memorandum of Agreement will be signed by BFAR and Cooperative. After turnover, BFAR 9 will continue to provide training and technical advice to the seaweed farmers/cooperative members, especially on new and improved technology, and continue monitoring the performance of the farm.

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1. Farm management plans developed with local Cooperatives for each of the 4 pilot farms

Three pilot areas for the development of farm management plan models have been identified and confirmed with industry stakeholders and government. 4 demonstration farms will be established in the three areas. These are:

- Thuan Nam district, Ninh Thuan province (*Kappaphycus alvarezii*) – a 1 ha pilot farm in “Zone D”
- Van Ninh district, Khanh Hoa (*Kappaphycus alvarezii*) – a 1 ha pilot farm in Van Phong Bay
- Ninh Hoa town, Khanh Hoa (*Caulerpa lentillifera*) - earth pond (1000 m²) and coastal farm (1000 m²) operated by Tri Tin company

Justification for inclusion of *Caulerpa* and selection of two sites for *Kappaphycus*

The *Caulerpa* pilot consists of two distinct operations – a pond system using a High Density Polyethylene (HDPE) frame, and an experimental coastal caulerpa farm, in close proximity to each other and both operated by the Project and Tri Tin company. While *Caulerpa* farmed in ponds may not deliver proof of concept of “off-the-coast seaweed farming systems”, its inclusion in the Project – together with a fully coastal *Caulerpa* farm - provides several environmental and socioeconomic benefits. Like other provinces in the South-Central coast of Viet Nam, Khanh Hoa has an abundance of what are now largely under-utilized and degraded shrimp ponds; these ponds are typically associated with declining productivity and increased local pollution and risks of disease. Replacing shrimp with *Caulerpa* – an approach that the local government authority (DARD) is supportive of - provides a means to reduce such negative environmental impacts²⁴. In this regard, the Project will monitor and assess the environmental impacts of the pond-based *Caulerpa* farming by:

- Comparing the level of N and P in the effluent discharges from shrimp farming sites and from *Caulerpa* farming sites;
- Comparing the overall quality (dissolved oxygen content, heavy metals, etc) of pond waters in shrimp and *Caulerpa* ponds.

Socio-economically, *Caulerpa* also provides a higher market value that will help with poverty alleviation and income streams for the farmers, allowing them as well as processors and exporters to leverage the expanded international and domestic market opportunities to develop value-added supply chain initiatives (see Output 3.1.2).

²⁴ The environmental benefits of conversion/rotation of shrimp ponds with *Caulerpa* can be highlighted across two main categories – pond sustainability and local environmental impacts. In terms of sustainability, shrimp ponds in sandy-soil areas typically have a short timeframe for overall pond viability, with local environmental conditions declining precipitously in the first few years of operation until the pond can no longer support a shrimp harvest without large investments in additional ameliorative inputs. In terms of environmental impacts, shrimp aquaculture in this area is additionally problematic due to high levels of water pollution and associated health of biota in the water, leading to disease spread and other impacts on local people. Replacing shrimp aquaculture with *Caulerpa* in this area will directly reduce pollution (i.e. from chemicals and drugs used to prevent or treat disease), and reduce excess nutrient loading (from uneaten feed and shrimp excreta), lessening impacts to local ecosystems and mitigating potential risks to the people that depend on them. The conversion to *Caulerpa* would contribute to the oxygenation of the pond water, would help absorb nitrogen and phosphorus, and would enhance carbon capture from the operation.

Therefore, the inclusion of both an inland pond system and a first-of-its-kind trial coastal farm for *Caulerpa* will be pursued. While of distinct operations, these two nearby systems will be combined in Project planning and budgeting (i.e. described as “Ninh Hoa site”). Both farms will be supported by the 50% co-financing agreed by Tri Tin company.

For *Kappaphycus*, two sites were selected for piloting – one in “Zone D” seaweed planning area of Ninh Thuan province, and one in Van Phong Bay seaweed planning area of Khanh Hoa province. Each site will initially be 1 ha (planned for expansion every year) and each with 0.5 ha applying an improved roping model and 0.5 ha applying net (local material) as means to reduce predation. The use of both material types is expected to provide a stronger experimental basis for developing an effective farm management model. While located in contiguous coastal provinces with generally similar biophysical conditions, the inclusion of two sites for *Kappaphycus* offers a hedge against uncertainties and risks, enhancing opportunities for developing a scaleable off-the-coast seaweed farming model.

Farm management planning and organization of cooperatives

Developing farm management plans and models that demonstrate the technical feasibility and commercial viability of the pilot seaweed farms will require strong participation from local value chains supported by a governance structure that ensures their meaningful engagement. Accordingly, farmer cooperatives will be formed at all 3 pilot sites, including two for *Kappaphycus* and one for *Caulerpa*. In addition to direct engagement in the pilot farms (especially farm management plan/model), the cooperatives formed – of raw dried seaweed producers as well as other segments of the supply chain including processing companies and/or suppliers - will offer improved governance over the broader seaweed development planning in the identified zones near or surrounded by the pilot sites.

While cooperatives are a common feature of the Vietnamese aquaculture industry (e.g. shrimp and pangasius), the formal establishment of a farmer “cooperative” can be an administratively lengthy process; hence, the Project will initially form a voluntary “group” of production households (about 20-30 households per site) to ensure their early participation in the activities. The local stakeholders’ meetings and field surveys have confirmed a generally strong interest among local stakeholders to participate. Component 3 activities will build the group’s internal operational capacities that will support its formal designation as a Cooperative (operating at Commune level).

Once farmer groups are established, farm management plans will be formulated for each of the 3 sites. The plans will include an enterprise plan, record keeping system, documentation of resource needs (including seedling and post-harvest facilities) and budget.

A farmer cooperative and associated farm management plan will be developed for *Caulerpa* at the Ninh Hoa site; however, this plan will address and compare both farming methods (pond and coastal) being piloted. Additionally, while a clear willingness for co-financing was expressed during project preparation, this would require clarification and finalization in early stages of project implementation. Accordingly, the benefit sharing mechanism for the pilot areas will be determined during project inception.²⁵

Following initial pre-planning and design, and formation of the initial farmer groups, a farm management plan will be developed as a critical early-stage deliverable of the Project. The Plan will include an enterprise

²⁵ During consultations the Director of D-Fish indicated that profits from the models should be applied to support operational costs and controlled by the relevant farmer group/cooperative

plan, record keeping system, documentation of resource needs (including seedling and post-harvest facilities) and budgets.

Activities include:

- Planning and design of the pilot models
 - Finalize culture system and the structures (including net materials for *Kappaphycus* pilots and earthen pond with HDPE frame for *Caulerpa* pilot)
 - Finalize farm size and location (linked to seaweed planning outcomes of Output 2.1.1) and the target production for Year 1
 - Acquire (or build) the culture structures, seed and other input materials
- Determine willingness for partnership/co-financing with private sector and benefit-sharing mechanism
- Form an initial farmers group of production households (20-30 households) for each of the 3 pilots (stakeholder mapping; local meetings)
- Farm management plan development:
 - Local planning workshops and stakeholder consultation
 - Draft Plan

Implementation arrangement: Planning and design of the pilot models will be prioritized for early implementation, and will be led by the N-PMU with strong engagement from the private sector. An open and participatory process of stakeholder engagement will be organized by the N-PMU, with facilitation support and Chair functions from D-fish. This will include an initial workshop on planning and design, as well as additional local planning workshops to support farm management plan development, including clarification of industry interest, additional co-financing for pilots, and agreements on benefit-sharing. The formation of farmer groups at each of the 3 pilots will also be prioritized for Year 1 and led by the N-PMU, integrated where possible with above consultations on farm site development. Building of the physical culture structures will subsequently be led by local industry stakeholders, with guidance from the N-PMU and D-Fish.

2. Seaweed farming systems model developed for *Kappaphycus* and *Caulerpa* that incorporate business plan, budget and marketing templates, and prescribe better management practices

Following the formulation of the farm management plans, farming operations will commence (at the beginning of Year 2) at all 3 sites. Assessments of technical and economic performance will be applied after the first crop is harvested, processed and brought to market. Based on results of all crop cycles in the pilots and informed by assessments, a seaweed farming system model will be developed for both *Kappaphycus* and *Caulerpa* that incorporates business planning, budget and marketing templates, and applies better management practices (i.e. applying practices identified through Component 1 and other project interventions). An “off-the-coast” model for *Kappaphycus* as well as for nearshore *Caulerpa* farming will be widely profiled (including via Component 4 activities) with fact sheets and other extension materials produced.

Activities include:

- Assessments of technical and economic performance at each pilot
- Farming system model/templates developed and profiled
- Produce Fact sheets / extension materials / apps (as appropriate)

Implementation arrangement: Assessments will be led by the N-PMU with support from community groups and technical experts, following an open participatory process of stakeholder engagement as

outlined above and elaborated in the Stakeholder Engagement Plan. Templates, fact sheets and extension materials will be developed by the N-PMU with support from D-Fish and industry experts.

3.1.2: Implementation of at least 2 seaweed value chain initiatives (adding value to raw seaweed in seaweed farming communities; improved propagules; transparency)

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The project will explore several biorefinery solutions that will increase the value of seaweed biomass and provide environmental benefits. The environmental benefits from biorefinery solutions include zero or almost zero waste with all parts of the biomass converted to a valuable product or precursor to a higher value product; use of fresh biomass as an input in a process that does not use chemicals (i.e. alkali) that can pollute soil and water; and promote a circular economy as with the production of pellets that are processed into bio-plastics, which are biodegradable and can be recycled into fertilizer. Economic and social benefits include better price and more demand for the farmers' fresh seaweed products; reduced cost from doing away with drying; and increased employment opportunities.

The project will connect seaweed biomass (produced by the project under 3.1.1 and through existing seaweed farms) to market. The project will both ensure a premium price for the Raw Dried Seaweed (RDS) in exchange for adhering to environmental criteria, and establish technologies to add more value to seaweed biomass at the site level. Added-value technologies will reduce the communities' dependency on one single market (carrageenan extraction industry), the project will establish new processing technologies in Roxas. Value-added to seaweed biomass means greater income for the communities, and provides an incentive to the seaweed farmers to further expand seaweed farms and production capacity (furthering social and environmental benefits).

Value-add processing technology

The exact type of processing technology will be selected during execution from the following:

Table 7 Value-add processing options (PH)

	Short description	Potential activities to be financed	Notes
Option 1: Production of food items	Use of eucheumatoids for e.g., bread, noodle production.	<ul style="list-style-type: none"> Seaweed culinary training and workshops Processing equipment 	<ul style="list-style-type: none"> Processing technology is continually being developed at the NSTDC, and can be applied through this project
Option 2: Liquid fertilizer production	Collection of seaweed juice/ drippings and preserved for use as fertilizer	<ul style="list-style-type: none"> Seaweed juice collection and preservation training and workshops Equipment 	<ul style="list-style-type: none"> Advancing the available traditional processing and preservation technology to improve seaweed juice quality and shelf life.

Option 3: Fish feed production	Fish feed is made from different ingredients including seaweed	<ul style="list-style-type: none"> • Purchase of equipment (same equipment for Options 3 and 4) • Extrusion equipment comprises feeder, extruder, cutting device 	<ul style="list-style-type: none"> • Fish feed formulation development is required • The fish feed consists of different ingredients – proteins, fats, etc., which may need to be brought to the community.
Option 4: Bioplastic refinery	At Brabender, a technology is being developed to process eucheumatoids via extrusion into a plastic-like material.	<ul style="list-style-type: none"> • Equipment for bioplastic pellet extrusion • Mill/chopper and infrastructure (warehouse to store and preprocess RDS and factory building for the extruder) • Training on equipment • Development to use fresh seaweed instead of sun-dried material would increase profit as drying would not be necessary 	<ul style="list-style-type: none"> • Processing for Option 3 and 4 would need to be done in Roxas for logistics, electricity, etc.

USD \$356,449 has been allocated to establish at least 2 processing technologies. The processing technologies to be supported by the project will be selected during execution. Key activities to produce this output will be undertaken by BFAR, and include:

- Select value-add processing technology
 - Feasibility study to assess the value-add initiatives, and evaluate the most promising to augment incomes of individual farmers and/or the cooperative. The following will be considered: Sustainability, product and market potential, cost of and returns from investment, co-finance opportunities, safeguards, and practicability of establishing in the community (e.g. space, electricity needs, etc.).
 - Consultation with seaweed farmers and the community
 - Based on community consultation and feasibility studies, stakeholders and BFAR to select at least two processing technologies
 - With communities, develop a Plan for establishing the processing technology (e.g. beneficiary selection, safeguards, where to place the technology)
- Establish processing technology for selected option
 - Establish at least two value-add processing technologies and select beneficiaries according to plan, the selection based on equal opportunity
 - Trainings to selected beneficiaries on operating the technologies
 - Develop business model to connect products to market
- Operating of processing technologies
 - The beneficiaries will operate the processing technology (they will receive benefits arising from the sale of the products)
 - Monitor and assess social and economic impacts (increased household revenues, sense of empowerment, achievement of parity in decision-making relevant to the management and operation of the enterprise, and equity in benefit sharing, etc)
 - Develop guidance note or a manual documenting how to establish and operate the technology to promote upscaling.

Purchase RDS at a premium price for meeting environmental criteria

For seaweed farmers to access price premium available through Coast4C's market linkages, seaweed farmers need to be able to demonstrate that they are meeting social, environmental and quality criteria, and a traceability system is required to assure seaweed that meets these criteria. Coast4C has established a traceability system using Koltiva SeaweedTrace software. Coast4C have adapted this software to the Philippine market and incorporated the necessary social and environmental criteria so that registered farmers can be evaluated against those criteria. All transactions at every stage of the value chain are recorded through SeaweedTrace using either a smartphone and/or sms messages, reducing the chances for corruption and malpractice. Coast 4C will register participating farmers in SeaweedTrace, with basic descriptive information on their farm sites and an annual assessment against the social and environmental criteria. For those farmers that do not meet the criteria, there will be an exploration of their interest to adopt the criteria and assessment of their needs to help them meet the criteria (i.e. with training and/or material support). All transactions and transfers are recorded through SeaweedTrace, and farmers that meet the criteria are eligible to receive a price premium. SeaweedTrace also allows continuous assessment of seaweed quality which is a key criteria for premium. Seaweed that meets the quality and criteria for the premium is kept aside for sale to premium markets, and SeaweedTrace identifies which farmers receive the premium and verifies the price paid. SeaweedTrace provides additional benefits of monitoring the productivity of different methods, allowing knowledge exchange between farmers, and monitoring changes in key criteria such as use of biosecurity measures and wellbeing of participants. Coast4C has trusted relationships with an increasing number of customers who require reliable information on the provenance of the RDS and sustainable practices by which it was produced, and are willing to pay a higher price for volumes of seaweed that meet these criteria. This includes the major carrageenan actors with established commitments to sustainability, and new markets such as biopolymers, where traceability and quality control are needed for the value-add technologies, such as Brabender which has specific quality requirements for RDS. This makes it imperative – in the event that the Brabender biorefinery technology is not established in Roxas, the project still ensures that the RDS can feed into this technology and gives farmers a premium price. This will broaden the beneficiary pool; any seaweed farmer can use this application and receive premium, whether she is participating in the offshore, value-add technologies, or farming separately but aims to meet these criteria.

Coast4C will undertake the following activities under this Output:

- Installation of a traceability software and registration and training of farmers and other intermediaries (e.g. cooperatives, other groups) in the use of this software. Coast 4C has already customized a specialist traceability platform for this purpose in the Philippines and has the needed accounts.
 - Set-up of Green Island/Roxas as a location within the SeaweedTrace platform
 - Registration and training of 100 farmers. Registration involves recording basic farmer information (system complies with the highest data protection requirements), plotting the farm and undertaking a farm verification visit and a questionnaire to document the habitat, materials and methods used in the farm, and other farming practices. Registration is entirely optional and farmers can opt out at any time. SeaweedTrace complies with the highest standards of data protection (GDPR compliant).
 - Verification of farms and those that meet criteria for premium
 - Implementation of SeaweedTrace for trading, which involves the recording of all transactions of premium-quality seaweed to trace movement from farm to customer, as well as inputs and impacts.
- Purchase of RDS at premium price

- Relevant facilities are necessary to separate premium quality seaweed from other sources of seaweed, and to ensure that quality standards are maintained throughout the value chain. This involves appropriate storage facilities at the community level, and a warehouse that Coast4C will establish in Roxas where seaweeds can be stored and processed ready for sale. These trading costs will be met through co-financing.
- Coast 4C will engage local community members in the processing of the seaweeds in Roxas. Seaweed will be processed for sale to responsible global markets in compliance with their specific requirements.

Along with purchasing seaweed at a premium, Coast4C will support an initiative to recycle end-of-life fishing nets to reduce plastic pollution and provide additional income to the communities. Seaweed farming is normally undertaken alongside fishing within a diversified livelihood. Plastic pollution is a major threat to the sustainability of marine resources in these communities. Monofilament Nylon 6 fishing nets are the most widely used gear by small-scale fishers in the Philippines, particularly for fisheries targeting blue swimming crabs. Additionally, monofilament Nylon 6 is increasingly used in seaweed farming, particularly deep water seaweed farming, as material for tubenets. They are well suited for this application because they retain the seaweed better than ties in higher energy environments. Deep water seaweed farming requires higher energy environments in order to succeed due to the lower levels of nutrients. However, the monofilament mesh from fishing nets and tubenets is normally replaced every 3-4 weeks due to wear and tear and damage that takes considerable time and is hard to repair. End-of-life mesh is discarded into the marine environment where it continues to ensnare and kill marine life in a process known as ghost fishing. Monofilament Nylon 6 nets are among the most deadly forms of marine plastic pollution as they can continue to catch and kill fish, ensnare boats and emit toxins into the marine environment for decades. Coast4C have developed a value chain for intercepting end-of-life fishing nets from the ocean and diverting them into the circular economy. This helps to provide a small supplemental income for fishers but most importantly helps reduce marine plastic pollution. While income from the sale of nets is modest, it does help to diversify sources of household income and increase resilience of small-scale fisher/farmers, and support the delivery of the marine spatial plan. Activities include:

- Toolkit and training on collection and recycling of discarded nets.
- Set-up of a community social infrastructure to facilitate the group activities, provision and access to technical services, and equitable participation in the collection and recycling of discards, marketing of the recycled products, and sharing of the proceeds.
- Monitoring & evaluation of the impacts of the project on the coastal environment and the livelihood of the participants.
- Purchase of end-of-life fishing nets from the fisherfolk, and trade and sell to responsible markets. Coast4C purchases the lines, compacts it at a facility using labor from the community and the community shares in the proceeds from the sale.
- Set up of warehouse equipped with compacting and baling facilities to prepare the fishing lines for sale – these costs will be met through co-financing.

VIET NAM

1. Kappaphycus seedling hatchery established, providing good quality and adequate supply of seedlings to improve the growth rate and productivity of the pilot farms/zones

Weak propagules were defined as a barrier during project preparation, and as a result consideration has been given to addressing this challenge. For *Kappaphycus*, the main issue has been low seed quality, lack of quality assurance in purchasing and the lack of facilities to maintain seedlings at a sufficient volume to meet needs at the beginning of crop cycles. The current scenario is one of farmers purchasing small volumes (at a high price) of seedlings and propagating them at the farm site through cutting. This process prolongs the crop cycle, leading to low productivity. A *Kappaphycus* seedling hatchery would significantly improve the growth rate and productivity in pilot farms, which can be profiled and scaled up in other areas (i.e. incorporated into the farm management model and associated extension materials under 3.1.1 above). With a reliable and sufficient supply of seedlings, farmers can grow more crops of *Kappaphycus alvarezii* and also, in the warmer season, *Kappaphycus striatus* or *Eucheuma denticulatum*. The hatchery will be established by the seedling extension service center in Nha Trang, which is under DARD. The center will provide the financing with support from the Project to enable the center to develop a business model.

Ongoing monitoring of results (i.e. quality and growth rates) in the hatchery and at seaweed farms will be integrated into the monitoring activities under Component 2 as well as overall project-level monitoring undertaken by the N-PMU.

Activities include:

- Technical study on the improvement of the quality seedling for *Kappaphycus*
- Establishing a *Kappaphycus* seedling hatchery; a suitable and strategic location i.e. conveniently accessible to scientific and technical personnel and farmers in both provinces where sites are to be established, will be determined at the start of the Project.
- Monitoring of results

Implementation arrangement: Technical studies will be led by the N-PMU in collaboration with external experts and research institutions. Ongoing monitoring of results (i.e. quality and growth rates) in the hatchery and at seaweed farms will be integrated into the monitoring activities under Component 2 as well as overall project-level monitoring undertaken by N- PMU i.e. by the M&E officer). Results will be profiled by the N-PMU and via D-Fish communication platforms, and as appropriate incorporated into the farm management model and associated extension materials.

2. One (1) Biorefinery system piloted (with at least 30% co-financing from private sector)

The biorefinery concept of converting biomass to beneficial byproducts is a relatively new idea in Viet Nam, and has not yet been significantly explored in the Viet Nam aquaculture industry (much less the relatively small seaweed sector). There has been limited analysis of potential biorefinery seaweed products as new “bridge” markets to promote increased growth of seaweed farming. However, potential biorefinery solutions are emerging and stakeholder consultations confirmed a strong interest in developing this segment, including developing downstream biorefinery processing for pre-treatment, fractionation, extraction, and purification and the associated production facilities to support such products being brought to the market.

These consultations determined that the most suitable path, given the relative infancy of the industry, would be to first assess feasibility and formulate a strong framework for biorefinery system development, including identification of market opportunities, resource needs and gaps, followed by the shortlisting of potential systems/products. Based on this assessment, one to two biorefinery systems will be selected (by the N-PMU Team in consultation with the private sector and D-fish) for piloting, with at least 30% co-financing from the private sector (as agreed by industry stakeholders during project preparation). Local

groups/cooperatives will then be trained on its operation and in the marketing of the extracts and by-products, with relevant training integrated with Outcome 3.2 activities (below) on seaweed toolkit/training for improved production and processing.

Activities include:

- Conduct a Feasibility Study and shortlisting of potential Biorefinery systems for *Kappaphycus* and *Caulerpa*
- Consultation meetings/workshops and participatory selection of one pilot out of the two that are assessed of their feasibility.
- Implementing pilot; operational training (on-site) and integrated into Outcome 3.2 materials/modules

Implementation arrangement: The Feasibility Study and subsequent shortlisting and selection of pilots will be led by the N-PMU in close consultation with the private sector (including Viet Nam Seaculture Association and individual seaweed companies) and with the support of D-Fish and external expert consultants. Implementation of pilots will be co-led by the private sector and the N-PMU, with at least 30% co-financing from the private sector as determined through a consultation process facilitated by the N-PMU. Training will be designed by the N-PMU in consultation with D-Fish and support from external technical experts.

Outcome 3.2. Generating benefits from seaweed aquaculture for target communities

In addition to piloting new technologies, the project will work with organized seaweed farmers in target communities to (a) increase the effectiveness of activities under Outcome 1, and (b) improve the practices and benefits for existing seaweed farms and seaweed farmers. To improve seaweed farming practices, the project will develop and deploy a Sustainable Seaweed Toolkit that incorporates the Principles of Responsible and Safe Seaweed Aquaculture (from Outcome 1.1) and food safety, environmental safety and operational safety protocols identified by the Global Safe Seaweed Coalition Platform and best practices identified under Component 1.

To address barriers related to lack of finance and selling power, the project will build support systems and tools related to marketing, business, and finance. The Toolkit and trainings will be provided to seaweed farmers and seaweed cooperatives/associations in the target communities.

3.2.1: Sustainable Seaweed Toolkit and trainings for improved production, processing, and market access

PHILIPPINES

BFAR will conduct training on the operation and management of an offshore large-scale farm on Green Island (Roxas, Palawan) and Zamboanga. Different toolkits will be prepared. These include a toolkit for selected farmers who will be trained on offshore seaweed farming operation and management under 3.2.2. Training will include safety procedures in operating and maintaining the offshore structure for a sustainable seaweed production.

Coast4C will develop a toolkit and training materials for sustainable practices that enable farmers to meet the criteria for price premium. This will include: a toolkit that documents the lessons learned from the

project and methods applied, and a training of trainers to personnel of BFAR and members of the cooperative on sustainability and quality requirements. These sustainable practices will extend on the Philippine Good Aquaculture Practices and incorporate best practices produced by the Safe Seaweed Coalition. The content will be tailored specifically to the requirements of buyers willing to pay a premium for the seaweed. These materials will basically provide a “how-to” guide for implementing the steps and practices required to qualify for premium prices.

VIET NAM

The deliverable is capacity building (awareness and training) programs developed and implemented on these skills:

- Seedling selection, maintenance and production (200 farmers/staff trained)
- Product value chain development, domestic market access strategy, and export development plans (100 farmers/staff trained)
- Establishing effective e-commerce platforms and e-marketing (40 local women)
- Post-harvest processing, product quality assurance, safety and environmental standards (100 farmers/staff trained)

Additional capacity-building for improved production and processing will be ensure that project results on farm management and value-chain models are optimized for community-based value addition, with the aim to facilitate adoption of improved technology, facilitate market access, enhance value, manage markets risks, raise incomes and generate local jobs. Informed by Best Practices from Output 1.1.2 and results of the pilots (Outcome 3.1), training modules and information packages will be developed and delivered (via workshops, seminars and peer-to-peer exchanges) on: seedling selection, maintenance and production standards (200 farmers/staff trained); product value chain development, export development plans and domestic market strategy (100 farmers/staff trained); post-harvest processing standards including HACCP, ISO and other product quality and safety standards (100 farmers/staff trained) and; international environmental standards (e.g. ASC, MSC, organic). The training and awareness program will be uniformly implemented across the seaweed sector with representation sought from all farming areas.

Because of the vital importance of digital media in product marketing and market development, and the lead role of women in this segment of the value chain, this Output will include parallel training for women in the local seaweed farming community on the use of e-commerce platforms (i.e. e-retail site development; online promotion and marketing; customer service; packaging; delivery and transactions).

The current scenario is that such training modules and guidelines do not exist for the seaweed industry (other than HACCP procedures). Hence, the training and awareness program will rely on Best Practices developed under Component 1 as well as the research and assessments conducted under Outcome 3.1, supplemented by additional consultations or reviews as required.

In order to provide sustained impact beyond the timeframe of the project, training modules and information will be consolidated into a simple app, published on Google Play (Android) for free use by all farmers. Additional, training modules/app will be incorporated into the MARD National Extension Center and other relevant platforms as identified.

Activities include:

- Development of information packages and conduct of training

- Design and implementation of an e-commerce training program (for 40 local women)
- Design and publication of a simple app (Android) consolidating above information packages

Implementation arrangement: Sustainable Seaweed Toolkit and trainings will be led by the N-PMU and supported by expert technical consultants and D-Fish. Close liaison with SEAFDEC technical experts on Best Practices and associated training modules will be required. The project's Stakeholder Engagement Plan will likewise support identification and suitable representation of local stakeholders in training activities. The N-PMU will also lead the design and implementation of e-commerce training, with support as required from consultants (e-marketing). The 40 women participants in the e-commerce training will be selected from those already involved or likely to be engaged in small scale value addition enterprises. A simple app that consolidates information and training packages will be led by the N-PMU with technical support from an IT expert. (The expert could be the same person hired to design the Information Management System under Output 2.2.2).

3.2.2: Seaweed farmer/cooperative support systems (value chain development and participation, business management, access to financing and other key inputs)

PHILIPPINES

Focus will be on capability building on the range of skills, aptitudes and practices to govern, strengthen and sustain a cooperative. Trainings (total of 16 sessions in 4 years) will be undertaken once every quarter to develop the knowledge, skills and attitudes of the local seaweed farmers and enable them to lead, manage and sustain their seaweed farming activities, trading, and livelihood (with additional seaweed value chain) beyond the 4-year duration of the project. This output is to build the capacity of seaweed farmers to manage a cooperative while 3.2.1 is to build their technical capacity for seaweed farming and a more effective participation in the seaweed value chain (value adding, market access, customer relations, business transactions)

This institutional capacity building is important to develop their knowledge, skills, and attitude to sustain the outcomes of the project. Their active involvement as BFAR's partner in operating and managing the project will provide them with actual field experience that improves their capability to operate the demonstration farm as a community business enterprise generating benefits for the community.

The following trainings will bolster the cooperative model by which members are trained and developed into creative entrepreneurs who will lift themselves and their community from poverty through business as the engine for growth and poverty reduction. These trainings (<https://cda.gov.ph/memorandum-circulars/mc-2015-09-revised-guidelines-implementing-the-new-training-requirements-of-cooperative-officers/>) will complement the required trainings for the established cooperatives in Palawan and Zamboanga:

- | | |
|--|---|
| 1. Governance and Management | 8. Parliamentary Procedures |
| 2. Internal Control Systems & Procedures | 9. Basic Accounting for Non-Accountants |
| 3. Leadership & Values Reorientation | 10. Audit Management |
| 4. Conflict Management | 11. Financial Management |
| 5. Strategic Planning and Management | 12. Marketing Management |
| 6. Orientation on Labor & Other Related Laws | 13. Records Management |
| 7. Entrepreneurship & Business Management Skills | 14. Cooperative Standards |
| | 15. Rules Formulation |

16. Human Resources Management

VIETNAM

Organization of cooperatives

As provided under Output 3.1.1 (pilot demonstration farms) farmer cooperatives will be formed at all 3 pilot sites, two for *Kappaphycus* and one for *Caulerpa*, with membership sought from raw dried seaweed producers as well as other segments of the supply chain including processing companies and/or suppliers. As the formal establishment of a farmer “cooperative” can be a lengthy process, the Project will initially form a voluntary “group” of production households (about 20-30 households per site) to ensure their early participation in the activities. The local stakeholders’ meetings and field surveys have confirmed a generally strong interest among local stakeholders to participate. Component 3 activities will build the group’s internal operational capacities that will support its formal designation as a Cooperative (operating at Commune level).

To achieve this, the project will help organize official meetings in all 3 sites, in order to agree on scope and common objectives and to confirm early interest. Once a minimum threshold of interest (e.g. 3 individual farmers and at least one private sector member) is achieved, the project will facilitate the development of a draft charter outlining common agreed objectives. Complementing other training and awareness-raising activities conducted through the project (e.g. 3.2.1), additional sign-on will be achieved through subsequent group and/or individual consultations.

Outcome 3.3. Expanded collaboration with the finance sector and private sector to support seaweed value chains in Philippines and Viet Nam

The project will leverage the finance and private sector to unlock finance, scale up seaweed production, and increase demand for seaweed biomass. This includes developing bankable business propositions to co-finance and scale up activities under Outcome 3.1, including processing and biorefinery technologies that bring value to seaweed farming communities while also contributing to the increasing demand for seaweed biomass.

3.3.1: Development of 3-4 bankable business propositions to scale up sustainable seaweed value chain solutions tested under 3.1 and new innovative solutions

PHILIPPINES

There will be four investment propositions: an upscaled model of a deepwater farm (Roxas) and of an offshore farm using the modified circular cage (Zamboanga), and at least two value adding enterprises. The farm model will be based on an analysis of the performance over the project period of the demonstration farms. The value adding enterprises will be based on the performance of the community-based enterprise established by the project and the performance of the biorefinery. Feasibility studies of three different products (e.g. fertilizers, fishmeal/oil replacement products, blue sugars for bio-plastics) will inform the business models. These will be carried by the national PMU with technical support of BFAR and Coast4C.

VIET NAM

The deliverable is to develop a portfolio of (at least 3) bankable business projects based on project models, feasibility assessments, and research.

In order to optimize results from the models advanced in Outcome 3.1 (and to take fullest advantage of new capacities developed under Outcome 3.2) it will be necessary to identify private sector partners and investors to secure further investment in seaweed value chains focused on innovative production - including testing technologies (biorefinery, seedlings) developed under the project and/or new models identified - in order to ensure that these projects are scaled up and succeed in bringing more value to seaweed farming communities and the national economy.

To secure such investment the Project will work with the private sector and local communities to advance 3 bankable business propositions for industrial scale off-the-coast seaweed farming. Based on the results of Outcome 3.1, assessments of value chain and financial requirements will be conducted for the products developed in pilots. Following this – and anchored by a fully engaged farmers’ cooperative, new capability and capacity in production and value-chain development, and a newly created multi-stakeholder platform -- a portfolio of projects for commercial-scale operation will be generated in close collaboration with the private sector and development partners (e.g. World Bank).

Activities include:

- i. Value chain assessment(s) for scaled up farming operations based on results of Outcome 3.1 and PROBLUE study
- ii. Finance needs assessment for all components of the value chain i.e. producing, processing, value-added, and marketing
- iii. Develop a portfolio of (at least 3) bankable business projects based on project models, assessments and research
- iv. Establish a multi-stakeholder platform (e.g. web platform) to support portfolio development, including membership from finance sector²⁶

Implementation arrangement: While overall portfolio development will be led by the N-PMU considerable engagement from seaweed companies and associations (e.g. Viet Nam Seaculture Association) is envisioned. In particular, selection of firms/consultants to conduct the value chain and finance needs assessments will be scrutinized and agreed upon with private sector stakeholders based on consensus. The establishment of a multi-stakeholder platform will be led by D-Fish, drawing upon their considerable web resources as well as the current aquaculture PPP where appropriate²⁷.

²⁶ Membership would potentially include World Bank, IFC, Aqua-Spark, IDH, DFCD etc. and will be confirmed in project implementation. Notably, a program for Bankable Nature Solutions (BnS) projects currently exists in Viet Nam via the Dutch Fund for Climate and Development, in partnership with WWF-VN. This represents a clear opportunity for hosting/co-hosting of the seaweed platform.

²⁷ The establishment of any new PPP is not planned in the project, given the considerable administrative resources typically required and the determination that a web-based platform established under the project (supported by current and generally strong D-Fish communication resources in the aquaculture sector) will be sufficient.

3.3.2: Investment seminars and industry and investment forums conducted in collaboration with government representatives, development partners²⁸ and private sector, including key value chain actors.

PHILIPPINES

The business models from 3.3.1 will be refined by reviews from private industry and the Department of Trade and Industry before they are presented in investment forums. The organization of the forums will be a joint responsibility of national executing agency (BFAR), Coast4C and the Regional PMU. Advice and collaboration in the organization of the forums will be sought from the Board of Investments of the Department of Trade and Industry. Investment funds, development banks, and private industry will be invited to the forums; at least 2 will be organized on the second half of Year 4.

VIET NAM

The deliverable is to organize at least 2 investment seminars with investment funds (e.g., Aqua-Spark, IDH, DFCD and other identified sources), to promote innovation, models and develop investment opportunities.

Activities include:

- i. Targeted outreach (consultations; workshops) with investors and financing institutions to disseminate results of investment models produced under Output 3.3.1.
- ii. Organize at least 2 investment seminars with investment funds (e.g., Aqua-Spark, IDH, DFCD and other identified sources), to promote innovation, models and develop investment opportunities

Implementation arrangement: Dissemination of results of investment models and portfolio of projects will be led by D-Fish and the private sector, supported by the N-PMU. Various communication channels from the private sector will be utilized, including those of VSA and VASEP. Collaboration and targeted outreach with potential partners/funders and other global platforms will be coordinated by the N-PMU in collaboration with the private sector²⁹. Results will be disseminated through knowledge-sharing (Component 4) activities of the Project.

Similarly, investment seminars with investment funds (e.g., Aqua-Spark, IDH, DFCD and other identified sources) will be organized by the N-PMU in collaboration with industry advisors. National seminars will be chaired by D-Fish with possible co-chairing (e.g. World Bank) explored.

Component 4: Knowledge Management, M&E, and IW Learn (regional). 4.2. Monitoring and evaluation system in place.

Outcome 4.1. Full participation in IW: LEARN and knowledge management/communication.

²⁸ This may include the Safe Seaweed Coalition, World Bank country offices, IFC and other partners/funders as identified during project implementation

²⁹ A small Advisory Group composed of seaweed private sector stakeholders in Viet Nam may be formed by the national project management unit to help guide outreach and dissemination

The Project will adhere to and support the knowledge exchange objectives of a GEF project. The different users of information in the industry and along the value chain, from farmers to policy makers, will be catered to, their needs assessed and information from the project focused on meeting these information needs. Knowledge products will be packaged as solutions to relevant issues and problems, designed and presented to stimulate innovative ideas. Messages will be geared to informing decisions and guiding actions that lead to desired changes in behaviors of actors along the seaweed value chain in line with regulations, standards and codes of practice. These will be shared widely and in a timely manner.

To ensure knowledge from the project is appropriately documented and disseminated, the project will implement a knowledge management and communications plan (Appendix 3). A mix of knowledge exchange media and activities will be carried out to share the results of the Project with relevant users of the information at the national, regional, and global levels to inform policy, programs, and development initiatives and provide decision support for seaweed aquaculture and processing enterprises. The knowledge products will support scaling up of project results.

Communication and knowledge products will include: a guide for establishing and managing offshore seaweed farms, lessons and best practices associated with deploying seaweed value chain technologies, trainings and toolkits for improved seaweed production, guidelines for achieving safety principles, guidelines for compliance with best practices, lessons in equitable participation among various actors and between genders in and sharing of benefits from business transactions along the seaweed value chain, national seaweed development strategies and action plans, methodologies for development of a seaweed area management plan that considers risks and user conflicts, and a report on the achievement of regional seaweed metrics and targets.

Knowledge management and communications will build on project partner's existing networks and communication mechanisms. SEAFDEC is a key partner for ensuring regional knowledge dissemination and uptake of project results in national policies and strategies.

The project will actively participate in and contribute to IW: LEARN, including PMU attendance at regional meetings, the GEF IW Conference, and twinning exchanges. A website will be developed that is linked and searchable through IW: LEARN's International Waters Information Management System. This will be the web-based platform to disseminate project results to a global audience and to relevant institutions and practitioners.

Finally, the Safe Seaweed Coalition will post project-developed knowledge products as appropriate, reaching a broad membership of practitioners and decision makers along the seaweed value chain.

Output 4.1.1: Participation in two IW:LEARN regional meetings and one GEF International Waters Conference, delivering IW:LEARN experience notes

As a GEF IW funded project, this project will actively participate in the IW:LEARN community. The PMU will undertake the following activities:

- The project will participate in the IW:LEARN community through the development of a project webpage on the IW:LEARN website within the first year of project inception. The project webpage on IW:LEARN will serve as an important channel to closer link the project objectives and MC goals with the IW:LEARN community and the GEF IW objectives. Knowledge products developed under Output 4.2.1 will be shared here.

- Develop IW:LEARN experience notes and publish to share lessons learned and best practices from the project (see also knowledge products under Output 4.1.2)
- The project will support in-person participation – selected from the regional and national executing agencies and the project management units -- to IW:LEARN events. Relevant IW:LEARN events will be identified during the project, and may include a project twinning, regional thematic IW:LEARN event(s), and the biannual IW:LEARN Conference (IWC).

Output 4.1.2 Knowledge management and communication platform and products

The project will develop knowledge and communication products to disseminate and scale up the project's technical and policy products at a regional level. The full Knowledge Management and Communications Plan can be found in Appendix 3, Knowledge Management and Communications.

The Project will undertake the following activities:

- Develop knowledge products that support technical outputs of the Project (a full list of products is also in Appendix 3).
- Package relevant knowledge above into formal communications products (including brochures, reports, videos), adhering to WWF and GEF brand guidelines;
- Deliver a public-facing website to ensure both targeted stakeholders and interested parties have access to the knowledge and communication products;
- Host webinars or side events to present project deliverables, best practices, and lessons learned, for example, lessons on improved zoning, private sector engagement, feasibility of carbon markets, supply demand models for different seaweed products;
- Documentation of environmental impacts of seaweed farming, including those related to coral reefs, marine life, other ecosystem services (breeding places and shelter to marine life), and carbon mitigation potential. This will be linked to the regular monitoring of the seaweed farms.
- Documentation of the social impacts of seaweed farming and processing including those on the households (improved nutrition and health, education of children, reduced burden of women), community (diversified livelihood opportunities, increased group activities, sense of pride), and individual farmers both women and men (sense of empowerment, equitable participation and decision making in household and farming activities).
- Monitor and measure the specific project impacts for each stakeholder group in the seaweed supply chain (e.g. men and women farmers, processors, traders, including those providing support services) to include their degree of participation in supply chain activities, capacity building activities, and in decision-making. The project will develop the tool and methodology for measurement of these impacts.

Communication and knowledge products will be shared directly with key stakeholders via methods defined in the Stakeholder Engagement Plan, including target communities, governments, and partner organizations.

Outcome 4.2. Monitoring and evaluation system in place

The Project Management Unit and project partners will follow an M&E plan to monitor and report on project progress, and identify any areas where adaptive management is needed. A bi-annual Progress Report, including tracking against the results framework and work plan.

Output 4.2.1: Monitoring and Evaluation reports (including project progress reports, midterm evaluation, terminal evaluation)

The PMU will follow an M&E plan (see Section 2.7) to monitor and report on project progress and identify any areas where adaptive management is required. Under this Output, the PMU will draft and deliver the following:

- A six-month Project Progress Report (PPR) and a 12-month PPR, which includes tracking against the results framework and work plan (and from which the PIR is generated and submitted to the GEF Secretariat);
- Annual Work Plan and Budget (AWP&B) with implementation targets;
- Quarterly Financial Report;
- Annual adaptive management meeting to review project results and discuss any necessary adjustments to the project strategy; and
- Closeout report.

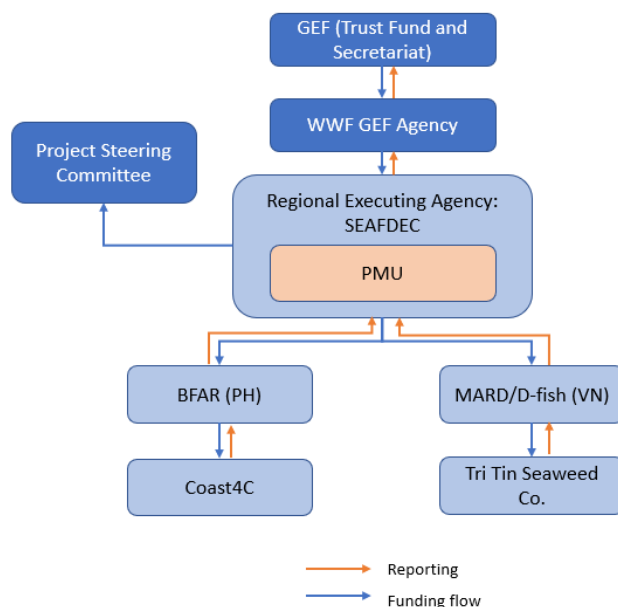
A Mid-term and a Terminal Evaluation will be conducted by independent consultants.

The project activities and timeline of their implementation is provided in Appendix 4.

2.3 Institutional Arrangement

The institutional arrangement for project implementation includes WWF as the GEF Agency, the Southeast Asian Fisheries Development Center (SEAFDEC) as the Lead Regional Executing Agency (its Secretariat in Bangkok, Thailand will host the Project Management Unit), the Bureau of Fisheries and Aquatic Resources (BFAR) of the Philippines and Directorate of Fisheries (D-fish) of Viet Nam as the project executing partners in the Philippines and Viet Nam, respectively, and a Project Steering Committee.

Figure 4 Project Governance Diagram



LEAD EXECUTING AGENCY

SEAFDEC is the Lead Executing Agency for the project. It will be responsible for overseeing the implementation of project activities. SEAFDEC will provide the regional leadership for the project. As an intergovernmental body with 11 member states, its regional mandate assures the incorporation of project results into its regional development programme and outscaling of the relevant aspects of the pilot projects. It will be the instrument for region-wide outscaling, sharing information, lessons and expertise, and promoting the adoption of SEA regional safety Principles and a Regional Guide to Promote a Sustainable Seaweed Aquaculture Industry.

PROJECT MANAGEMENT UNIT

As part of its responsibilities, SEAFDEC will host a Project Management Unit (PMU) at headquarters (Bangkok, Thailand). The PMU will be responsible for the day-to-day management of the project including overall project administration and management, disbursing and administering funds to BFAR and D-fish (To be confirmed pending due diligence process), and monitoring and reporting. The PMU will be comprised of the following members. All will be recruited by SEAFDEC

- The Project Manager/Technical Advisor (PM/TA) will have overall responsibility for the implementation of the Project and specific responsibility for the execution of Components 1 and 4. The Project Manager/Technical Advisor will coordinate with the Managers of the Philippines and Viet Nam National Project Management Units (N-PMU). He/she is responsible for technical deliverables under Component 1, completing project progress reports, annual results framework and workplan reporting, and collaborative development of the annual work plan and budget.
- The Finance and Administrative Officer reports to the PM/TA and is responsible for overall financial oversight of the project, including tracking the budget, facilitating financial transactions, and preparing and delivering the quarterly financial reports.
- A Technical Specialist (TS) will be posted in the Aquaculture Department (AQD) and will provide technical inputs and assistance to Component 1 activities.

Specialist support services will be provided by an M&E Specialist and Communications Specialist, who are to be engaged under short-term contracts.

- The M&E Specialist will report to the PM, he/she will provide technical assistance in gathering, compiling and analysing data for the annual results framework tracking.
- The Communications Specialist will implement the knowledge management and communication strategy for the project; including delivery of knowledge and communication products.
- An I.T. Specialist will design, develop, set up, test and maintain the project website and train regional and national PMU personnel on its use.

SEAFDEC will designate an officer in its Aquaculture Department to support with the technical delivery of the project. The officer will have expertise in research, training and extension services. The detailed PMU governance structure can be found in Appendix 5.1.

NATIONAL PROJECT EXECUTING AGENCIES

The national partners responsible for project implementation in the Philippines and Viet Nam are BFAR and D-Fish, respectively. BFAR and D-fish are responsible for national-level project management and

delivery of Component 2 and 3 (with contributions to Component 4); they will report to SEAFDEC. The governance structures of the Philippines and Viet Nam. National Project Management Units (N-PMU) can be found in Appendix 5.2 and 5.3, respectively.

BFAR and D-Fish will establish a national-level project management unit. (N-PMU) responsible for project management and execution of the activities in indicated in the Strategy and the Project Results Framework.

BFAR will establish a national Project Management Unit (N-PMU), to be headed by the National Coordinator of BFAR's Seaweed Development Program as the National Project Officer (NPO), funded through co-financing. The N-PMU officers to be recruited are the Project Manager (PM), Project Development Officer (PDO), Safeguard and Gender Specialist (SGS), Administrative and Finance Officer (AFO), and Project Assistant (PA). They will report to the project coordinator (sitting in BFAR and covered through co-financing). At the field level (Roxas Palawan and Zamboanga City), project personnel will be composed of the Project Field Managers, administrative assistant, Farm in-Charge and Farm workers. Personnel in Zamboanga shall be funded by the BFAR Regional Office No.9 (co-financing). Personnel in Roxas, Palawan shall be charged under the project fund.

A National Project Coordinating Committee will be constituted to provide strategic direction to the project and ensure cross sector coordination. The members shall be high level officers engaged in program management and/or policy making at the agency and sectoral levels and, from the academic sector, in research and development on marine science, from the departments of Agriculture, Environment and Natural Resources, and Trade and Industry, the Seaweed Industry Association of the Philippines, University of the Philippines, Marine Science Institute and University of the Philippines in the Visayas College of Fisheries.

Two local coordinating groups, for Palawan and Zamboanga, will be organized by BFAR. They will ensure interagency coordination at the local level; promote local stakeholders' understanding of the Project objectives, strategies and outputs; ensure local stakeholders' active and equitable representation in the Project plans and activities; respond to field implementation issues and challenges by undertaking troubleshooting and crisis management as required; provide feedback to Project Management Unit on the status of implementation of the project at the local level including issues, challenges and best practices; and make recommendations and commitments of their respective agencies towards improving project implementation. These "on the ground" coordinating committees will be composed of local officials, chair of the committee on NGOs, Peoples Organizations and Cooperatives, chair of provincial development councils, environment and natural resources officer, provincial fishery officer, chair of the municipal fisheries and aquatic resource management council, seaweed association leaders, and chair of fishers cooperative. Palawan's Council for Sustainable Development of the Office of the President will be invited.

The BFAR N-PMU will subgrant to Coast4C for activities under Component 2 and Component 3.

D-fish will recruit the following positions to the N-PMU: a Project Manager, Policy Specialist, Value Chain Specialist, a finance-administrative Officer, and a Safeguards/Gender/M&E Specialist.

A multi-sectoral Expert Working Group (EWG) will be established under D-Fish to support stakeholder consultation and input from a diversity of public and private actors. Relevant ministries/departments will nominate their representatives in the EWG.

D-fish and BFAR are responsible for contracting and overseeing consultants and subgrantees for key activities. Additional subgrants will be made to partners for implementing value-add initiatives, these partners will be selected based on the criteria and process described under Output 3.1.2.

In Viet Nam, subject to the legal provisions and oversight obligations of the primary grant agreement, the N-PMU will subgrant to the Tri Tin company for pilot testing *Caulerpa* culture in nearshore waters, a potential expansion area for small producers. Tri Tin is a private company engaged in farming of *Caulerpa* and processing and marketing (in domestic and export markets) of *Caulerpa* products. It is the source of planting materials for the small farmers in the area, it purchases raw materials for its processed *Caulerpa* product forms from the farmers, and could subsequently, after the project, be a provider of training and technical services. The intention is for the pilot farms to serve as a learning facility for the farmers in the project community, with all data and results being made available for public use in furtherance of the broader project goals.

PROJECT STEERING COMMITTEE

A Project Steering Committee (PSC) will be formed to serve as the oversight, advisory, and support body for the project. The PSC will consist of a representative from the Ministry of Agriculture and Rural Development (VN), Ministry of Natural Resources and Environment (VN), , Department of Agriculture (PH), Department of Natural Resources and Environment (PH), Seaweed Industry Association of the Philippines, and SEAFDEC. A representative from WWF-PH and WWF-VN and a member of the WWF GEF Agency team will hold an “observer status” in the Project Steering Committee. The PSC is responsible for approving annual work plans and budgets and reviewing and approving any changes to the project strategy alongside WWF GEF Agency. The PSC will be invited to a (virtual) annual reflection workshop (see M&E section) to discuss the theory of change and project progress.

WWF GEF AGENCY

WWF-US, through its WWF GEF Agency will: (i) provide consistent and regular project oversight to ensure the achievement of project objectives; (ii) liaise between the project and the GEF Secretariat; (iii) report on project progress to GEF Secretariat (annual Project Implementation Report); (iv) ensure that both GEF and WWF policy requirements and standards are applied and met (i.e. reporting obligations, technical, fiduciary, M&E); (v) approve annual workplan and budget; (vi) approve budget revisions, certify fund availability and transfer funds; (vii) organize the terminal evaluation and review project audits; (viii) certify project operational and financial completion, and (ix) provide no-objection to key terms of reference for project management unit.

2.4 Stakeholder Engagement

This section comprises the summaries of national and local stakeholder consultations carried out in the Philippines and Viet Nam. The Philippines organized a national, provincial-level, and municipal-level consultations. Viet Nam had conducted a national consultation and local consultations. Stakeholders were identified for further discussions and negotiations as to their specific roles in the implementation of the Project

Key stakeholder engagement meetings and workshops are listed in Table 8. The Stakeholder Engagement Plans for the Philippines, Vietnam, and Regional level are submitted with this Project Document in a separate volume.

Table 8 Summary of stakeholder meetings and consultations

Country	Date	Title
Global	20 October 2021	Safe Seaweed Coalition
Regional	6 May, 2021	Kickoff Workshop
Regional	Ongoing	ASEAN Seaweed Industry Club
PH	28 June 2021	National Stakeholder Consultation (virtual)
PH	3 August 2021	Provincial-level Stakeholder Consultation - Palawan (virtual)
PH	3-4 December 2021	Provincial-level Stakeholder Consultation - Zamboanga
PH	8 September 2021	Local Stakeholder Consultation (virtual) – Green Island / Palawan
PH	3-4 December 2021	Local Stakeholders Meetings - Zamboanga
PH	18 Feb 2022	Validation Workshop - Philippines
VN	16 July 2021	National Stakeholder Consultation
VN	28 July 2021	Project Development Meetings (D-Fish)
VN	14-16 December 2021	Local Stakeholder Consultations
VN	16 Feb 2022	Validation Workshop

REGIONAL / GLOBAL

1. Project Kickoff Workshop. A project kickoff workshop took place on 6 May 2021, and included representatives from SEAFDEC, SEAFDEC AQD, BFAR, D-fish, FASPS, the project development team, and WWF GEF. The process for project development was discussed, as well as a workplan with roles.
2. SEAFDEC Program Committee Meeting. The project was presented to SEAFDEC members at the SEAFDEC Program Committee Meeting. The Program Committee recommended that the Project be placed under the ASEAN-SEAFDEC Strategic Partnership (ASSP) to ensure regional participation in relevant activities, region-wide adoption of its results, and continuity of relevant project initiatives. It would also facilitate inclusion of relevant recommendations into ASEAN policy through the ASSP Fisheries Consultative Group, which deliberates on, among others, policy matters and endorse their recommendation to the Senior Officials Meeting of ASEAN Ministers of Agriculture and Fisheries or SOM-AMAF.
3. Safe Seaweed Coalition/ Lloyds Register, London. Safe Seaweed Coalition identified areas of synergy and receive feedback on the project strategy (specifically Component 1, under which the project is developing principles that will build off the Safe Seaweed Coalition guidance). It was agreed that communications will be a key area to amplify project knowledge products. Experts from SSC will be invited to participate in the forums to develop the principles of responsible and safe seaweed aquaculture to the SEA region and the guidelines on the application of the principles to the development of the safety standards, and the development or updating of national industry codes of conduct, and good management practices.
4. ASEAN Seaweed Industry Club. The Club has been identified as a stakeholder, specifically for participation in the Seaweed-Technical Working Group forums to develop two key outputs in Component 1. Discussion with the Chair of the Club is ongoing. Meanwhile, its role in the Project is included provisionally. Club members are national seaweed industry associations designated for ASIC membership by their respective

governments. Current members are industry associations from Indonesia, Malaysia, Philippines, Thailand and Vietnam.

Monthly coordination meetings took place between SEAFDEC, SEAFDEC AQD, BFAR, D-Fish, PH project development team, VN project development team, lead consultant, and WWF GEF.

PHILIPPINES

During project concept stage, the project team had meetings with BFAR National Coordinating Unit-Seaweed Development Program (NCU-SDP), Philippines Foreign Assisted Special Projects Service (FASPs), and Seaweed Industry Association of the Philippines (SIAP). During project development, the project undertook a series of consultations – one with national stakeholders and three with local stakeholders. Most of the consultation meetings, except in Zamboanga, were done virtually. The stakeholders were also requested to complete a questionnaire to supplement information that were obtained through the virtual meetings.

National Stakeholders Consultation. The project preparation team hosted an online National Stakeholders Consultation on 29 June 2021. Forty-seven participants representing 17 stakeholders attended, including government policy, regulatory and management agencies (6), academic and research and development institutions (4), NGOs and Social Enterprises (2), Processing and trading enterprises (4), and the Seaweed Industry Association of the Philippines (1). Participants identified numerous challenges to the seaweed industry, including: diseases and pests (lack of biosecurity measures); declining productivity/yields of seaweed farms due to low quality seed, farm practices, and technologies; in terms of seaweed products – many products are low value, there is a lack of diversification in seaweed products, and this is linked to limited markets; environmental/natural challenges related to climate change and other environmental threats, biodiversity considerations (e.g. dugongs can get caught in nets), and potential introduction of alien species. Participants suggested that the project consider the following during project design: support for a more productive technique and higher quality RDS; support for reliable and year-round supply of quality propagules; enhance farmers' entrepreneurial skills; support for improved and more affordable financial services such as loans bundled with index-based insurance; and support for the development, production and marketing of new or higher value seaweed products.

In Roxas, Palawan, one provincial and two local stakeholders' consultations took place. Provincial-level stakeholders agreed to the rationale of selecting Roxas, Palawan as a site for the project, given that it has existing seaweed farms and a well-developed cooperative. The provincial-level stakeholders noted a number of key considerations for the project design: viability of farming techniques, post harvest, value adding, siting of farm in the designated zone, and a site management plan.

The local Stakeholders Consultations in Roxas, Palawan included seaweed farmers, traders, officers of the Northern Palawan Fishers Cooperative (NPFC), and representatives from the provincial, city, and municipal government. Two activities were conducted: a SWOT Analysis of the local seaweed industry on Green Island and in the municipality of Roxas, and a resource mapping exercise to verify the location of the proposed project site (initially identified by the Northern Palawan Fishers Cooperative) and to obtain basic data on the areas currently used for seaweed farming and trading. Three key constraints were highlighted: (a) lack of proper drying facility; (b) lack of capacity to address impacts of diseases and epi/endophytic infestations; and (c) lack of quality propagules or seedstocks. Nine threats were identified three of which directly concern the local seaweed industry and these are (a) disease and pest infestations; (b) adverse weather condition; and (c) grazing by fish and turtles. The local seaweed industry may also be

threatened if the demand for carrageenan from the Philippines drops because of reports of presence of microplastics in the exported carrageenan products. There is also no electricity connection on Green Island, which will be considered if the project plans to put up a facility that would require electricity. Green Island is also a nesting site of sea turtles and “dugong” (*Dugon dugong*), which should be protected and their habitat enhanced/improved with the expansion of seaweed farming offshore.

The stakeholders meeting in the second site, Zamboanga City, Zamboanga del Sur took place on December 3. The Project’s Lead National Consultant met with three BFAR Region IX officers, two local government unit officials from the Office of the City Agriculturist, and one farmer, the president of the Aplaya Buenavista Seaweed Farmers Association, (Buenavista is the district of Zamboanga City which has jurisdiction of the site of the BFAR demonstration project), and the BFAR Regional Director, who is in charge of the demonstration project. Key information on the BFAR project, the beneficiaries, and the status of seaweed farming in Zamboanga City were provided by the persons met. Most important was arriving at an understanding of the role of the Blue Horizon Project in the BFAR demonstration project, which were further clarified and expressed in concrete terms in subsequent meetings.

A validation workshop was held on 18 February 2022 joined by 66 participants from government agencies, provincial and municipal local government units, intergovernmental agency, non-government organizations, and cooperative officers. These key points were discussed: ensure no conflicts will be caused in the farm site; ensure protection of wildlife especially the iconic species; ensure that there is no child labor in connection with the project operation as well as in the community. No problem was foreseen with biomass production, but a decision regarding bankable business models may take time. Assurance of a ready supply of seedling to start a new crop was highlighted by the impact of the recent typhoon that destroyed standing crops and the lack of a ready source of seedlings from the province. In this regard the project will add the establishment of a nursery to its activities.

In addition to the above, multiple meetings and correspondence took place with Coast4C and Brabender to discuss the possibility of partnership and the institutional arrangements and strategy for it. It was decided that Coast4C would be a project partner, undertaking capacity building in best practices and provision of services to organized farmers. In addition, Brabender would be included as a potential provider of a biorefinery solution for pilot testing in Roxas; it may be selected during project execution if a number of conditions and criteria are met.

A stakeholder engagement plan has been designed that includes engagement with national government agencies, provincial and municipal agencies and organizations, private industry, academic and R&D institutions, community-based organizations, and farmers’ associations.

VIET NAM

National Stakeholders Consultation (and follow up meetings with D-Fish and other organizations). A National Stakeholder Consultation Workshop was held on 16 July 2021 joined by 31 representatives of companies, institutions, Universities and local authorities of provinces. Among the issues taken up were the selection of sites and species for culture, opportunities for participation in project development and execution. A critical issue was the definition of offshore. Depending on the situation, the demonstration farm should be sited not very far from the shore, in waters as deep or deeper than 10 meters. It was agreed that a business model or models be identified to develop the value chain for certain products based on market studies. Three possible species were named: *Kappaphycus* spp for carrageenan,

Gracilaria spp for agar, and *Caulerpa* sp for food. There is a need to support seed improvement and promote good farming practices and new technology, preferably through the aquaculture associations. The private sector favors the development of industrial scale farms in offshore areas. The Vietnam Seaculture Association, during the consultation and in discussions with the president before that, expressed its support to the project and was advocating industrial scale seaweed farming in the areas where windfarms are located, which is offshore.

Meetings with D-Fish. The project development team consulted D-fish. Project sites were shortlisted to the provinces of Khanh Hoa, Binh Thuan, Ninh Thuan, Hai Phong/Quang Ninh. It was agreed that a national seaweed development plan should be developed, that a national seaweed development plan should be formulated to contribute to Marine Spatial Planning, application of MSP at the provincial level should take place to inform the provinces' Socio-economic Development Plans should be considered, and the Project should help identify the potential areas for seaweed aquaculture and provide guidelines for the development of the value chain for seaweed cultured in an industrial scale. The plan must be consistent with the socio-economic plans of the provinces.

Local Stakeholders Consultations. From 14 to 16 December, two members of the PPG team of Viet Nam conducted five in-person meetings with stakeholders at the provincial and commune and ward levels in the provinces of Ninh Tuan and Khanh Hoa. There was unanimous acceptance of the project among the stakeholders that included provincial officers of the Department of Agriculture and Rural Development, Aquaculture Department, representatives of other government agencies, and district, commune/ward officials, owners of seaweed enterprises (farming, processing and trading), seaweed farmers, and members of women unions and farmers unions. The meetings confirmed the sites for the demonstration farms and the species (*Kappahycus* sp and *Caulerpa* sp) and identified potential collaboration with private seaweed enterprises.

Commune stakeholders, Phuoc Dinh. A meeting took place with stakeholders at the commune level: Phuoc Dinh Commune in Thuan Nam district, Ninh Thuan Province. The vice chair and another official of the commune, six seaweed (*Kappaphycus* sp) farmers, a member of the Farmers' Union, a member of the Women's Union and a representative of a trading company (Hoa Trinh Co) took part in the consultation.

Consultations also took place with the Aquaculture Department of the Province of Khan Hoa. The Aquaculture Department confirmed that Khanh Hoa has good conditions for seaweed farming, include *Kappaphycus* and *Caulerpa* species, and that aquaculture is in competition with other sectors for space, especially tourism. A constant challenge is market price fluctuation. The project met with the owner of the local *Caulerpa* seaweed farming and processing company, Tri Tin Company. Tri Tin Co noted that they plan to pilot test some farming models, and support the idea to establish a seaweed farmers' association or cooperative in the ward or district.

Farmers and officers of Ninh Hai Ward (14 participants including 2 women), as well as the commune authorities and the Tri Tin company, were very supportive of the idea to establish a sustainable seagrape supply chain. Major challenges noted include: (1) market price, (2) farming techniques need more improvement, (3) diseases that include worm-seaweed and an as yet unknown disease. Occasionally, low salinity of the culture water particularly during the rainy season. Women participation in seagrape farming is 60%, mostly in harvesting and post-harvest handling.

The validation workshop in Vietnam on 16 Feb 2022 was joined by 42 participants from D-Fish, WWF, officers of the DARDs in four provinces that include the two where the project farms will be sited, officers of the sub-departments of aquaculture of the same four provinces, Agriculture Extension Center of Khanh Hoa, sub-department of rural development of Khanh Hoa, RIA3, RIMF, GIZ, two private seaweed companies, Viet Nam Seaculture Association, and seaweed farmers from the project sites.

There was unanimous agreement to the seaweed proposal for Vietnam although there were suggestions to add other species and set up more pilot farm sites in four other provinces. It was pointed out that the post project plan is to outscale the results to these other seaweed growing provinces and that the project will be sharing the lessons and guidelines generated by the project to all these provinces. The suggestion was made to reduce the number of staff and use the “savings” to bolster some activities such as the development of farming systems models, establishing cooperatives, and more activities on technology transfer. The need to assure adequate supply of high quality seedlings was reiterated. In this regard the meeting strongly endorsed the activity to establish a seedling nursery with the Seedling Center taking the lead role. Engaging the private sector in activities to improve the seaweed value chain was likewise emphasized. The recommendation was for the cooperatives established under the project to develop strong linkages with private industry.

2.5 Gender

In accordance with the GEF’s Policy on Gender Equality and the WWF Gender Policy, a Gender Analysis and Action Plan was developed during project development to ensure inclusion of gender aspects throughout all components of the project. Given the different gender profiles and activities at the regional and national level, two detailed Gender Analyses and Action Plans were developed, one for the Philippines and one for Viet Nam. The gender analyses are summarized below. A higher-level gender analysis and action plan was conducted for the regional components (Component 1 and 4) and will be overseen and implemented by SEAFDEC.

The gender analyses and action plans are contained in a separate volume that accompanies this Project Document.

REGIONAL GENDER ANALYSIS

At the Regional level, the key institutional context is SEAFDEC’s Gender Strategy.³⁰ This Strategy was approved by the SEAFDEC Council at its 51st Meeting in March 2019. The goal is for SEAFDEC to be gender-responsive and gender-sensitive in pursuing sustainable development and management of fisheries and aquaculture in Southeast Asia. This will be achieved by mainstreaming and integrating gender perspectives into the SEAFDEC organization, and in its *programs, projects, and activities* to ensure that men, women, and youth at all levels, access equitable benefits in the sustainable development and management of fisheries and aquaculture. Directly relevant to the Gender Action Plan of the Project is

³⁰ SEAFDEC. (2019). *SEAFDEC Gender Strategy—Mainstreaming gender in SEAFDEC and its programs*. Southeast Asian Fisheries Development Center. Bangkok, Thailand.
<http://repository.seafdec.org/bitstream/handle/20.500.12066/4861/Gender%20Strategy.pdf?sequence=1&isAllowed=y>

strategy “2.2. Integrate gender perspectives throughout the cycle of gender-sensitive programs and projects...,” which includes the following action items:

1. Incorporating the conduct of gender analysis in the baseline surveys of project sites to understand the gender conditions that require interventions
2. Providing appropriate interventions to ensure equal opportunities to male and female stakeholders in accessing and receiving benefits from fishery resources, information, financial sources, and capacity building opportunities
3. Promoting equitable participation of male and female stakeholders in the implementation of programs and projects where applicable
4. Collecting and compiling sex-disaggregated data throughout the implementation of programs and projects
5. Conducting impact analysis of the program and project interventions to male and female stakeholders
6. Integrating gender perspectives when disseminating the results from programs and projects

PHILIPPINES GENDER ANALYSIS

At the national level, the Magna Carta of Women provides a framework of rights of women based on international law that *“seeks to eliminate discrimination through the recognition, protection, fulfillment, and promotion of the rights of Filipino women, especially those belonging in the marginalized sectors of the society.”* It is a fulfillment of the government’s commitment to the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) and to the UN Human Rights Council.

The Bureau of Fisheries and Aquatic Resources of the Department of Agriculture (DA-BFAR) spearheads the mainstreaming of gender considerations into program/projects/activities for the fisheries and aquaculture sector, in coordination with the Philippine Commission on Women (PCW). The Gender and Development (GAD) focal point committee is responsible for formulating the roadmap for GAD mainstreaming of BFAR. In 2012, BFAR published the Gender and Development (GAD) Checklists for the Fisheries Sector which covers the following components: fisheries and coastal resources conservation and management programs, livelihood and food security, research, and training.

A gender analysis of the seaweed industry revealed some gaps in the promotion of women’s rights across the value chain. Seaweed farming is primarily a family enterprise, hence, women and men (i.e., husband and wife) participate actively at all stages of seaweed production and trade. However, women continue to be constrained by social norms such that their involvement is interpreted as an extension of their household duties rather than a form of economic participation. Seaweed farms are owned by both husband and the wife but there is a need for continuous effort to ensure that women are equally involved in decision-making process and that they are able to achieve equal access to resources (e.g., credit, information). Women are also able to participate in organizations, even being elected as officers. However, there is a need to ensure that this participation is not considered simply as an extension of their reproductive responsibilities, serving as representatives of their husbands when they are not able to attend meetings or community activities because they are working in the farm.

Analysis of national and local conditions revealed some context-specific gender gaps that need to be addressed in order to make the project more inclusive. In this connection, gender mainstreaming efforts should focus on the following areas that constrain the attainment of gender parity.

- Social norms influence men and women’s perspectives, practices, and decisions. This negatively impact women more than men resulting to a multitude of issues concerning power dynamics in households.
- The seaweed value chain continues to be male-dominated, especially at the production stage. Though women were reported to be actively involved at all stages of seaweed production, their involvement is considered as an extension of their reproductive roles. In turn, women are at risk of becoming invisible in the formal labor sector.
- Women’s participation in the decision-making process needs to be further investigated to determine the extent to which women are involved in making decisions at various aspects of their livelihood. There is also a need to ensure that women are able to voice out their concerns, based on their perspective and personal understanding of issues, and that they are not simply echoing the concerns of their husbands or any male member of the family.
- Women and men have varying degrees of access to resources and services. Women are often at a disadvantaged because the ownership of the seaweed farms are less likely to be associated to them because of the patriarchal nature of the society.
- In order for the project to be gender sensitive and responsive, stakeholders need to be able to identify, acknowledge, and understand the implications of differences and inequalities between women and men and use this as basis for designing strategies that are able to address the different needs, interests, capacities, and contributions of women and men. A gender sensitivity training or orientation for the stakeholders is needed to ensure that gender is properly mainstreamed throughout the project cycle.

The analysis suggests that for the project to be gender sensitive and responsive, stakeholders need to identify, acknowledge, and understand the implications of differences and inequalities between women and men and use this as basis for designing strategies that address the different needs, interests, capacities, and contributions of women and men.

VIET NAM GENDER ANALYSIS

In Viet Nam, the main policy framework related to gender mainstreaming is the Law on Gender Equality. It mandates Government bodies to fulfill their responsibilities on gender equality and ensure that violations are addressed. Guidance documents and implementing decrees delineate the responsibilities of each agency or organization for implementation of the Law. This includes targeted policies and measures such as the National Strategy on Gender Equality, the Action Plan on Gender Equality as well as the introduction and/or revision of other legislation vital to the promotion of gender equality and the protection of women’s rights and interests. The National Strategy on Gender Equality (2021-2030) includes two objectives pertinent to the project: *Increasing the rate of female employees engaged in paid work to 50% by 2025 and to approximately 60% by 2030*; and *Reducing women’s average hours of housework and domestic care without wage to 1.7 times in 2025 and 1.4 times in 2030 compared to men*.

The Strategy notes that in Viet Nam, the common notion is women are secondary earners and men the breadwinners. The gender earnings gap is estimated to be 35.2 percent in rural areas. Meanwhile, the pandemic has contributed to a reduction in working hours for women and loss of jobs.

Viet Nam has witnessed steady progress in women entrepreneurship as it ranked 10th in Asia and 25th globally in 2020 on the proportion of female participation in entrepreneurial activities. Nevertheless,

women tend to face greater vulnerability and disadvantages due to low levels of financial and digital literacy, lack of opportunities for capacity development, and discriminatory socio-cultural norms. The Law on Support to SMEs (2017) provides preferential measures for women-owned SMEs. In cases where SMEs are eligible for state support, priority is given to women-owned SMEs or SMEs employing more women. In September 2019, the government issued Circular 5 on training incentives for women-owned SMEs.

Relevant findings from the 2012-15 study by the *Institute for Social Development Studies on the Social Determinants of Gender Inequality in Viet Nam*³¹ include:

- Traditional rigid gender perceptions towards men and women's values and roles are the underlying causes of gender inequality. The value of the role of family caregiver assigned to women is still firmly sustained in the minds and behaviors of men and women across all social strata.
- Gender inequality in education is partly caused by the prescribed caregiver role of women in the family. Women have significantly lower levels of education compared to men.
- More than 20% of women (covered by the survey) did not work because of household chores, compared to 2% of men.
- Domestic work remains women's main responsibility. Women undertake 12 out of 14 tasks ranging from cooking to caring for senior or sick family members. Men primarily undertake one to two tasks like fixing of household appliances, and contacting local authorities.

As part of the project's gender analysis in Viet Nam, survey and focused discussions were undertaken. Results showed that in seaweed farming roles, men perform activities at sea for transport, care of the crop, and security (particularly at night). Men are mainly responsible for seed selection, while both men and women decide on the selling price and who to sell the harvest to, although women have a greater role on these two matters. Women are wholly in-charge of housework, family arrangements, ceremonies, as well as most of the family healthcare and children's schooling. In the localities some jobs are preferably given to men, particularly paid work. However, some women also work on seed selection and care of the crop at sea. Both men and women take part in community activities and commune meetings. Because the men usually work at sea, their participation in community activities is limited.

Some seaweed farming households hire temporary workers, of which women account for 50-60%. Women work onshore doing cutting, tying seedlings, harvesting, and drying. The men bring seaweed to the culture site, use boats to stake poles, harvest the crop and transport the harvest to shore. Men's daily wage is 20% higher than that of women.

The pre-processing and processing segments of the seaweed value chain in Viet Nam are recent and mostly small scale. Most of the seaweed companies started as household businesses and a few grew to limited companies. 66.7% of the surveyed businesses – mostly SMEs – are led by women. Women workers in those companies accounted for 80-90% of the labor force, mainly working on tasks such as drying, sorting out the seaweed by quality, removing impurities, washing, weighing and packing. The men workers carry raw materials and finished products and operate equipment. Still, the men are paid more than the women workers. Because seaweed cropping is seasonal, the workers have a seasonal contract.

³¹ [https://investinginwomen.asia/knowledge/social-determinants-gender-inequality-Viet Nam/](https://investinginwomen.asia/knowledge/social-determinants-gender-inequality-Viet-Nam/)

More than 62% of the seaweed households have a woman joining the Women's Union. The Union promotes awareness raising on gender inequality, domestic violence as well as provides microfinance service to members.

GENDER ACTION PLAN

Based on the gender analyses conducted for the project, a Gender Action Plan was developed for Philippines and Viet Nam, and the regional level under SEAFDEC (SEAFDEC Gender Action Plan is included in Table 9, a Gender Analysis and Gender Action Plan was developed for Philippines and Viet Nam and is included in the submission package as a separate document). Under SEAFDEC's Gender Strategy, the SEAFDEC Secretariat, with PMU's advice, will include in the agenda of the yearly Programme Committee and Council of Directors meetings a session on the project's GAP; initially, to promote awareness of the GAP among the members of these bodies and subsequently to report on the status and request appropriate action, as needed, in support of the Plan.

The PMU based in SEAFDEC will be responsible for implementing gender-specific activities under Component 1 and Component 4. The gender focal points of AQD and Training Department (TD) will support the PMU. The PMU will be responsible for working closely with the N-PMU in Philippines and Viet Nam to ensure strong collaboration, sharing of lessons and experiences, and overall monitoring and reporting to improve learning and outcomes on gender mainstreaming in this project. In Philippines and Viet Nam, the Gender Action Plan will be executed by a Gender and Safeguards Specialist recruited to the N-PMU. Budget has been allocated for gender-specific activities.

Table 9 Gender Action Plan - summary

Output	Gender-Specific Activity	Indicator & Target	Responsible
Component 1: Regional approach and capacity for seaweed value chains in SEAsia			
1.1.1. Regional Seaweed Technical Working Group, constituted and formally mandated by SEAFDEC Governing Council	<ul style="list-style-type: none"> The project will promote equitable participation of men and women in the working group The ToR of the Seaweed Technical Working Group will include gender-specific considerations 	<ul style="list-style-type: none"> At least 50% of the Regional Seaweed Technical Working group is women The ToR includes specific gender-sensitive consideration 	SEAFDEC PMU (and SEAFDEC AQD and TD)
1.1.2: Guide to Promoting a Sustainable Seaweed Industry in the SEA Region, endorsed by the SEAFDEC Governing Council	Gender will be mainstreamed throughout the Guide, with recommendations and action items for mainstreaming gender in the SEA seaweed industry	Guide is developed with gender-sensitive considerations throughout.	SEAFDEC; consultant writing the guide (with the Gender focal points in AQD and TD).
1.1.3. Principles and toolkit for safe seaweed applicable to	Gender-responsive standards will be included, with the toolkit	Principles and toolkit are gender sensitive.	Focal points of AQD and TD, BFAR's GAD Committee, Gender

SEAsia, aligned to the Safe Seaweed Coalition principles	providing a guide for application of the Principles.		officers of PH and VN N-PMU
1.1.4. Training modules and information packages to support a sustainable seaweed industry in the SEAsia	Training modules and information packages will include specific components on gender, this will support implementation of the actions above	<ul style="list-style-type: none"> At least 60% of participants attending the trainings are women Gender-responsive training module 	SEAFDEC PMU (and SEAFDEC AQD, facilitators develop and conduct the trainings)
Component 4: Knowledge Management, M&E, and IW Learn (regional)			
4.1.1: Participation in two IW:LEARN regional meetings and two IW Conferences, delivering IW:LEARN experience notes	Project lessons learned and best practice related to gender will be documented and disseminated in through IW: LEARN project	<ul style="list-style-type: none"> Specific lessons and best practices related to gender documented and included in at least 2 products 	SEAFDEC PMU (and through communications consultant), Philippines coordination unit, Viet Nam coordination unit
4.1.2 Knowledge management and communications products	The project will develop and publish communication products related to gender. This includes lessons learned, best practices, and other information gleaned from the project and that could support scaling up of gender equality and women's empowerment in the SEA seaweed industry.	<ul style="list-style-type: none"> Communication platform and products are gender-sensitive Information is disseminated in an equitable way (to ensure women and men have equal access) 	
4.2.1: Monitoring and Evaluation reports (including project progress reports, midterm evaluation, terminal evaluation)	<ul style="list-style-type: none"> The PMU and project partners will collect sex-disaggregated data at regional and national level Progress against the Gender Action Plan will be assessed through project reporting requirements (PPR, midterm and final evaluations) The project will report against gender-specific indicators annually 	<ul style="list-style-type: none"> Monitoring against gender-disaggregated or gender-specific indicators Project reports include information on progress towards GAP goals 	SEAFDEC PMU, Philippines coordination unit, Viet Nam coordination unit

Progress against the Gender Action Plan will be tracked through the following indicators:

- GEF Core Indicator 11: Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment (11,000 women, 4,000 men)
- Women empowerment
 - Increase in the number of women in leadership and management roles in farmers' associations/cooperatives

- Number and type of value chain upgrading initiated and operated by women
- Number of women participating actively in the development of management plans
- Access to equitable resources
 - Decrease in disparity of men and women's wages in the production and processing segments.
 - % of women across the whole project (compared to baseline data), who now have access to or acquire:
 - Financing, resources, opportunities, capacity building
 - Higher income from value adding enterprises
 - Skills in enterprise planning and management

Progress will be assessed through surveys, supported by qualitative assessments.

2.6 Safeguards

The Project will Comply with WWF's Environmental and Social Safeguards Framework (ESSF), as detailed in the Environmental and Social Safeguards Integrated Policies and Procedures (SIPP). The Project has been categorized as Category "B" given that it is essentially a conservation initiative, expected to generate significant positive and durable social, economic, and environmental benefits. Any adverse environmental and social impacts are expected to be minor and site specific and can be mitigated.

Safeguards mitigation plans have been prepared for both Viet Nam and the Philippines. For Viet Nam, an Environmental and Social Management Framework (ESMF), including a Process Framework (PF), has been prepared. For the Philippines, an ESMF, including a PF and an Indigenous Peoples Planning Framework (IPPF), has been prepared. These ESMFs define procedures for managing the project activities' potential environmental and social risks and impacts.

The Project is required to comply with WWF's Standard on Environmental and Social Risk Management, the Standard on Grievance Mechanisms, and the Standard on Stakeholder Engagement. The following standards below have been considered and if necessary, triggered.

Standard on Protection of Natural Habitats: This standard has been triggered as the project will support the creation for four seaweed demonstration farms, which will include small scale infrastructure and planting of seaweed propagules. No invasive species will be used. There is also the potential that the infrastructure could lead to marine mammal entanglement. Measures to avoid, minimize, and/or mitigate these risks to natural habitats have been incorporated into the ESMFs for both Viet Nam and the Philippines.

Standard on Restriction of Access and Resettlement: This standard has been triggered because the project will support marine spatial plans / provincial seaweed development plans for target sites. These development plans may include marine zoning restrictions, which might restrict access to fishing or other traditional uses. However, by making offshore farms, there should not be the same level of tenure issues as near-shore farms. The sites will be placed somewhere that avoids or minimizes access restriction. For both Viet Nam and the Philippines, the Process Framework, as part of the ESMF, details the mitigation measures for access restriction.

Standard on Indigenous Peoples: As a precautionary approach, this standard has been triggered as there are Indigenous Peoples present in the project areas for the Philippines. Local stakeholder meetings showed that there are two classifications of residents on Green Island, Roxas – local residents (those born and raised on Green Island) and migrants (i.e., residents who came from other provinces or municipalities in Palawan). The Cuyunon is the largest ethnic group residing on Green Island (originally from the municipality of Cuyo in Palawan) and are also involved in seaweed farming. The Cuyunons are identified as one of the indigenous groups in Palawan, but unlike the other ethnic groups, they are well-integrated into communities and the whole province (i.e., have adopted the national system of governance). They have also become less and less distinguishable because they have long intermingled with residents from other municipalities in Palawan. In the two demonstration sites in Viet Nam, no indigenous peoples are present. An IPPF will be prepared as part of the ESMF for the Philippines.

Standard on Community Health and Safety: This standard has been triggered. Under Component 3, there will be four demonstration offshore seaweed farms. This might bring additional challenges like ensuring workers' wellbeing in demanding environments. Protecting the safety of employees and infrastructure might be challenging in difficult conditions and remote areas that are harder to reach and monitor from land. Mitigation measures to avoid or minimize these risks have been incorporated into the ESMFs for Viet Nam and the Philippines.

Standard on Pest Management: Seaweed farming does not require any inputs (pesticides), therefore the project is not expected to contribute to pesticide use or other relevant chemicals and this standard has not been triggered.

Standard on Cultural Resources: This standard is not triggered as the project is highly unlikely to have an impact on cultural resources.

Two Safeguards Officers will be hired for the Project; one in the N-PMU in Viet Nam, and the other in the N-PMU in Philippines. The Safeguards Officers will implement the ESMFs and conduct compliance monitoring, supervision, and reporting. The EAs will implement the ESMFs and associated monitoring, and where there might be gaps in capacity, the Safeguards Officer will build capacity through trainings and collaboration.

A project-level grievance mechanism will be developed in the first six months of implementation for both Viet Nam and the Philippines, in line with the guidance and principles established in the ESMFs. The WWF GEF Agency's grievance mechanism will be available throughout the project lifecycle, and accessible to stakeholder and project-affected peoples.

The final ESMFs (including PFs and IPPF) and the Stakeholder Engagement Plans (SEPs), will be disclosed on the websites of the EAs for a 45-day public disclosure period and final documentation will be disclosed in country in a locally accessible manner for at least 45 days in order to issue the Safeguards Compliance Memo prior to Agency Approval.

2.7 Monitoring & Evaluation

The project monitoring and evaluation plan has been developed in coordination with various stakeholders. In Philippines, this included the FASPS, BFAR, Coast4C, Local Government Units of Palawan

and Zamboanga City, and the U.P. Marine Science Institute. In Viet Nam, this included D-Fish, DARD of Khan Hoa and Ninh Thuan, Peoples Communes in the identified project areas, and some entities in the private industry. US\$ 331,757 has been budgeted for M&E.

The Project will be monitored through the Results Framework (Appendix 6). The Results Framework includes 1-2 indicators per Outcome. The baseline has been completed for each indicator along with feasible targets, set annually where relevant. A methodology for measuring indicator targets is provided. Indicator targets are Specific, Measurable, Achievable, Relevant, and Time-bound (SMART), and disaggregated by sex where applicable. Component 4 of the Results Framework is dedicated to M&E, knowledge sharing and coordination.

Relevant Core indicators have been included to provide a portfolio level understanding of progress towards the GEF Global Environmental Benefits (GEBs).

The PMU will have several staff responsible for M&E: The Project Manager/Technical Advisor will be responsible for completing project progress reports and ensuring that the project M&E plan is implemented to WWF and GEF standards, on time to meet reporting deadlines and of the highest possible quality. The Project Manager/Technical Advisor will also oversee the collaborative production of annual project work plans (with the N-PMUs) and their implementation. The Financial and Administration Officer is responsible for preparing and delivering the quarterly project-level financial reports included in the M&E plan. An M&E Specialist will provide technical assistance in gathering, compiling and analyzing data for the annual results framework tracking, and providing advice to the Project Manager/Technical Advisor to improve the results, efficiency and management of the project.

The national project management officers and project field staff will be directly responsible for collecting and compiling data at the national level and submitting these to the SEAFDEC PMU for consolidation and analysis.

The following is a summary of project reports:

Table 10 M&E reporting

M&E/ Reporting Document	How the document will be used	Timeframe	Responsible
Inception Report	<ul style="list-style-type: none"> Summarize decisions made during inception workshop, including changes to project design, budget, Results Framework, etc. 	Within three months of inception workshop	PMU Project Manager/Technical Advisor and M&E Officer
Annual Work Plan and Budget (AWP&B)	<ul style="list-style-type: none"> Plan activities and budget for each project year 	Annual	PMU Project Manager/Technical Advisor
Quarterly Field Report	<ul style="list-style-type: none"> Inform PMU PM on progress, challenges and needs of activities in field. 	Every three months	N-PMU
Quarterly Financial Reports	<ul style="list-style-type: none"> Assess financial progress and management. 	Every three months	PMU F&A officer N-PMU
WWF Project Progress Report (PPR), annual	<ul style="list-style-type: none"> Document project progress Inform management decisions and drafting of annual workplan and budget; 	Every six months	PMU Project Manager/Technical Advisor, N-PMU

Results Framework and workplan tracking.	<ul style="list-style-type: none"> Share lessons internally and externally; Report to the PSC and GEF Agency on the project progress. 		
Project Closeout Report	<ul style="list-style-type: none"> Based on the format of the PPR Summarize project results and overall outcomes to the PSC and GEF Agency. 	One month after technical close	PMU Project Manager/Technical Advisor
Mid-term Project Evaluation Report	<ul style="list-style-type: none"> External formative evaluation of the project; Recommendations for adaptive management for the second half of the project period; Inform PSC, GEF and other stakeholders of project performance to date. 	Midterm	External expert or organization
Terminal Project Evaluation Report	<ul style="list-style-type: none"> External summative evaluation of the overall project; Recommendations for GEF and those designing related projects. 	Before project completion	External expert or organization

Independent formal evaluations have been budgeted and will adhere to WWF and GEF guidelines and policies. The Midterm Evaluation will be conducted within six months of the midpoint of the project and the Terminal Evaluation will be completed before the official close of the project. The evaluations provide an opportunity for adaptive management as well as sharing of lessons and best practices for this and future projects. The Operational Focal Point will be briefed and debriefed before and after the evaluation(s) and will have an opportunity to comment on the draft and final report.

An annual reflection workshop has been budgeted for the PMU, with other stakeholders, to review project progress and challenges to date, taking into account results framework tracking, work plan tracking, stakeholder feedback and quarterly field reports to review project strategies, risks and the theory of change (ToC). The results of this workshop will inform project decision making (i.e., refining the ToC, informing PPRs and AWP&Bs).

2.8 Budget

Table 11 Summary budget by Component, Partner

	SEAFDEC	BFAR (Philippines)	D-Fish (Viet Nam)	Total (\$)
Component 1	763,330			763,330
Component 2	128,363	378,438	905,191	1,411,992
Component 3	264,617	1,574,133	\$1,072,030	2,910,780
Component 4	420,835	116,000	91,350	628,185
PMC	285,714			285,714
Total	1,862,860	\$2,068,570	\$2,068,570	6,000,000

Table 12 Co-financing

Sources of Co-financing	Name of Co-financier	Type of Cofinancing	Investment Mobilized	Amount (\$)
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GEF Agency	WWF US	In-Kind	Recurrent Expenditure	720,000
GEF Agency	WWF US	Grant	Investment Mobilized	3,584,825
Civil Society Organization	Safe Seaweed Coalition	In-Kind	Recurrent Expenditure	300,000
Civil Society Organization	Safe Seaweed Coalition	Grant	Investment Mobilized	200,000
Civil Society Organization	Coast 4C	In-Kind	Recurrent Expenditure	300,000
Civil Society Organization	Marine Environment and Resources Foundation, Inc. (MERF)	In-Kind	Recurrent Expenditure	50,000
Civil Society Organization	Marine Science Institute	In-Kind	Recurrent Expenditure	20,000
Private Sector	Brabender GmbH & Co.KG	In-Kind	Recurrent Expenditure	300,000
Private Sector	Tri Tin Company	In-Kind	Recurrent Expenditure	10,000
Private Sector	Tri Tin Company	Grant	Investment Mobilized	562,608
Recipient Country Government	Directorate of Fisheries, Viet Nam	In-Kind	Recurrent Expenditure	1,000,000
Recipient Country Government	Bureau of Fisheries and Aquatic Resources Office IX (BFAR)	In-Kind	Recurrent Expenditure	1,658,836
Recipient Country Government	Bureau of Fisheries and Aquatic Resources Office	In-Kind	Recurrent Expenditure	219,360
Other	Southeast Asian Fisheries Development Center (SEAFDEC)	In-Kind	Recurrent Expenditure	600,000
Total Co-financing				9,525,629

3.1 Incremental Cost Reasoning and Global Environmental Benefits

The project will build off a baseline of private sector, government, academic, and NGO initiatives to strengthen and support scaling up of the seaweed value chain.

BASELINE

- Global initiatives – various private sector actors are driving seaweed value chains. The Global Safe Seaweed Coalition is working with a range of stakeholders to establish standards (e.g. for food, environmental and workers’ safety) to help standardize the seaweed sector.
- Regional initiatives - SEAFDEC helps coordinate member states and facilitates information on various research programs and technologies (including for seaweed). The South China Sea SAP also provides an important baseline from which the project can build.
- National – Philippines and Viet Nam have various initiatives to strengthen seaweed farming and have seaweed associations (or aquaculture associations with seaweed now prominent in their portfolio such as the Viet Nam Seaculture Association). The Project will build on the following initiatives:
 - Initial results of research and development to develop seed stock that are resistant to diseases and ongoing efforts to develop seed stock tolerant to higher sea temperature.
 - National efforts to further improve seaweed farming practices and promote adherence to (in the Philippines) national standards of good seaweed aquaculture practice and product (raw dried seaweed) quality.
 - Ongoing research and technology development in the Philippines on the production of bio-stimulants (fertilizer), bio-pharmaceuticals and other higher value products.
 - Technology development involving a foreign technology company and a Philippine university and another local company aimed at producing pellets with a facility that can be operated at the community or site level, the pellets being raw materials for the manufacture of bio-plastic packaging and other products which can then, after use, be degraded and processed into fertilizer.
 - In Viet Nam, the expansion in the production and local demand of the food species, *Caulerpa lentillifera* is being promoted. It is now being cultured in degraded shrimp ponds. It has a high market value in domestic markets and a good prospect for export of processed product forms. The cropping cycle is also short i.e. around 30 days.

Other initiatives at the regional and national levels to which the Project will contribute includes:

- Regional and national climate change policies and action plans.
- Coastal resources management policies and projects on biodiversity conservation, mitigation of pollution of marine waters, and improved productivity of aquaculture and fisheries.
- Regional and national strategies to promote the sustainable development of the marine resources guided by the concept of Blue Economy.
- Marine biodiversity conservation or enhancement.

ALTERNATIVE SCENARIO

With GEF financing, the project will build on the above-described baseline to (1) accelerate seaweed farming in Philippines and Viet Nam (as well as regionally through knowledge sharing and eventually a broader-scoped technical cooperation), thereby supporting seaweed farmer livelihoods resilience and community development, (2) bring investment to biorefinery solutions for new and existing seaweed products. The biorefinery solutions will be localized (e.g. near seaweed farming communities), which will generate new sources of income and additional jobs. In addition, the new products will encourage greater uptake of seaweed biomass upstream; (3) promote better practices for seaweed farming and seaweed value chains through the Safe Seaweed Coalition and trainings/toolkits.

GEF finance allows the project to provide the technical assistance to governments and the seaweed industry sector in general to:

- Build an enabling environment for sustainable seaweed farming with inputs to the policy and practice of marine spatial planning, zoning, and seaweed culture area management.
- Boost the seaweed aquaculture development strategies with the range of knowledge to be generated and shared by the project from siting, site management, good aquaculture practices, post-harvest practices and technology, value addition, and development of value chains for seaweed products.

The environmental benefits to which the project will contribute are:

- Reduced pollution load in coastal waters by assimilation of nutrients, such as N and P.
- Reduced acidification and deoxygenation of marine waters
- Sustained coastal and marine ecosystems goods (i.e. coral reefs, marine life that constitute the various trophic levels) and services (such as provision of breeding places and shelter to marine life), and maintained capacity of natural systems to sequester carbon.
- Maintenance or improvement of the conditions for marine biodiversity
- Increased ecosystem resilience

Overall, the project will strengthen blue economy opportunities while also addressing pollution reduction. Seaweed captures nitrogen, phosphorus, and carbon which helps reverse or mitigate eutrophication, supporting local and global ocean health. In addition, the project will generate socio-economic benefits, including improved livelihoods and increased income from seaweed farming and processing.

Table 13 presents the detailed incremental cost reasoning for the project.

Table 13 Incremental Cost Reasoning

	Cou ntry	Barriers	Baseline	Alternative Scenario (strategy)	Global Environmental Benefits
Regional integration	Regi onal	<ul style="list-style-type: none"> Seaweed is a growing industry in SEA, but there are limited plans guiding orderly and coherent expansion Lack of regionally harmonized principles guiding seaweed farming > impacts, scales of production, quality of seaweed biomass, market standing 	<u>Regional</u> <ul style="list-style-type: none"> SEAFDEC supports fisheries development in the region and has 11 member states. AQD supports seaweed development <u>Global</u> <ul style="list-style-type: none"> Safe Seaweed Coalition – global membership; setting global standards for safe seaweed (consumer, environmental, operational) 	<p>Through SEAFDEC, the project will develop:</p> <ul style="list-style-type: none"> Regional Seaweed Guide to support development of seaweed in the region Regionally adapted principles (based on Safe Seaweed Coalition) to ensure the development of seaweed value chains is done in a safe and environmentally friendly way, and standardized for better market uptake Trainings and knowledge sharing to support the above 	<p>Increased seaweed farming – supported by zoning, plans, and investments– will yield numerous global environmental benefits including:</p> <ul style="list-style-type: none"> Carbon, Nitrogen and Phosphorous capture, which helps prevent or reverse eutrophication Increased biodiversity due to healthier marine habitats (linked to above)
Planning	PH	<ul style="list-style-type: none"> Sustainable growth of seaweed farming is constrained by a lack of marine spatial plans and area management plans, and operationalization of these plans 	<u>National level plans</u> <ul style="list-style-type: none"> BFAR’s Seaweed Roadmap (2016-2022) Carrageenan Industry Roadmap Philippines National Standards (PNS) <u>Local-level planning</u> <ul style="list-style-type: none"> Zoning Map (with Palawan Council for Sustainable Development) 	<u>Local level planning</u> <ul style="list-style-type: none"> A MSP will be done for Roxas to site seaweed farms and ensure environmental and social sustainability The project will support BFAR in adapting and translating the provisions of the Seaweed Industry Roadmap into local regulations (i.e. municipal ordinances) and good practice guidelines 	<p>The project will contribute to:</p> <ul style="list-style-type: none"> Sequestration of CO2 Capture of nutrients (N and P) Enhancement of marine habitats <p>In addition, the project will contribute to:</p>
	VN	<ul style="list-style-type: none"> No national strategy and plan for the seaweed sector Lack of reliable, updated information on the sector 	<u>National level plans</u> <ul style="list-style-type: none"> MSP process led by MONRE Strategy for Development of Viet Nam’s Fisheries By 2030, with Vision Towards 2045 <u>Local-level planning</u> <ul style="list-style-type: none"> Provincial development plan 	<u>National level plans</u> <ul style="list-style-type: none"> Seaweed zones mapped in 10 provinces (contribute to MSP) Viet Nam National Seaweed Plan (NSP) Regulations for implementation of NSP IMS platform <u>Local-level planning</u>	

	Cou ntry	Barriers	Baseline	Alternative Scenario (strategy)	Global Environmental Benefits
				<ul style="list-style-type: none"> 2 provincial seaweed development plans 	<ul style="list-style-type: none"> Orderly expansion and development of the seaweed industry marked by environmental and social responsibility. Biodegradable and recyclable (into bio-stimulant) packaging materials. Helps reduce plastic pollution. Reduces use of fossil-fuel based fertilizer Higher quality RDS and value added products expand the demand for seaweed. This has to be met by increased production through the expansion in production area, which increases and spreads the environmental benefits generated
Seaweed farming	PH	<u>Seed stock</u> <ul style="list-style-type: none"> lack of quality and reliable supply of propagules or seedstocks > low quality biomass <u>Constraints to farming</u> <ul style="list-style-type: none"> Lack of tested technology and limited expertise in offshore seaweed farming Disease (ice ice, epi/endophytic infestations) 	<u>Seed stock</u> <ul style="list-style-type: none"> R&D to develop resilient and quality seed stock PSU has a two-year project on seed improvement on Green Island; can supply the seeds for the pilot farm <u>Seaweed farming</u> <ul style="list-style-type: none"> Palawan –using monoline method, planting cottonii Zamboanga – offshore seaweed farming has been piloted here. 	<u>Seed stock</u> <ul style="list-style-type: none"> In Zamboanga, the project will establish a 2-ha farm to be utilized as a seaweed nursery. For Green Island, seed stock is being addressed through baseline <u>Seaweed farming</u> <ul style="list-style-type: none"> Pilot technologies for offshore seaweed farming (to fit various conditions) – Green Island 	
	VN	<u>Seed stock</u> Lack of reliable supply of quality propagules for Kappaphycus <u>Constraints to farming</u> Lack of experience in offshore farming of Eucheumatoid species	<ul style="list-style-type: none"> Propagules being produced by Nha Trang Fisheries University and Research Institute of Marine Fisheries Technology available from RIMF, RIA3 and Nha Trang Fisheries University and training conducted by these institutions 	The project will establish a Kappaphycus seedling hatchery	
Post harvest processing Community-based production of consumer products	PH	<u>Drying</u> Lack of proper drying facility increase risk for contamination <u>Post-harvest processing</u> <ul style="list-style-type: none"> Limited or no on-site post-harvest processing technology 	<u>Drying facilities:</u> <ul style="list-style-type: none"> Philippine Rural Development Project is providing farmers with seaweed dryers The local government had provided farmers with bamboo poles to build drying platforms but this has not been sustained, farmers drying their seaweeds on the ground. 	<ul style="list-style-type: none"> Facilitate investments to process seaweed into products indicated by baseline market analyses Technology and trainings for production of consumer products Establishment and training of community-based enterprises for production and trading of the consumer products 	

	Cou ntry	Barriers	Baseline	Alternative Scenario (strategy)	Global Environmental Benefits
		<ul style="list-style-type: none"> Biorefinery solutions are emerging but still have much untapped potential. <u>Seaweed products</u> <ul style="list-style-type: none"> Low value and limited diversification of products Undeveloped / limited markets for products Price volatility 	<u>Product development:</u> <ul style="list-style-type: none"> DOST is piloting a processing technology using carrageenan as fertilizer Brabender is developing an extruder for pellets an intermediate material for manufacturing bioplastics. 	<ul style="list-style-type: none"> Supporting market access for the products 	<ul style="list-style-type: none"> by seaweed farming. A number of consumer products are biodegradable and recyclable, or substitute of products that are based on fossil fuel and/or require more energy to process.
	VN	<u>Precursor products</u> <ul style="list-style-type: none"> Outdated processing technology <u>Consumer products</u> <ul style="list-style-type: none"> Knowledge and skills needed for processing and marketing 	Facilities and process upgrade <u>Cottage-scale production</u> <ul style="list-style-type: none"> Home-made products based on carrageenan Export products from Caulerpa 	<ul style="list-style-type: none"> Introduction of biorefinery technology Organized SMEs/Cooperatives, training, e-commerce 	
Seaweed farmers	PH	<ul style="list-style-type: none"> Skills and facilities to produce and market seaweed food and other consumer products in an environmentally and socially responsible manner. 	<ul style="list-style-type: none"> BFAR provides technical support to the farmers, especially the Cooperatives Coast4C provides support for environmentally and socially responsible farming and post harvest practices 	<ul style="list-style-type: none"> Support system prepares coops to become self-reliant and sustainable 	
	VN	<ul style="list-style-type: none"> Skills and facilities for deep-water commercial-scale farming, post harvest processing for higher quality RDS, value -addition, value chain development 	Seaweed has been identified as a priority and key commodity, under the Marine Economic Development Strategy approved March 2021.	<ul style="list-style-type: none"> Integrated community level seaweed enterprises – from seed production to culture to post harvest processing to value-adding and marketing – managed by well-trained and organized men and women farmers 	

CONTRIBUTION TO CORE INDICATORS

The proposed project will contribute to following four GEF Core Indicators:

Core Indicator 5: Area of marine habitat under improved practices to benefit biodiversity: Seaweed contributes to nitrogen and phosphorus capture, thereby reducing pollution and hypoxia. By ensuring an enabling environment for seaweed farming regionally, and in the Philippines and Viet Nam specifically, and through the project demonstration farms, the project is expected to contribute to a significant amount of nutrient capture to reduce pollution and hypoxia in the Sulu Sea and South China Sea. This can reduce stressors on habitat for marine biodiversity.

Core Indicator 6: Greenhouse Gas Emissions Mitigated: Seaweed absorbs a significant amount of carbon. While some of the absorbed CO₂ may be released during the processing stage, studies show that 5-10% of the seaweed biomass will end up in deep-sea sedimentation before harvest, serving as a permanent carbon capture. Additionally, some of the seaweeds may serve to reduce biogas production from the animal husbandry sector, offsetting any CO₂ re-release. Overall, through seaweed production, the project will contribute to greenhouse gas mitigation.

Core Indicator 7: Number of shared water ecosystems (fresh or marine) under new or improved cooperative management: 2. The project will support Sulu Celebes Sea and South China Sea. This work will be tied together at the regional level through the lead executing agency. This includes supporting national/local reforms in Viet Nam and South China Sea. Also towards this core indicator and for both shared water ecosystems, the project will dedicate 1% of the budget to IW Learn activities, including creation of a website for a seaweed platform, participation in the biannual IW Conference, and twinning events. The project will produce experience and results notes under Component 4 to support knowledge sharing and scaling up of project results.

Core Indicator 11: Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment: Through strengthened seaweed value chains, including the establishment of medium-scale seaweed farms, the project will support income generation and livelihoods to local seaweed farmers in Philippines and Viet Nam. The majority of seaweed farmers are women, therefore it is expected that many of these beneficiaries will be women.

It is expected that the project will also provide training and tools that directly benefit government staff, communities, and private sector actors. Overall, the project will directly benefit 4,000 men and 11,000 women.

These contributions are summarized in the below.

Table 14 Contribution to GEF Core Indicators

LEVEL	Core Indicator	Environmental benefits
Core Indicator 5	Area of marine habitat under improved practices to benefit biodiversity (excluding protected areas)	1,882

Core Indicator 6	Greenhouse gas emissions mitigated	290
Core Indicator 7	Number of shared marine ecosystems under new or improved management	2
Core Indicator 11	Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment.	15,000

3.2 Alignment with GEF Focal Area

The project is aligned with the GEF Focal Area on International Waters. It will directly support the following International Waters Focal Area objectives:

1. IW-1-1: Strengthen blue economy opportunities through sustainable healthy coastal and marine ecosystems. The project will strengthen sustainable seaweed production and processing in Viet Nam and Philippines, which supports both national development strategies as well as healthy coastal and marine ecosystems. Regionally, the project will support knowledge sharing of seaweed as a blue economy opportunity through the regional executing agency.
2. Objective IW-1-3: Strengthen blue economy opportunities by addressing pollution caused by nutrient accumulation compounded by deoxygenation in marine environments. This project will work closely with the private sector, communities, and academic institutions to support innovative technologies for seaweed production and processing. Seaweed production will help address eutrophication from nutrient accumulation, acidification and deoxygenation in marine environments. Processing will include biorefinery technology (operated on-site or at the community level) that makes use of the entire biomass and reduces or does away with the use of alkali to extract the colloids), as well as the production of precursor products such as pellets for bio-films or higher-value product forms that are biodegradable.

The goal of the International Waters focal area is the promotion of collective management for transboundary water systems and subsequent implementation of the full range of policy, legal, and institutional reforms and investments contributing to sustainable use and maintenance of ecosystem services. The project will contribute to this goal by focusing on, among others, preventing degradation of the marine environment and combating ocean hypoxia. It will bring the lessons and experiences learned from the project (such as marine spatial planning, zoning and development of an integrated area management plan for seaweed sites that considers the competing users of the common resource, and evidence of farmed seaweed's capacity to mitigate deoxygenation and eutrophication) to SAP's knowledge-based action planning for the management of coastal habitats. The project's output, "Guide to promoting regional seaweed development in the SEA region" will contain approaches and best practices that can be most effectively implemented through regional cooperation. The Guide thus complements SAP's program for regional cooperation in the management of the marine and coastal environment of the South China Sea.

Outscaling the results of the Project to the Southeast Asian Region will be facilitated through the intergovernmental mechanisms of SEAFDEC and ASEAN and to other countries through Lloyds Register and the Safe Seaweed Coalition.

3.3 Private Sector Engagement

The Project will stimulate private sector investment in the production of new seaweed products and participation in new seaweed product value chains, which will diversify income opportunities and enhance the livelihoods and resilience of communities engaged in seaweed production. It will identify investment opportunities for private sector and government and produce investment models for large scale offshore seaweed farming that can be operated by organized farmers (i.e. cooperative) or a private company, community-based bio-refinery technology operated by an association or cooperative of seaweed farmers, small-medium-scale community-based production of seaweed-based consumer products, and commercial scale processing of low-carbon and biodegradable high-value products. It will provide information and technical inputs to improve and strengthen the policy environment to enable the above initiatives and especially to give assurance that the investments are protected. Training will also be provided to the operation of a bio-refinery and processing of consumer products. A support system will be devised for the associations or cooperatives and the community based small scale enterprise to access and effectively utilize technical, information, and financial services.

The project has received a co-finance letter from Brabender and Tri Tin Company. Brabender may be selected as a partner to support bioplastic biorefinery solutions in Philippines under Output 3.1.2. Tri Tin Company will provide co-financing to support piloting of seaweed farms under Output 3.1.1.

3.4 Socio-economic benefits

The project's contribution to the ultimate goal of human well-being is the sum total of the environmental, economic and social benefits that it generates. The benefits are inter-related, and their synergy enhances the overall outcome.

Among the noteworthy social and economic benefits are the increased opportunities for the farming households, but especially the women who have a major participation in the family seaweed enterprise in Southeast Asia, to earn more; this contributes to their empowerment at the household and community levels. Empowerment enhances their opportunities and capacity to earn more income. Direct economic benefit comes from the improvement of farm household and community revenues from higher crop productivity, higher production volume and better-quality farm product, small-scale production and sale of seaweed-based consumer products, and better access to market.

The synergy can be expressed thus: A healthy and resilient ecosystem can better support economic development and contribute to social cohesion and resilience. Economic development fosters social stability and provides a better platform for promoting social equity and gender equity. Social stability and equity are requisites of a conducive social climate, that encourages investments in economic development and environmental management. Economically developed communities tend to pay more attention and allocate more resources to improve their environment.

3.5 Risks and proposed Mitigation Measures

Table 15 Project Risk Assessment and Mitigation Plan

Risk	Risk Level	Project Mitigation
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Local governments and local communities are not supportive of the Project	Low	<p>Local governments have been engaged during project development. In the Philippines, a potential area estimated to be 300 hectares has been identified and scouted by the officers of the Northern Palawan Fishermen Cooperative. A biological, natural, and social risk assessment was carried out with the participation of provincial, municipal, community stakeholders. A SWOT analysis during one (on-line) meeting provides the basis for a project implementation strategy that would enhance their livelihood strategies and, just as important, does not disrupt community relations.</p> <p>In Viet Nam, MARD - D-Fish National Mariculture Strategy to 2030 seeks to empower the local governments for management of the coastal and offshore areas so that the implementation of the Strategy, which hews towards industrial scale aquaculture production units (on sites that will be leased) is guided by regulations which formulation benefit from a wider stakeholder consultation. The Project has also consulted with the local governments, local officers of national agencies (MARD, MONRE) and local leaders on ways that it can provide technical inputs to support the Strategy.</p>
Project scale being industrial rather than small scale and being sited in offshore sites, could appear to local communities as irrelevant to their livelihood strategies and more oriented towards the interest of large enterprises.	Medium	<p>The Project has met (virtual mostly but also in-person) with the community stakeholders including the local government, NGOs, and other projects operating in the area to describe and explain the environmental, economic, and social benefits expected from the Project that will accrue to the communities. The common understanding was arrived that project activities should foster the sense of co-ownership of the project.</p> <p>The mechanisms by which they will be able to attain scale, such as a cooperative or a formal association (of producers), will rely on the formation or strengthening and professionalization of a cooperative or association. The cooperative should have a significant role and not appear as a mere surrogate to other (outside) players. Appropriate support to the cooperative or association will be provided. It will be made clear that the project is a pilot and its positive results will eventually redound to the benefit of the cooperative, the community, the seaweed industry, and the environment.</p> <p>Viet Nam's Marine Fisheries Development Strategy to 2045 envisions the expansion of mariculture at an industrial scale. This makes it even more critical to carry out the risk mitigation strategies described above so that the communities and the organized groups in the project site/s will be supportive because they play a significant role in Project implementation and have a sense of co-ownership of the results.</p>
Culturally inappropriate project delivery will hamper relationships with and social acceptability by the community of the project	Low	<p>Working with local community facilitators, opinion leaders and organized farmer and women groups, the project 1) will ensure appropriate community protocols are followed, does not debase local culture and traditions; and (2) be sensitive to local issues that have the potential to turn into problems, and plan and carry out ways to resolve them before they escalate into a social conflict.</p>

The social risk from power asymmetry in the community by which the members with more power tend to appropriate the major roles in and benefits from the project.	Medium/ Low	With organized groups that are managed professionally, the probability of this risk arising would be low. The project will engage and provide opportunities for meaningful participation of cooperatives/associations. Where these are not existing, the project will encourage and provide appropriate assistance to the formal organization of farmers associations. It will strive to be transparent and fair in its engagements. It will ensure equitable benefit sharing under the social safeguards strategy.
Conflicts arise with other users of the marine resources particularly on the location of the demonstration farm once established.	Low	The Project has consulted with the Local Governments (in PH and in VN) and the local communities, to obtain information and assurance – backed by local regulation -- that the site of the project does not obstruct navigation, does not prevent fishers from accessing fishing grounds. And that there will be an assurance of security to the Project demonstration farm. An area management plan that comprises good management practices and safety standards for the identified seaweed farm site will avoid negative impacts of the farm operation on the environment and thus to other users of the same marine landscape.
Natural risks spawned by climate change such as rising sea temperature, adverse weather events (typhoons, monsoons) will disrupt project operations.	Medium to High	The project will use cultivars that are tolerant to temperature fluctuations, especially higher water temperature. Providers of quality planting materials – science and technology institutions -- have been engaged. Timing of crops will be informed by local knowledge and long-term forecasts to avoid the months when typhoons or monsoons occur. The Project will employ a culture system and use structures that provide protection to the crop from strong winds and rough seas. Sites will also be located in areas that are reasonably sheltered from strong winds and currents.
Biological risks such as pests, grazers and predators, endo- and epiphytes, and diseases impact on the growth of the demonstration crops.	Medium	Sites are being selected that pose minimal risks from these factors; deeper offshore waters are generally less prone to epiphyte and endophyte infestation. Disease-resistant planting materials will be sourced and used for the demonstration crop (as mentioned above, providers of these quality materials have been engaged).
Risk from the demonstration farm to protected marine life like dugongs and sea turtles	Medium to High	The Green island site is a nesting area of dugongs. And there is the risk of their and the sea turtles' entanglement in the seaweed lines. In Zamboanga, the cage structures do not pose this risk. There is obviously no such risk with culture ponds. The field personnel will be instructed to regularly inspect the farm and free any dugong or sea turtle found entangled in the ropes.
Chemical risks such as pollution from agricultural and domestic runoffs, oil spills, unsuitable water parameters in growing area renders the area unsuitable for a seaweed demonstration farm.	Medium	The sites selected are in areas that are not exposed to heavy runoffs from land-based activities and with sufficient chemical and dissolved oxygen content. Offshore and deeper waters are generally safe from industrial, agricultural, and domestic discharges, and well oxygenated. Consultations have also confirmed the sites are designated solely for seaweed farming and will be outside the navigation routes for fishing and transport vessels.

Public health risk, particularly the Covid19 pandemic	High	Advisories on precautionary, exigency, and emergency measures by WHO and the government health authority will be heeded and complied with. These will be brought to the attention of all project personnel and anyone doing personal transaction with any project staff for the purpose of having a common understanding and as much as possible mutual agreement of the need for and benefits of compliance. This would mitigate the impact of the pandemic on project staff, the community and people whom the project staff meet personally in the course of project operations.
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Table 16 Climate Risks and Mitigations

Country	Climate Change Risk	Impacts on Communities and the Environment	Mitigations
PH and VN	Coastal communities face climate hazards that include a rise in sea surface temperatures .	Ocean warming and ocean acidification put seaweed, and surrounding coral reefs, under stress. Warming ocean waters have also been associated with ice-ice disease, which deteriorates the quality and yields of seaweed. Coral bleaching, as well as warming water temperatures, may result in less ecological habitat for fish and sea life in the area. This could cause a general decline in fish populations in the project areas and negatively impact seaweed harvesting.	The project will work with academic institutions that are researching more climate and disease resilient seaweed strains. Climate and disease resilient propagules will be explored for the demonstration farms. The project will also incorporate climate resilient training where applicable.
PH and VN	Coastal communities in the Philippines and Viet Nam face an increase in frequency and severity of storms and typhoons . In the off-season alone (around December), the Philippines has seen an increase in typhoon occurrences of more than 70% (from 2012-2020). Typhoons overall are becoming more destructive. La Niña events trigger a more erratic precipitation pattern and correlate closely with a rise in frequency of severe storms and climate events. The	Impacts recognized in the Philippines include infrastructure damage, loss of livelihoods and even loss of life. Typhoon Rai, which struck Philippines (including Palawan, one of the project areas) in December 2021, caused significant damage to buildings, crops, and left 397 people dead and more than half a million affected people displaced. 74% of the country's population is exposed to multiple climate threats at any given time. ³³ In Viet Nam, tropical storms	Aspects of the project were designed to combat the increasing frequency and severity of storms. For the project site in Green Island, the site was selected because it is protected by corals, which will help in dispersing strong waves during typhoons and protect the seaweed farm. In Philippines and Viet Nam, the project will apply a robust design of seaweed farm infrastructure as well as utilize early warning to save crops before typhoons hit the region.

³³ GFDRR Country Profile for the Philippines

	number of rainy days and associated storms in the Philippines has increased overall since the 1990s. ³²	cause major damage to property and infrastructure, as well as costing lives.	
PH and VN	The Philippines and in Viet Nam, are experiencing significant sea level rise .	Sea level rise is a threat to coastal communities and is expected to result in thousands of climate refugees. The increase in natural disasters and the rising sea level also cause damage to the reef systems and coastal mangroves, having detrimental effects on coastal communities and their associated economic stability.	The project may explore insurance protection against loss of crops and/or infrastructure in the face of extreme climate related disasters.
VN	Severe drought is a major climate risk that communities face in the project area. The frequency and intensity of dry spells causing droughts have increased under the influence of the El Niño effect. One of the project sites, Ninh Thuan, is one of the hottest and most drought-ridden areas in the country. The province has the lowest average rainfall in the country (about 750 mm per year) and is also the hottest province of Vietnam, with an average temperature of about 27 degrees C. ³⁴	Particularly in Ninh Thuan (although it has been noted as an issue in Khanh Hoa as well), severe drought poses risks to farmer communities, where impacts on water resources and also on the electrical grid may disrupt supply chains and/or operations. In the case of drought, the availability of water resources is limited (this is a particular issue for the inland earthen caulerpa ponds in Khanh Hoa).	The project will consider the impacts that drought has on communities in the areas that are most susceptible during project implementation.

Note: Climate risks were identified using the WWF Climate Risk Screening tool. The Screen was conducted for both Philippines and Viet Nam, and is uploaded with the submission.

Table 17 COVID-19 Risk Analysis

Risk category	Potential Risk	Mitigations and Plans
Risk of the ongoing COVID-19 pandemic affect project implementation	COVID-19 delays may impact timelines for project implementation.	Project start-up and implementation may be delayed due to COVID-19. Adaptive adjustments will be considered in annual workplans to mitigate such delays.

³² Folland, C.K., J.A. Renwick, M.J. Salinger, N. Jiang, and N.A. Rayner, 2003: Trends and variations in South Pacific Islands and ocean surface temperatures. *Journal of Climate*, 16, 2859-2874 and Folland, C.K., J.A. Renwick, M.J. Salinger, and A.B. Mullan, 2002: Relative influences of the Interdecadal Pacific Oscillation and ENSO on the South Pacific Convergence. *Zone. Geophysical Research Letters*, 29, 21-1-21-4

³⁴ Tuan, N. and Canh, T. (2021) Analysis of Trends in Drought with the Non-Parametric Approach in Vietnam: A Case Study in Ninh Thuan Province. *American Journal of Climate Change*, 10, 51-84. doi: [10.4236/ajcc.2021.101004](https://doi.org/10.4236/ajcc.2021.101004).

		The project will utilize remote working tools to support and engage with partners and stakeholders where needed (including for regional workshops and trainings, etc).
Stakeholder engagement process	COVID-19 restrictions may limit effective engagement with stakeholders – particularly local communities (as a result of, for example, travel restrictions)	<p>Consultations will only be undertaken in compliance with national and local guidelines, and with COVID-19 precautions in place. This may involve, for example, small group sizes, the use of testing, and PPE.</p> <p>The PMU and N-PMU's will develop guidance on COVID protocols. In all cases, continued attention will be given to ensuring the voices of IP, women, youth, and any underrepresented community members.</p>
Livelihood/economic challenges	COVID-19 impacts may lead to increased livelihood/economic challenges and isolation of the communities.	The project will support seaweed value chains, which will strengthen livelihoods in the project areas. The strategy includes specific provisions around linking to markets to.

Table 18 COVID-19 Opportunity Analysis

Opportunity Category	Plan
Reduce the vulnerability of affected communities within the project landscape	The project will support more secure and sustainable livelihoods and enhanced livelihood assets for the target communities. Improved incomes will come through the production of more and better-quality biomass, production and sale of traditional product forms, and participation in the production and sale of higher value products. Social co-benefits are in the form of a secure livelihood, more employment generated by the production of and trade in traditional and new consumer products, improved food security.
Protect and restore natural systems and their ecological functionality	<p>Seaweed has numerous environmental benefits for the marine environments, including carbon capture and assimilation of excess nutrients from coastal waters, which is associated with mitigation of ocean eutrophication and acidification as well as improvement of habitat for marine life.</p> <p>Marine spatial planning will ensure seaweed farms are placed in a socially and ecologically sustainable way.</p>
Include a focus on production landscapes and land-use practices within them to decrease the risk of human/nature conflicts	The project will support safe and sustainable seaweed farming. The safeguards documents have mitigations in place for any human/nature conflicts.
Promote circular solutions to reduce unsustainable resource extraction and environmental degradation?	The project may support a bioplastic refinery solution in the Philippines under Output 3.1.2 (based on selection criteria during implementation). Coast4C will support an initiative to recycle end-of-life fishing nets to reduce plastic pollution and provide additional income to the communities. Finally, plastic alternatives for the seaweed farms will be explored.

3.6 Consistency with Regional and National Priorities or Plans

This project is consistent, and provides support to, national seaweed development strategies and plans in Viet Nam and Philippines. In Viet Nam, the project provides direct support to the country's Marine Aquaculture Strategy, which targets 400,000 MT of seaweed production by 2030, of which 100,000 MT will come from offshore operations. In the Philippines, the project contributes to development of the seaweed sector, a goal of the DA-BFAR Fisheries Roadmap. Seaweed aquaculture also contributes to the Sustainable Development Goals that both Viet Nam and Philippines have committed to, especially the environment, biodiversity, and climate targets.³⁵ At the regional level, the project is consistent with the implementation of the South China Sea Strategic Action Programme, of which Viet Nam and the Philippines are signatories.

The project is consistent with the following national and regional strategies, plans, reports, and assessments under relevant conventions:

Table 19 Alignment to regional and national plans and priorities

Country	Title	Relevance to Project
PH	Philippine Action Plan for Sustainable Consumption and Production ³⁶ (Aligned with SDGs)	The Philippine Action Plan for SCP (PAP4SCP) is a guiding framework to influence and steer sustainable behavior and practices across sectors and levels of government by implementing policy reforms and set of actions over the period 2020-2040. Its goal is to increase the nation's uptake of green products and services. The Project can contribute to the Action Plan's sub-outcome of having national resources efficiently used and equitably allocated. It has a direct contribution to the intermediate outcome of increasing innovations and investments in green technologies and systems.
PH	National Adaptation Plan (NAP) ³⁷	Outlines a long-term program and strategies for adaptation and mitigation. In 2010, the Government of the Philippines released its National Framework Strategy on Climate Change (NFSCC). The framework stresses a balance between adaptation and mitigation, and laid the groundwork for the development of the National Climate Change Action Plan (NCCAP) for 2011– 2028. It has seven priority sectors for adaptation. Two of these are ecosystem and environmental stability and knowledge and capacity development.
PH	DA-BFAR Fisheries Roadmaps	BFAR's seaweed industry roadmap (2016-2022) includes 3 components: (1) Improved/increased production; (2) organized seaweed farmers; and (3) promotion/commercialization of seaweed products.
PH	"Seaweed Industry Roadmap" of the Seaweed Cooperatives	The Seaweed Industry Roadmap 2016-2020 (recently updated for the period 2022-2026) focused on two major red seaweeds species, namely, Eucheuma and Kappaphycus. The roadmap was spearheaded

³⁵ <https://www.nature.com/articles/s41893-021-00773-9?proof=t>

³⁶ [https://sdg.neda.gov.ph/philippine-action-plan-for-sustainable-consumption-and-production-pap4scp/#:~:text=The%20Philippine%20Action%20Plan%20for,term%20\(2030%2D2040\).](https://sdg.neda.gov.ph/philippine-action-plan-for-sustainable-consumption-and-production-pap4scp/#:~:text=The%20Philippine%20Action%20Plan%20for,term%20(2030%2D2040).)

³⁷ <https://napglobalnetwork.org/wp-content/uploads/2018/02/Philippines-NAP-process-country-poster-Feb2018.pdf>

		(and updated) by BFAR; it is among the agriculture sector roadmaps of the Department of Agriculture. Three programs that have been implemented are training for farmers in good farming practices and production of climate-resilient species, training of seaweed farmers in entrepreneurial skills, and promoting community-based product champions. An important objective is to reduce the importation of raw dried seaweed for local processing.
PH	National Science and Technology Plan for Seaweed ³⁸	Includes milestones/targets for the decade, including interventions on research and development, promotion of technology transfer, policy, and capacity building.
VN	National Action Plan for The Implementation of the 2030 Sustainable Development Agenda ³⁹	Viet Nam's commitment to the following sustainable development goals (2030) are relevant to this project: Eliminate hunger, ensure food security, improve nutrition, and promote sustainable agricultural development; Achieve gender equality; Ensure sustainable, comprehensive, and continuous economic growth; Ensure sustainable production and consumption; Sustainably conserve and utilize the ocean, the sea, and marine resources for sustainable development
VN	Marine economic development strategy to 2030, with a vision to 2045 (Marine Aquaculture Strategy)	<p>Viet Nam adopted a marine economic development strategy to 2030, with a vision to 2045 on 11 March 2021. This strategy gives a strong emphasis on sustainable aquaculture with an orientation towards industrial scale production. The strategy draws its conceptual guide from the Blue Economy. The Strategy's development orientation for the aquaculture subsector relevant to the Project includes:</p> <ul style="list-style-type: none"> • Develop effective farming of aquatic species of certain economic value, associated with ecological environment protection, proactively adapting to climate change. • Develop marine aquaculture into a commodity production sector, encouraging the development of industrial-scale aquaculture in open sea zones; creating a large volume of products for export processing and domestic consumption. • Develop farming of microalgae and seaweeds to serve food needs and supply raw materials for other economic sectors (e.g. cosmetics, pharmaceuticals,). Cultivating ornamental and recreational aquatic creatures and those used as handicrafts and pharmaceuticals to meet the needs of domestic and foreign consumer markets. • Encourage the development of aquaculture models that apply new and advanced technologies, reduce production costs, are environmentally friendly, and adapt to climate change; organic and ecological farming models, applying certification standards for good aquaculture practices (GAP) for value enhancement and sustainable development. <p><u>The strategy targets 400,000 MT of seaweed production by 2030, of which 100,000 MT will come from offshore operations.</u></p>

³⁸ <http://www.pcaarrd.dost.gov.ph/home/isp/images/matrices/seaweeds.pdf>

³⁹ https://Vietnam.un.org/sites/default/files/2020-08/ke%20hoach%20hanh%20dong%20quoc%20gia_04-07-ENG_CHXHCNVN.pdf

Regional	ASEAN Joint Response to Climate Change ⁴⁰	An ASEAN Action Plan on Joint Response to Climate Change was adopted by the 12th ASEAN Ministerial Meeting on Environment held on 26 September 2012, to implement the ASEAN Leaders' Statement on Joint Response to Climate Change issued at the 16th ASEAN Summit in 2010. The Project contributes to the mitigation of climate change impacts on marine ecosystems as well as to community resilience to climate change risks.
Regional	ASEAN's Blueprint for the ASEAN Socio-Cultural Community - Cooperation on Coastal and Marine Environment ⁴¹	ASEAN's Blueprint for the ASEAN Socio-Cultural Community (ASCC Blueprint) 2025 serves as the guiding mandate of the ASEAN Working Group on Coastal and Marine Environment. The Group aims to ensure that ASEAN's coastal and marine environment are sustainably managed; representative ecosystems, pristine areas and species marine environment instilled. Among its 7 priority programmes to which the Project has direct contribution are: Coastal and Marine Pollution Mitigation (nutrients, marine debris, eutrophication etc.); Climate Change Issues and Impacts in Coastal Areas; and Integrated Coastal Management (ICM) and Marine Spatial Planning (MSP)
Regional	Strategic Action Program for South China Sea and the Gulf of Thailand ⁴²	The Strategic Action Program for South China Sea and the Gulf of Thailand (implemented by UNEP and GEF) aims to assist countries in meeting the targets of the coastal and marine environment components of the Strategic Action Programme for the South China Sea through implementation of the National Action Plans. The Project will have a direct contribution to Component 1: Reducing habitat degradation and loss via national and local reforms to achieve Strategic Action Programme targets for coastal habitat management in the South China Sea and Gulf of Thailand

3.7 Innovativeness, Sustainability & Potential for Scaling up

INNOVATIVENESS

The project is innovative in several respects:

- In the context of the Philippines and Viet Nam and, more broadly of Southeast Asia, offshore commercial-scale farming has not been demonstrated for the seaweed species popularly grown in the region i.e the carageenophytes. The project will introduce and test the suitability of systems (and structures) for growing seaweed in an offshore or off-the-coast environment. It will produce a Production System Model or models, if there are more than one species, based on several successful crops. The Model will describe the biological and technical feasibilities, economic viability, and social acceptability of the farming system. In Viet Nam the project will support the expansion of the culture of the food species, *Caulerpa lentillifera*, in degraded shrimp ponds. Substituting seaweed for shrimp in degraded shrimp ponds would provide environmental, economic and social benefits: no mechanical aeration, no need for expensive

⁴⁰<https://environment.asean.org/wp-content/uploads/2015/06/ANNEX-8-Lead-Countries-for-ASEAN-Action-Plan-on-Joint-Response-to-Climate-Change-27-March-2013.pdf>

⁴¹ ASEAN Cooperation on Environment. <https://environment.asean.org/awgcmce/>

⁴² <https://scssap.org/about-us/scs-sap-implementation-project>

shrimp post-larvae, no feeding with high protein feed whose main ingredient is fish, no usage of anti-microbials and chemicals, and the seaweed assimilates the dissolved nutrients in the culture water. Caulerpa has also a much shorter crop cycle (30 days compared to 90-180 days for shrimp) and, in Viet Nam as well as in the Philippines and Thailand, the domestic price for Caulerpa is high.

- Introducing and demonstrating as well as training local people (growers) on the application of a bio-refinery system that would make full use of the seaweed plant, produce precursor materials (i.e. pellets) for processing into biodegradable higher value products like bio-plastics, or produce a finished product such as fish feed with seaweed as one of the ingredients and a binder. This would be a new technology for seaweed farmers in the Philippines and Viet Nam and, in general, Southeast Asia.
- Developing investment models in the manufacture of higher value products and promoting them for prospective public-private or private financing is a new strategic approach to the development of the seaweed industries of most of Southeast Asia.

SUSTAINABILITY.

Sustainability will be accomplished through a number of approaches:

- Strengthened planning and enabling conditions, which will continue to guide the seaweed sector in both the Philippines and Viet Nam, as well as regionally. This includes:
 - Development of a 'Regional Guide for Promoting a Sustainable Seaweed Industry in SEA Region,' which SEAFDEC will continue to oversee and support past project close. The project will also support standards for good aquaculture practice and promote their adoption (and long-term application) by national standard authorities and industry groups through webinars and workshops.
 - In Viet Nam and the Philippines, D-Fish and BFAR, respectively will continue to oversee project-developed plans (e.g. National Seaweed Plan) and legal/policy measures.
 - In Viet Nam, the project will support the Provincial social and economic development plans by providing technical (information and lessons learned) inputs to the planning process.
- The project will develop a sustainability/exit strategy for supported seaweed farms and biorefinery solutions to ensure sustainability. This includes the following: For seaweed farms, the project will train seaweed farmers in any new technology and management requirements. During the project, the PMU will identify who will take over the seaweed farm(s) after project close – this will likely be a cooperative or association that has received training through the project, and meets set criteria (fiduciary, social, etc). Business plans (including financials) will be supported. It is expected that the farms will be financially self-sufficient by the end of the project, and that farmers will continue to utilize the farm sites for seaweed production.
 - For biorefinery solutions, the project will consider 'likelihood of sustainability' as part of the selection criteria during execution. This should include consideration of operating and maintenance costs, and current and potential market. Biorefinery options will be selected through a participatory approach with communities to ensure buy-in, and trainings will be provided to develop their capacity. Community enterprises, cooperatives, and associations will be established and/or strengthened to ensure continued ownership. Finally, the project will work to link these products to market to ensure, where possible, a positive cash flow by the end of the project, and conditions to ensure continued use of the biorefinery solutions after project close.

- The project will provide trainings, workshops, and exchanges to support best practices, learning, and capacity at the local, national, and regional level. This includes trainings for seaweed farmers, establishing cooperatives where appropriate, and supporting existing cooperatives. If these trainings and outcomes are shown to be successful, it is expected that these practices will continue to be applied by seaweed farmers long-term.

SCALING UP

A successful project outcome would catalyse scaling up of the project within the project countries and across Southeast Asia. Support to this will be through several key strategies:

- Once the project has proof of concept for the offshore seaweed farming, as well as biorefinery solutions, models and guidance documents will be developed and shared (under Component 4) to allow for application in other seascapes.
- In Viet Nam, the project will map seaweed zones in 10 provinces to be used for a national-level MSP but also provincial-level planning. While the project will only directly develop two provincial seaweed development plans (to guide pilot seaweed farms), the project will support the deployment of guidelines and trainings to upscale the planning process to the other seaweed-zoned provinces.

To support scaling up of project results, the project will rely on SEAFDECs membership and outreach through Component 1 and Component 4. The project will ensure a global reach through the Safe Seaweed Coalition, which will publish knowledge products as appropriate and allow reach to a global audience that may take up project results. A complement to this approach is engagement with national industry associations, donor and technical assistance agencies, NGOs, and academic and R&D institutions, which could apply project findings and scale up the pilots.

3.8 Lessons learned and Best Practice

The cases described in this section provide lessons in small scale producers empowerment, women empowerment, adaptation to climate variability, potential and requirements of a technology for offshore farming of seaweed, engendering synergy among technical assistance organizations in providing assistance to a seaweed farming community, and the strategies needed to get the seaweed industry, particularly its farming sector, from the business as usual scenario to a dynamic and innovative economic sector.

1. Offshore deepwater farming and its impact on women farmers: Zanzibar

Offshore deepwater culture was tried in Zanzibar with the use of tubular nets in which the seaweeds (*Kappahycus* sp) are enclosed. A study of its impact, from the perspective of a technological innovation (i.e. deepwater seaweed farming using tubular nets) demonstrated (a) an adaptation to climate variabilities such as rising temperatures, stronger winds and irregular rainfall and (b) a means to empower women. The innovation required new skills of women that included the ability to swim and operate and steer a boat but, more fundamentally, required access to a boat, which many of them did not have; it showed the potential to positively strengthen, develop and assert women's skills and rights. It raised the women's self-esteem and feeling of independence. A major recommendation from the study is that adaptation options to the increasing impacts of climate change will be possible only with institutional

support (policy, science and technology, finance), significant investments (i.e. in R&D, infrastructure, facilities and resources to expand production, capacities to develop and manage the value chain, and measures to mitigate climate change risks, reduce vulnerabilities and increase resilience to production and marketing risks), and through the empowerment of women and the participation of local communities in these initiatives.^{43 44}

2. Protect Wildlife Project: Department of Environment and Natural Resources, Philippines, and USAID

This Project, broadly aimed at wildlife conservation, included sites in four regions of the country. The assistance provided to seaweed farmers in a number of communities in Palawan Province created an environment (seaweed farms) conducive for marine life to thrive. The social outcomes were adaptation to climate change and empowerment of the farmers, achieved through four actions: (1) farmers, both male and female, were organized into a seaweed association; (2) the association made it easier and more effective for the project to deliver technical assistance that contributed to the achievement of its core objective of protecting wildlife; (3) an expanded and more progressive seaweed farming improved family incomes, which helped reduce the need for illegal trade in endangered wildlife (i.e green sea turtle) even as the seaweed farms served as nurseries for fish, squid, crabs, lobsters and other crustaceans; (4) since the association was of small-scale seaweed farmers, and needed key assistance to improve their seaweed-based livelihood, a third organization – a church-based NGO and social enterprise – collaborated with the Project and filled the gap that the DENR-USAID Project mandate did not allow it to do. This was to provide technical assistance, training in improved farming techniques, and loans (through the microfinancing instrument of the NGO, called Ecumenical Loan Fund) to enable the association to acquire land-based and floating solar dryers to improve harvest quality. The collaboration then facilitated the association's link to the provincial and national industry associations. Noteworthy is that the facilities (dryers) were not given as a gratuity but acquired through a loan⁴⁵ – an approach that underlines the need to be prudent in the provision of subsidies (which might later encourage repeated demands for more). This would undermine the paramount goal of a rural development assistance: beneficiaries attain self-reliance. Subsidies play an important role in initiating the support system of a rural development initiative. They should not foster utter or perennial dependence.

3. Coast 4C Limited, and the Zoological Society of London – Philippines (ZSL-Philippines)⁴⁶

⁴³ Cecile Brugere, Flower E. Msuya, Narriman Jiddawi, Betty Nyonje & Ritha Maly (2020): Can innovation empower? Reflections on introducing tubular nets to women seaweed farmers in Zanzibar, Gender, Technology and Development, DOI: 10.1080/09718524.2019.1695307 <https://doi.org/10.1080/09718524.2019.1695307>

⁴⁴ de Jong Cleyndert G., Newman R., Brugere C., Cuni-Sanchez A., Marchant R. (2020) Adaptation of Seaweed Farmers in Zanzibar to the Impacts of Climate Change. In: Leal Filho W., Oguge N., Ayal D., Adelake L., da Silva I. (eds) African Handbook of Climate Change Adaptation. Springer, Cham. https://doi.org/10.1007/978-3-030-42091-8_54-13.7.

⁴⁵ <https://businessmirror.com.ph/2019/06/17/seaweed-farming-helps-empower-women-in-palawan/>
Source: Annual Report, Protect Wildlife Project. June 2016-March 2021. Project sites were in nine provinces including Palawan. DENR and USAID. With the collaboration - in the Palawan project community of Isugod, Quezon -- of the Lutheran World Relief and the micro-lending program of the Ecumenical Church Loan Fund (ECLOF). Project duration was June 2016 to March 2021.

⁴⁶ Response to the Questionnaire sent to stakeholders for the National Stakeholders Consultation Meeting in the Philippines on 29 June 2021, by Nicholas Hill and Amado Blanco, Coast4C Unit 2, 9-11 Arthur Avenue, Cronulla, NSW 2230 Australia. ZSL-Philippines, Gaviola Compound, Maria Theresa Village II, Cebu City, Phil.

In the business-as-usual scenario (i.e. nothing changes in the way that seaweed has been supported by government and NGOs for the past four decades and seaweed continues on its trajectory of decline), decline in farm-level production will be offset by expansion to new areas. Under this scenario, seaweed farming continues to subsidize overfishing. How? Surplus or income from seaweed farming is normally reinvested into fishing assets. This way the farmer-fishers can maintain fish catches in the face of declining fish stocks. It is a risk management mechanism because of the production and marketing risks associated with seaweed farming, such as typhoons, theft, and ice-ice disease, fluctuating prices, and market manipulation practices like “stop-buying” to drive down prices at harvest time. Fishing enables farmer-fishers to feed their families. However, they need seaweed farming to be able to continue fishing because of declining fish stocks. There has been evidence of whole-scale shifts out of seaweed into massive levels of fishing when something changed in the landscape (for example the price of seaweed drops for an extended period due to a drop in carrageenan prices). This explains why fishing effort levels had continued to increase, for over four decades, despite the promotion of seaweed farming as an “alternative livelihood” to fishing.⁴⁷

Government and NGOs should invest in making the enabling environment for a thriving and regenerative seaweed economy, including provision of services that small-scale farmers need to boost their production using regenerative approaches. This must come with the integration of seaweed into marine conservation activities (such as MPAs) to ensure that it does not continue to subsidize overfishing, zoning, and incentive structures that support regenerative farming. Services needed include new strains and new seaweed farming methods made accessible to farmers. Examples are those that make seaweed farming more resilient to climate change and reduce the impact of diseases, particularly farming in deeper waters and higher energy environments, like tube-net farming, or the vertical line methods being adapted for deeper waters and use of rafts that can be moved to safety in the event of a storm or moved to another area as the conditions change and make areas more susceptible to disease. The sector also needs improved and more affordable financial services (such as specific loans bundled with index-based insurance), and transparency that include traceability and accountability in the supply chain so that price manipulation does not happen and, on the other hand, product quality and safety standards to ensure that seaweed farmers adopt best practices, for example not using single-use plastics that generate loads of plastic waste, not destroying coral reefs (removal of coral from seaweed farms is a common practice), and not engaging child labor or other labor abuses. Finally, there are good prospects for investments in local biorefineries using green technologies that allow 100 percent utilization of seaweed biomass for multiple markets.

4. Key factors influencing upgrading opportunities for seaweed farmers, Lombok, Indonesia

Farmers can improve their incomes through value chain upgrading. For instance, process upgrading improves the quality of the raw dried seaweed and functional upgrading adds value through processing. But two factors constrain them from doing so: exchange conditions and governance, the latter mostly a function of access to capital and social-political relations. The lack of access to favorable credit terms from institutional credit providers (such as local banks) usually compel farmers to turn to collectors for loans. The outcome is a captive relationship between the trader and farmer. This relationship limits farmers’ opportunities for product upgrading (i.e. improving the biomass quality) and does not support functional

⁴⁷<https://coast4c.com/livelihood-diversification-for-conservation-interactions-between-seaweed-farming-and-fishing-in-danajon-bank-central-philippines/>

upgrading (i.e. processing). In practical terms, the farmer will not invest in upgrading product quality because he/she cannot get a higher price for it anyway. Meanwhile, the prevailing seaweed pricing system creates unfair exchange conditions such that a higher value seaweed does not earn a higher price in the local market. Functional upgrading, or becoming a processor of seaweed-based products, is limited by exchange conditions (i.e. cost of inputs vis a vis price of product), as cost of ingredients can be too expensive relative to the value of the product. Then, their persistent indebtedness prevents them from ending the captive relationship and seeking out other functional roles, or joining a farmer group. There are other marketing challenges as well such as competition from other products, insufficient brand recognition and the cost of marketing. These are the constraints Lombok farmers faced in realizing their entitlement through participation in the seaweed value chain.

However, with government programs that offer resources in the form of supplies and training, farmers can form groups to leverage those resources and avoid getting indebted to local collectors. Access to a local banking system with favorable loan terms would mitigate the problem of indebtedness to collectors and transform the relationship from captive to relational. Relational governance opens up more possibilities for upgrading. Process upgrading remains a common strategy for farmers, and the absence of captive relationships makes farmer coordination (i.e. being organized into clusters, associations or cooperatives) more feasible.⁴⁸

5. Research on two culture models around offshore islands, Research Institute for Marine Fisheries, Haiphong, Viet Nam

The technical feasibility of cage culture in offshore waters has been explored and established. The Research Institute for Marine Fisheries, under a 2017-2019 national research project, piloted two culture models of seaweeds in offshore islands. One was *Caulerpa* in concrete tanks, the other *Kappaphycus alvarezii* in floating cages, at offshore islands. The culture model in floating cages was done at Phu Quy Island (Binh Thuan province, middle of Viet Nam). After each culture batch in the floating cages (60 days), seaweeds developed well with seedling productivity of 0.7 ± 0.068 kg raw seaweed/piece (20-25 pieces/line suspended inside cage) and growth rate of 3.74 ± 0.19 %/day. The research conclusion: “A big amount of commercial seaweed product was achieved from both the concrete ponds and floating cage models. The results provide a scientific platform for large-scale farming of these commercial seaweeds in Viet Nam.”⁴⁹

In addition to these, Appendix 7 features three lessons on best practices, one applied by a social enterprise working with seaweed farming communities and the other two based on the projects of the Global SeaweedSTAR distilled into policy briefs. The first policy brief provides recommendations to incentivise seaweed aquaculture to balance economic profitability with environment, human and organism health. A key set of recommendations advocates a wider environmental, gender-responsive and socially inclusive approaches to upscaling the seaweed industry. The second, based on research in Malaysia funded through the Global SeaweedSTAR program describes the setbacks linked to the decline in Malaysia’s seaweed production and volatility in the economic sustainability of the industry and proposes strategic recommendations to revive and sustain the value chains in the seaweed industry.

⁴⁸ Wright, Emily C. 2017. The upshot of upgrading: Seaweed farming and value chain development in Indonesia. MA in Geography thesis, University of Hawaii at Manoa, USA. <https://core.ac.uk/download/pdf/211328913.pdf>

⁴⁹ “Potential development of large-scale commercial seaweed farming at the offshore islands of Viet Nam.” <http://www.rimf.org.vn/Contents/Item/Display/22444>.

SECTION 4: TECHNICAL APPENDICES:

- Appendix 1 Location of Project Sites: Maps and Coordinates
- Appendix 2 Justifications for Selected Sites and Species
- Appendix 3 Knowledge Management and Communication
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