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NATIONAL SEAWEED *(kappaphycus)* INDUSTRY ROADMAP 2022-2026

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NATIONAL SEAWEED (*kappaphycus*) INDUSTRY ROADMAP 2022-2026

MESSAGE

The importance of the Philippine seaweeds industry cannot and must not be ignored. It is the number 1 aquaculture commodity comprising 60-70% of our total aquaculture production. Seaweeds is one of our top fisheries exports, which in 2019, is valued at US$250 million. Furthermore, more than a million Filipinos, majority of them farmers, are dependent on the industry for their living.

Unfortunately, however, the industry is threatened by a multitude of problems, foremost among which is decreasing production. As I see it, some of the causes are unstable supply of propagules and a marketing system that make farmers vulnerable to price fluctuations which disincentivize many to plant more. This situation can be attributed to the small-scale, stand-alone old model type of farming still engaged in by seaweed farmers. What is needed is to cluster and consolidate their production and marketing.

I have noted with glee that this Road Map will be addressing the problem of propagules availability by establishing seaweed nurseries operated as a business enterprise by cooperatives. The marketing problem is also being solved thru the organizing and strengthening of cooperatives.

The thrust towards organizing seaweed farmer cooperatives to enable them to cluster their production and consolidate their marketing will increase yield and bring better farm gate prices by enabling them to sell in volume direct to processors. These twin moves will in turn make the industry realize its full potential as a major source of livelihood and source of foreign exchange earnings for the country.

This is a perfect template for implementing the Farm and Fisheries Clustering and Consolidation Program (F2C2) Towards Greater Inclusive Agri-Business Development laid down in Administrative Order No. 27 series of 2020. Seaweed Farmer Cooperatives is the perfect vehicle for realizing this.

WILLIAM D. DAR, Ph.D.
Secretary, Department of Agriculture

"A food-secure Philippines with prosperous Farmers and Fisherfolk"

Masaganang ANI Mataas na KITA

MESSAGE

The seaweed industry occupies a large seat in our country's fisheries sector. With a total production of 1.49 million metric tons, seaweed is the top commodity produced by the aquaculture fisheries subsector. Over 60,000 hectares of shallow coastal waters are farmed in the country, with the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), MIMAROPA, and the Zamboanga Peninsula among the major seaweed producing regions. In terms of value, our high-quality, food grade carrageenan contributed USD 250 million to our total export earnings in 2019. Ecologically speaking, seaweed farming also plays a huge role in fighting climate change by absorbing carbon emissions, regenerating marine ecosystems, and creating biofuel and renewable plastics as well as generating marine protein.

This five-year Seaweed Industry Roadmap addresses issues at the production and marketing level. Currently, the seaweed sector focuses on the production of Raw Dried Seaweeds (RDS) to supply the carrageenan processing plants. This led to unstable marketing and prices arising from the local and international issues such as low demand and lower price of RDS from other countries. This Roadmap addresses one of the value chain gaps by promoting the commercialization of other seaweed products like food and other applications. The recommendation to establish Village Level Processing Plant (VLSPP) to be managed by seaweed cooperatives would provide higher value-added income from seaweeds.

The Department of Agriculture's Bureau of Fisheries and Aquatic Resources commits its full support in the implementation of this roadmap, towards creating a meaningful contribution for our shared vision of a food-secure Philippines, with prosperous fisherfolk, free from hunger and poverty.

Maraming salamat at Mabuhay ang ng Pangisdaan!

COMMODORE EDUARDO B. GONGONA, PCG (RET.)
BFAR National Director

MESSAGE

Our past and present Roadmaps have served well in maintaining the stability and growth of the Seaweed Industry. Our stakeholders equipped with such Roadmaps have faced the challenges of changing economic times and climate conditions with firm sense of directions and purpose. In the end, our Industry has harnessed the strength of its resources in good measures, transformed opportunities into gains and countervailed the risks thereby, past upheavals were turned into manageable and tolerable degrees enough to offset the ensuing aftermath and in turn, provide the momentum for recoveries. Over the years, the Industry continues to deliver positive contributions to our economy and retain the top spot for worldwide market leadership in seaweed business.

As always been the case, the demand of the processors for seaweed far exceeds the available supply being produced by seaweed-fisherfolk sector. Thus, the basic assumptions of Industry's Roadmap revolve around the raw material requirements of processors for which the fisherfolk sector gives its support and sets its direction for seaweed production. This Roadmap formula has proven beneficial to the Industry though by itself carries inherent exposure on too much dependence on single product commodity, the carrageenan.

The present economic atmosphere arising from the so called "new normal" has compelled the Industry to take a second look and reassess its way of doing business. An opportune time has come for seaweed production sector to stand on its own at equal footing with the processing sector, by way of an independent Roadmap but would still complement the traditional processor - driven Roadmap. The encouragement and support of the Dept. of Agriculture and Bureau of Fisheries and Aquatic Resources for this endeavor, augurs well in strengthening the Industry's production thrusts which include among others, product diversification, new market opening, livelihood sustainability, food security, climate change adaptation and marine resources conservation. But most of all, the seaweed Roadmap as envisioned would redound to the benefits of the greatest number of Industry's stakeholders, the fisherfolk.

We take with great zeal and pride our participation in the Development Team for seaweed production Roadmap. Our gratitude to fellow team members representing the government and public sector, private business group, academe, science and research, who in one way or another exerted their collective efforts and shared meaningful contributions to make the Roadmap an inspiring reality. We are also looking forward to seeing this Roadmap in full fruition in the near future.

ALFREDO A. PEDROSA III
Roadmap Development Team Leader


DEPARTMENT OF AGRICULTURE
BFAR

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List of Acronyms

Alkali-Treated Cottonii
(ATC)
alkali treated *cottonii* chips
(ATCC)
alkali treated seaweed
(ATS)
Aquaculture Steward Council - Marine Steward Council
(ASC-MSC)
Bangsamoro Autonomous Region in Muslim Mindanao
(BARMM)
Bureau of Fisheries and Aquatic Resources
(BFAR)
Carrageenan Processing Plants
(CPP)
Cooperative Managed Seaweeds Nursery Business Enterprise
(CMSNBE)
Department of Agriculture
(DA)
Department of Education
(DepEd)
Department of Environment and Natural Resources
(DENR)
Department of Health
(DOH)
Department of Science and Technology
(DOST)
Department of Trade and Industry-Bureau of Investment
(DTI-BOI)
European Union
(EU)
Food and Agriculture Organization
(FAO)
Government Controlled Corporation
(GCC)
Ingredient Solutions Inc.
(ISI)
International Trade Center
(ITC)
Local Government Unit
(LGU)
National Fisheries Research and Development Institute
(NFRDI)
National Organic Standards Board
(NOSB)
National Seaweed Technology Development Center
(NSTDC)
Non-Government Organizations
(NGOs)
Palawan State University
(PSU)
Philippine Crop Insurance Corporation
(PCIC)
Philippine Natural Grade
(PNG)
Philippine Rural Development Project
(PRDP)
Philippine Statistic Authority
(PSA)
polyethylene
(PE)
Production Loan Easy Access
(PLEA)
Raw Fresh Seaweeds
(RFS)
refined carrageenan
(RC)
Refined Carrageenan
(RC)
Return on Investment
(ROI)
Seaweeds Industry Association of the Philippines
(SIAP)
semi-refined carrageenan
(SRC)
Semi-Refined Carrageenan
(SRC)
state universities and colleges
(SUCs)
strengths, weaknesses, opportunities, and threats
(SWOT)
Technical Education and Skills Development Authority
(TESDA)
United States Department of Agriculture
(USDA)
University of the Philippines – Marine Science Institute
(UP-MSI)

EXECUTIVE SUMMARY

The Philippine seaweed industry roadmap is primarily intended to identify aspects of the industry that require sets of short-, medium-, and long-term initiatives that will eventually serve as the foundation for more consistent and coherent Department of Agriculture policy and program support. The roadmap's objective is to develop a detailed strategic plan for the Philippine seaweed industry to guide it toward the goal of regaining its international seaweed market position and becoming the "Global Market's Preferred Seaweed and Carrageenan Supplier." The roadmap analyzes the supply and value chains of the Philippine seaweed industry and discusses the industry's vision, mission, goals, plans, and targets. Additionally, it discusses the action plans and key outcome areas in detail, including the implementation and monitoring plans for the industry's advancement.

The Philippines ranks third in the world's seaweed production, behind China and Indonesia (FAO, 2018). Over 60,000 hectares of shallow coastal waters are farmed in the country, with the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), MIMAROPA (Mindoro, Marinduque, Romblon, Palawan), and the Zamboanga Peninsula are among the major seaweed producing regions (Philippine Fisheries Profile, 2019). With a total production of 1.49 million metric tons, seaweed is the top commodity produced by the aquaculture fisheries sub-sector (Philippine Fisheries Profile, 2019).

Seaweeds are classified into 1,065 species (Lastimoso and Santianez 2021) with 5 species that are commercially farmed and are commercially available in raw (fresh or dried seaweeds) and processed forms (carrageenan). The United States, China, Spain, Russia, and Belgium are the leading importers of Philippine seaweed (Pedrosa, 2017). It is estimated that approximately 1.2 million people are involved in and benefit from seaweed farming, which provides jobs and improves the socioeconomic status of coastal communities across the country (SIAP, 2021).

To help the industry, the Department of Agriculture (DA) through the Bureau of Fisheries and Aquatic Resources (BFAR)-Seaweed Development Program (SDP) and the Seaweeds Industry Association of the Philippines (SIAP) collaborated to create the Philippine Seaweeds Industry Roadmap, which is stakeholder-led, market-driven, Local Government Unit (LGU) enabled, inclusive, and value-chain competitive. The roadmap is an important contribution to the development of the seaweed industry, which is critical to the country's rural poverty reduction program.

The roadmap is the result of a series of consultations facilitated by the BFAR-SDP in collaboration with seaweed stakeholders, concerned national agencies such as the National Fisheries Research and Development Institute (NFRDI), the Department of Trade and Industry-Bureau of Investment (DTI-BOI), LGUs, and selected academics such as University of the Philippines - Marine Science Institute (UP-MSI), the University of San Carlos, and Palawan State University (PSU). Additionally, a series of draft report presentations were held to validate the data and elicit feedback from industry stakeholders. Furthermore, secondary data were used to present trends in production, area, yield, prices, and trade.

I. INTRODUCTION

Rationale

Over the years, seaweeds have been utilized throughout the world. The global seaweed industry is approximately 12 million metric tons in volume annually (equivalent to more than USD 6 billion) of which 85 percent consists of food products consumed directly or indirectly by humans. Seaweeds are not the only source of nutritious food for the people, but their culture and trade afford significant improvement in socio-economic livelihoods. Further, seaweed-derived products such as carrageenan and agar have become a major source of trade income for several countries (FAO, 2018).

In the Philippines, seaweeds are one of the most economically important fishery products which comprise 60-70 percent of the total aquaculture production. It consistently ranks as one of the top three exports of the fisheries sector. In 2019, seaweeds came second to tuna on export value which went up from US$ 207 million in 2018 to US$ 250 million in 2019 or an equivalent increase in the share to the total export earnings from 13% to 22%. Carrageenan remains the major product being shipped abroad comprising 94% of the total seaweed export value in pesos. United States of America (USA), People's Rep. of China, Spain, Russia, and Belgium are among the major markets for Philippine seaweed products.

Currently, the Philippines is endowed with 1,065 seaweeds species (Lastimoso and Santianez 2021) but production is mainly *Eucheuma* and *Kappahycus.* The country pioneered the cultivation of the carrageenan-bearing seaweeds *Eucheuma* that led to its dominance in commercial seaweeds production and recognition as the top seaweed producer in the international market. However, the Philippines lost its stance when Indonesia outdistanced its production in 2008 (PRDP, 2018). Seaweed production in the country also started to dwindle after its highest recorded production of 1,840,832 MT was achieved in 2011, primarily because of pests and disease outbreaks, exacerbated by climate change. Notwithstanding this, the country remains to be one of the major seaweed producers globally with great potential for exploring and developing other economically important seaweeds (e.g. *Gracilaria* which is the source of agar and agarose; Sargassum as a source of alginate, fucoidan, and fucoxanthin; *Asparagopsis* as a feed supplement for cattle to reduce enteric methane emission; and, *Caulerpa* as a sea vegetable; etc).

The area for expansion of the Philippine seaweed industry is vast and awaiting its full realization. The potential area for seaweed farming is huge. SIAP has estimated an aggregate of 700,000 hectares of the farmable area but only 8 percent are being utilized. BFAR Regional Offices likewise reported that current utilization rates range from 16 to 88 percent (PRDP, 2018).

Seaweed production in the Philippines is characterized as a family enterprise that is often situated in the most economically depressed areas of the country. The Department of Trade and Industry (DTI) registered about 200,000 fisherfolk households or approximately one million individuals dependent on seaweed culture as an alternative

source of livelihood. Apart from this, there are about 170,950 related jobs supported by the seaweeds sector. With this, the sector offers a vast opportunity for employment generation and inclusive growth and development.

Over and above the economic value of seaweeds, their benefits to the environment cannot be overlooked. It provides food, habitat, and breeding grounds for many marine species and organisms and promotes ecological stability and sustained productivity (PRDP, 2018). Because of these, it is hardly surprising that seaweeds are one of the eight commodities of national importance identified in the commodity prioritization under the World Bank-assisted Philippine Rural Development Project (PRDP).

Most of the seaweeds produced in the country are transformed into carrageenan, either as semi-refined carrageenan (SRC), also known as Philippine Natural Grade (PNG) carrageenan, or refined carrageenan (RC). Despite the decline in production, Philippine carrageenan, particularly food-grade SRC still dominates the global supply.

As of 2020, 16 known carrageenan processing plants were established in the country (personal interview, Solante, 2021). The declining seaweed production trend though incites the decision of some of the processing plants to relocate to areas where seaweed supply is more abundant and cheaper, such as in Indonesia.

The global demand for seaweeds and their derivatives is expanding. Its reputation as healthy food and the heightened popularity of Japanese cuisines build up the demand along with the increased usage in other applications such as food gels, processed meats, pharmaceuticals, cosmetics, fertilizers, and biotechnology, among others. Data from the Food and Agriculture Organization (FAO) of the United Nations on increased global seaweed consumption for food and other uses from 10.1 million MT in 2000 to 23.2 million MT in 2013 substantiate this market trend (PRDP, 2018). However, carrageenan exports exhibited a downtrend after 2014 when the National Organic Standards Board (NOSB) of the US recommended the delisting of carrageenan in the list of allowable ingredients for US organic products. Despite this, the United States Department of Agriculture (USDA) announced the renewal of carrageenan in the National List of Allowed Substances in 2018. USDA is set to review the list again in 2023 wherein the industry must prove that carrageenan passes the standards. Another challenge for the Philippine Seaweed Industry is the Aquaculture Steward Council - Marine Steward Council (ASC-MSC) Seaweed Standard which is globally recognized for sustainable and responsible seafood particularly in the European countries. With this risk of losing the sizeable US and European markets, the country may also lose its status of being the lead carrageenan exporter in the world.

Given the present condition of the Philippine seaweeds industry, this commodity roadmap is formulated essentially to identify aspects of the industry that necessitates sets of initiatives in the short or 5-year term that will eventually form the basis of a more consistent and coherent policy and program support of the Department of Agriculture.

During the Seaweed Industry Stakeholders Consultation, the participants recommended that because of the “New Normal Situation”, a short or 5-year term seaweed industry roadmap would be considered in the projection of strategies and targets.

Objectives

The general objective of this roadmap is to develop a detailed strategic plan for the Philippine seaweeds industry that will guide progress towards its goal of regaining its position in the international seaweeds industry and be the "Preferred Seaweed and Carrageenan Supplier in the Global Market". Specifically, this roadmap seeks to:

1. Present the current situation, performance, and outlook of the industry as well as the market trends and prospects;
2. Provide an analysis of the industry in terms of its structure, strengths, weaknesses, opportunities, and threats (SWOT), farm income, benchmarks, and competition;
3. Define the short- (2022-2026) direction of the seaweeds industry;
4. Determine the needed strategies, policies, and programs to reach its goal, including the required investment and support from the private sector; and
5. Identify the relevant stakeholders and define the roles and responsibilities they will play in implementing the roadmap.

II. INDUSTRY SITUATION AND OUTLOOK

Structure

Seaweeds are marine algae grown in the sea or cultured in ponds that are categorized based on their pigmentation: the red algae (*Rhodophyceae*), brown algae (*Phaeophyceae*), and green algae (*Chlorophyceae*). Seaweeds are being consumed directly as food and utilized in their industrial form such as the carrageenan. In the Philippines, only a fragment of seaweed produced is being eaten by the populace. A substantial portion of the seaweeds grown is manufactured into carrageenan which is usually traded in the world market. For this reason, the seaweeds industry is essentially considered an export industry.

Seaweed farming used to be an alternative livelihood in the past. Interestingly, it has emerged as an important and major livelihood in coastal communities, particularly in the southern part of the Philippines (PRDP, 2018). Albeit that there are 1,065 seaweed species (Lastimoso and Santianez 2021) in the country, the industry predominantly utilizes the species *Kappaphycus alvarezii*/*Kappaphycus striatum* (cottonii) and *Eucheuma denticulatum* (spinosum). These species are the main species cultured by seaweeds farmers and utilized for the production of carrageenan in the country.

Product Forms

Seaweeds are marketed in various product forms. Seaweeds traditionally dispensed in food forms are typified as Raw Fresh Seaweeds (RFS), Seaweeds Chips, and Seaweeds Noodles, whereas the Raw Dried Seaweeds (RDS) and Carrageenan, either semi-refined (SRC) or refined (RC) represent the seaweeds commonly used in an industrial form. Much

recently, seaweeds were developed as fertilizers for crops and components for swine/poultry feeds.

Raw Fresh Seaweeds (RFS)

RFS is the most basic form of seaweeds. These seaweeds are brought immediately to wet markets upon harvest. RFS consumed for food is served raw as a main ingredient in fresh salads. Alternatively, RFS is used for replanting by seaweed farmers. Farms with limited RFS for replanting obtain their seaweed planting materials from co-farmers with oversupply.

Seaweed-Enriched Food Products

Seaweed Chips and Noodles are popular value-added forms of seaweeds. Both are made from a mixture of ground raw dried seaweeds, flour, salt, and other seasonings and cooked into strips. The noodles though are much longer and thinner in appearance. Seaweed chips are marketed in small packs, primarily intended for children to be consumed as snacks.

Raw Dried Seaweeds (RDS)

RDS are the typical output of seaweed farmers. These are the seaweeds that are subjected to drying before trading in the market. These are primarily used for extracting carrageenan, thereby making it the main requirement of the carrageenan processing plants.

Refined Carrageenan (RC)

RDS are further transformed to RC or SRC. RC is the pure hydrocolloid extracted from raw dried *Kappaphycus alvarezii and K. striatum* commercially called 'cottonii' and *E. denticualtum commercially called* 'spinosum' seaweeds through the process of alcohol precipitation or gel pressing. Alcohol precipitation can be used for all types of carrageenan, but the gel method is only applicable for kappa-carrageenan (Mc Hugh, 2003). Alcohol precipitated RC is often utilized in relatively high-end applications, such as meat products and jams that require maintenance of the true color of foods or products. Hence, it is expensive relative to the gel-pressed RC.

Semi-Refined Carrageenan (SRC)

SRC, either food grade or pet grade, is a seaweed product that is processed from RDS in a much faster way. In producing SRC, there is no extraction of carrageenan from seaweeds, but a mere acquisition of insoluble residues through alkali treatment. Residues are dried, chopped, and milled into powder form afterward. For this reason, SRC is considerably cheaper than RC but is mainly for kappa-carrageenan (Mc Hugh, 2003; Dewi, Darmanto, and Ambariyanto, 2012). The Philippines is known for a specific variation of SRC, the Philippine Natural Grade (PNG).

Fertilizer, Growth Promoter, and Feeds

Brown and green seaweeds are sun-dried, powdered, and used as animal food supplements/ingredients. Sargassum spp. are specially processed by water extraction and fermentation, to produce coffee brown liquid retaining its natural valuable properties as a potent natural fertilizer for palay and other crops and as pesticide and insecticide as well (Mr. E. Dublin, 2020). Meanwhile, drippings of Kappaphycus and Gracilaria while drying are used directly to fertilize crops by which, BFAR – National Seaweed Technology Development Center (NSTDC) has obtained a significant increase in the growth rate of green vegetables at different planting seasons.

Key Industry Players

The seaweeds industry in the Philippines is generally composed of four major players namely the input suppliers, producers/farmers, traders/consolidators, and processors/exporters.

Input Suppliers

The input suppliers are the providers of the inputs for seaweed production. This includes sources of seaweed propagules and farm implements that farmers use to commence the cultivation of seaweeds. Suppliers of propagules or seedlings consist of the farmers themselves, private and government nurseries, seedling banks, government agencies, and other private organizations. Customarily, farmers acquire propagules by retaining a portion of the good quality harvest from their farms. However, there are situations that they do not have sufficient planting materials saved that they resort to purchasing from other farms, private nurseries, and seedlings banks, obtaining their benefits as members from established seaweed nurseries of the government and farmers associations, and depending on the provisions and/or donations of BFAR, LGUs, Non-Government Organizations (NGOs) and other government agencies. If in need of financing, traders/middlemen serve as the major source of support in securing inputs but in exchange for a commitment by the farmer to sell the harvest exclusively at a much lower price. Government and NGOs dole-out support are usually minimal at 50 to 100 kilograms for a limited number of seaweed planter beneficiaries (around 100) for specifically targeted municipalities. Usually, the propagules distributed from government support are from winning contractors who are businessmen with only superficial knowledge of seaweeds. In general, they simply buy the seedlings from seaweed farmers but because they only have a cursory familiarity with the plant, they are supplied by unscrupulous farmers with fresh seaweeds that are already matured and no longer suitable for replanting. This highlights the importance of propagule suppliers in maintaining the quality and productivity of seaweed farms.

The source of farm implements, consisting of nylon, polyethylene (PE) ropes, floaters, wooden stakes, and plastic straw soft ties, among others, are varied. For developed seaweed areas such as Bohol and Palawan, farmers acquire the supplies from hardware stores and agri-vet and fishing supply stores either through cash or credit. On some occasions, farmers obtain these materials from the traders who also have merchandise

stores or from their investors/financiers. On the other hand, many farmers, particularly in relatively depressed areas, rely on the free-of-cost provisions of BFAR, LGUs, NGOs, and other organizations. The latter usually match the seedlings that they dole out to farmers with the farm implements.

There are also instances that farmers just gather farming materials from their neighborhoods. Used plastic bottles and discarded Styrofoam are utilized as floaters; mangrove sticks, and other wood sticks are employed as stakes for poles of the seaweed farms. Albeit that paddle and motorized boats that are essential for transporting the seaweeds are commonly owned by the farmers, some fiberglass boats were also provided by BFAR and other government and non-government institutions supporting the industry.

In addition to the materials needed for seaweed cultivation, permits and licenses are required for farms operating in select municipalities. Farmers secure their permits and licenses from their respective LGUs, wherein the LGUs set the guidelines and fees applicable for seaweed farming in their areas.

On another note, technical training and assistance are also being provided to the seaweed growers. BFAR, with the assistance of the local government, state universities and colleges (SUCs), and other agencies and organizations, administer training on seaweed cultivation and related technologies to farmers free of charge. Technical assistance throughout the production period is likewise extended to the seaweed growers, especially with the new farmers and during unpleasant times when farmers experience problems such as the onslaught of pests and diseases.

Seaweed Producers / Farmers

The growing of seaweeds in the production phase is the core of the seaweeds industry. Considering that the output at this stage signifies the magnitude of seaweeds available for consumption or the raw materials for carrageenan manufacturing, it essentially determines the success or failure of the industry.

The seaweed producers/farmers are the chief players in the seaweed production segment. Seaweed producers in the Philippines are mostly fishermen, together with their wives and adult children. With almost all the family members involved in the undertaking, seaweed farms are considered a family venture in the country. At present, it is estimated that about 200,000 families (200,000 husbands and wives or approximately 400,000 individuals) are engaged in seaweed farming.

Associations and cooperatives are very evident among seaweed growers. The farmers organize themselves to form cooperatives or associations primarily to satisfy the requirement of donors of material inputs and technical assistance to be considered as priority beneficiaries of the government's projects and support.

The report of Quiaoit et. al. (2018), as cited in PRDP (2018), indicated that there is 102,000 ha of productive seaweed farms as of 2016. The estimated 400,000 individual

farmers thereby convey that each farmer has a one-fourth hectare of seaweed farm on average. Among the recorded seaweed farms in 2018, Tawi-Tawi has the vastest seaweed area of 62,911 ha (61%), whereas farms in Palawan have the highest average size of 0.73 ha (Table 1).

Table 1. Number of Farmers and Average Farm Size in Selected Areas

Region / Province	Production Area (ha)	No. of Farmers	Average Farm Size (ha/farmer)
Philippines	102,000	400,000	0.25
Region 2	15.10	147	0.10
Cagayan	15.10	147	0.10
Region 4-B	No data yet	No data yet	No data yet
Palawan	5,567	7,604	0.73
Region 5	559	2,963	0.18
Sorsogon	55.5	370	0.15
Region 7	4.024.03	12,586	0.32
Bohol	2,714.36	7,225	0.38
Region 8	1.074.47	3,228	0.33
Leyte	925	1,471	0.63
Region 9	11,888	26,800	0.44
Zamboanga City	2,345	8,424	0.28
Zamboanga Sibugay	5,310	10,394	0.51
Region 13	876.65	1,365	0.64
Surigao del Sur	377	873	0.43
ARMM	69,303		
Tawi-Tawi	62,911		
TOTAL	**264,861.71**		

Source: PRDP, 2018 (National VCA for Seaweeds)

Seaweed farmers perform several tasks in seaweed production: 1) farm selection and acquisition; 2) farm preparation; 3) procurement of seedlings and other inputs; 4) cutting and tying of seedlings; 5) planting and tying of floaters; 6) farm maintenance; 7) harvesting; 8) drying, sorting and cleaning; 9) packing; 10) hauling; and 11) selling.

The first thing a seaweed farmer needs to do is to select and acquire the area where he will cultivate the seaweeds. The farmer primarily decides where to put up his farm. This decision however is usually limited to certain considerations, such as the size of waves and water current, because the majority of the farmers cannot determine areas suitable for planting. Subsequently, the farmer needs to secure the area he has chosen. The rule of *First Come, First Serve* basis commonly applies to the acquisition of seaweed farm area, thereby affording favor to existing, old farmers and disadvantaging new entrants. Nevertheless, a new farmer may request an existing farmer to grant a small area where he can grow seaweeds. The farmer may also borrow an area from old farmers who have no plans of planting seaweeds for a certain period. Purchasing the area from old-time farmers selling their farms is another option in some regions to secure a place. Although the seaweed areas may be passed on from one person to another or may be used by different individuals, generally, there is no legal document that verifies a farmer's

ownership or right to use a certain area of the sea for seaweed cultivation. Ownership or usage of an area is widely based on established rules and relationships within the community, usually implemented by the barangay-level government.

Preparing the farm for seaweed cultivation is the next task of the farmer. Herewith, farmers set up the farm according to the cultivation method they plan to employ appropriate to the topography of the area. The common seaweed culture methods in the Philippines are the fixed-off bottom line, floating monoline, and raft method (PRDP, 2018). The anchors, posts, and cultivation lines are being established during farm preparation. Nets to act as the fence are also being set up at this point, especially in shallower areas. This painstaking activity however necessitates assistance from other male members of the household or hiring of other people.

Purchasing or sourcing the seedlings or propagules is another job of the farmer. Typically, farmers save a portion of the harvest and use it as seedlings in the next planting season. Purchasing from co-farmers within the locality or in nearby towns only happens when a farmer was not able to save due to low harvest or infestation of pests and diseases. In case there is a need to go to a relatively distant place to buy their propagules, farmers coordinate with each other to buy in bulk. Wives frequently assist their husbands in scouting for places where they can buy seedlings. Meanwhile, some farmers obtain their propagules from BFAR and established nurseries. It is very seldom that the seedlings are sourced from the wild and if sourced elsewhere, need to be subjected to biosecurity measures to avoid the possible spread of pests and diseases.

The farmers prepare the seedlings for planting as soon as it has arrived in their area. It is being cut and tied to the cultivation lines. This laborious task is mainly performed by wives, assisted often by the children. There are situations that workers are hired to accomplish this job.

The actual planting takes place once the seedlings are prepared. The cultivation lines are brought to the farm and tied to the mainlines. Floaters are tied to the cultivation lines subsequent to the installation of the cultivation lines. This planting activity is usually done in the early morning to avoid exposure to the sun and takes about two to eight hours to complete depending on the number of lines to be installed. Laborers are also hired if the farm is huge to ensure that the planting will be accomplished within the day.

The seaweed plants will be harvested after 45-60 days. In between the planting and harvesting, farmers regularly perform check-ups of their plants and other necessary actions to maintain their farms. Farm maintenance involves shaking of culture lines to remove silt, dirt, and other unwanted seaweeds attached to the cultured seaweeds, replacing detached seedlings, repairing the structure, removing grazers, and possible relocation of farms in times of typhoons. Apart from this, replanting, which is the pruning of the seedlings after 15 to 30 days to add new cultivation lines, is carried out by the farmers.

Farmers harvest their plants when it has grown to their maturity after 45 to 60 days. While this is being observed by the majority, a few farmers harvest before this recommended time. Some farmers also dip their seaweeds in chemical fertilizer(s) to

make them grow bigger ahead of the recommended time. Albeit the seaweeds appear to be big in size, the carrageenan yield from fertilized seaweeds is lower (PRDP, 2018). The voluminous seaweed harvest varied depending on farm size and culture method and techniques, are cleaned, placed in baskets or nets, and carried from the farm to the shore by boat. Men farmers generally perform the harvesting and the majority merely have small paddle boats to move the seaweeds. For this reason, boat rentals, borrowing, and sharing are predominant during harvest time.

Farmers likewise perform drying of the seaweeds following the harvest if they plan not to sell their seaweeds fresh or wet. Farmers place the seaweeds under the sun either spread throughout the shore with fishnets underneath drying platforms or hang them normally for 2-5 days. Drying is extended to 7 days when it is raining. Although farmers are much aware of the moisture content requirement of traders and carrageenan processors, they have no access to the mechanical instrument to determine the dryness of their seaweeds. Instead, some farmers send RDS samples to NSTDC for free seaweed quality analysis where the result is usually released a day after receipt of samples. Yield, gel strength, and viscosity results are also released after 3-5 days from receipt of samples at NSTDC. Other farmers rely on physical observations to tell that their seaweeds are dried enough for selling. The common wet-to-dry ratio of seaweeds according to farmers is 7:1, i.e. 7 kilograms of wet seaweeds is reduced to just 1 kilogram when fully dried at moisture content higher than the acceptable 35-40 percent.

In addition to drying, farmers must ensure that their seaweeds are clean. Seaweeds may get contaminated during drying. The sand and dirt are attached to it when it is laid onshore. The rain gets to it when the farmer was unable to secure the seaweeds as soon as possible when the rain comes. These contaminations result in lower buying prices of the seaweeds. Some seaweeds may also still have soft ties attached to them which need to be removed. Thus, farmers also carry out sorting and cleaning of the seaweeds.

Once the seaweeds are dried and clean, farmers haul the seaweeds to their homes and pack them into sacks. Packing takes 2 hours up to a whole day to accomplish. Finally, the farmers are ready to sell their produce. They bring the seaweeds to the buyers either in their barangay, municipality, or province depending on the proximity and ability of the farmer to bring the seaweeds to the trader. Buyers offer to pick up the seaweed if it is more than 2 sacks. Farmers usually sell their seaweeds to their *suki* buyers (PRDP, 2018; Suyo et al. 2020). Though, they also check and compare prices and choose the highest buying price. This however causes conflicts when the farmer has outstanding loans and prior agreements with their buyers.

There are seaweed producers who have explored beyond the regular role of growing seaweeds and extended its function to buying seaweeds from other farmers. Conversely, there are seaweed buyers who have also considered cultivating seaweeds to satisfy deficits in seaweed supply. These are known as farmer traders.

Traders

Traders are the buyers of seaweeds from the farmers and sellers of seaweeds to the processors. As such, they are considered as the bridge of the farmers to the processors.

The PRDP (2018) reveals that there are nearly 400 industry players involved in the trading of seaweeds, and as expected, the high seaweed producing areas have the greater number of traders (Table 2). The seaweed trading sector is comprised mostly of comparatively smaller traders; only about 18% are large traders. RDS exporters are also considered seaweed traders.

Table 2. Seaweed Traders in the Philippines;

Province	Total Trader	Buying Station	RDS Exporter
Philippines	**344 (70)**	**14**	**15**
Region 2	**3**	**-**	**-**
Cagayan	3	-	-
Region 4A	**22**	**-**	**1**
Batangas	5	-	-
Quezon	17	-	1
Laguna	0	-	-
Cavite	0	-	-
Region 4B	**55**	**5**	**-**
Palawan	39	5	-
Occidental Mindoro	4	-	-
Oriental Mindoro	2	-	-
Romblon	10	-	-
Region 5	**19 (15)**	**1**	**-**
Albay	2 (2)	-	-
Sorsogon	4 (4)	-	-
Camarines Sur	2	-	-
Camarines Norte	5 (3)	1	-
Masbate	4 (4)	-	-
Catanduanes	2 (2)	-	-
Region 6	**26 (15)**	**5**	**-**
Antique	15 (15)	-	-
Iloilo	7	5	-
Guimaras	1	-	-
Negros Occidental	3	-	-
Region 7	**13 (13)**	**-**	**8**
Bohol	9 (8)	-	-
Cebu	5 (5)	-	8
Negros Oriental	0	-	-
Siquijor	0	-	-
Region 8	**22**	**2**	**-**
Leyte	15	-	-
Northern Samar	0	1	-
Eastern Samar	7	1	
Region 9	**147 (16)**	**Many**	**6**

Zamboanga City	46 (16)	Many	6
Region 10	**5 (1)**	**-**	**-**
Ozamis City	4	-	-
Misamis Oriental	0	-	-
Lanao del Norte	1 (1)	-	-
Region 11	**3 (3)**	**-**	**-**
Davao City	3 (1)	-	-
Region 13	**10 (1)**	**1**	**-**
Surigao del Sur	10 (1)	1	-
ARMM	**22 (6)**	**-**	**-**
Tawi-Tawi	19 (3)	-	-
Basilan	2 (2)	-	-
Sulu	1 (1)	-	-
Maguindanao	-	-	-

Source: Consolidated from KIIs and Stakeholders' Consultation

There are three types of traders observed in the country: 1) Barangay traders; 2) Municipal traders, and 3) Provincial traders. In general, these traders are classified based on their location and volume of transactions.

Barangay traders are the seaweed buyers confined within their barangay or island. They are the most accessible type of traders to the farmers. They consolidate a small volume of seaweeds which they consequently sell to bigger traders in the town or province proper. The average volume of seaweeds they trade is just 5 MT or less per transaction. Besides buying seaweeds, these traders are also loan providers to the farmers. They loan out money for the purchase of farm implements or they supply the farm implements to farmers in form of loans. Most of them likewise have sari-sari stores where farmers get their daily needs. Buyers obliged farmers with loans to sell their seaweeds to them upon harvest as repayment. Unfortunately, buying prices offered by the barangay traders are lower for farmers with loans. Some of the barangay traders are being supported by a bigger trader through a marketing capital.

Traders with seaweeds transactions that are relatively bigger than the barangay trader but smaller than the large provincial traders are the municipal traders. They are usually situated in the cities or municipalities and gather seaweeds from the different barangays. They have storage facilities that can accommodate bigger volumes of seaweeds that is why they are also called *stockers.* Their clients are composed of barangay traders, farmers with access to their shops or buying stations, and provincial traders. It is also possible that they have exporters and processors as their clients. The average volume of seaweeds traded per transaction is about 5 -10 MT. Similar to the barangay traders, they also offer loans to seaweed growers and may have capital support from large traders, processors, or exporters.

The traders with the greatest seaweed volume transaction are the large or provincial traders. Seaweed trading per transaction of the provincial traders is 10-20 MT. Their seaweeds are collected from 5-10 barangay or municipalities within the province they are located. They are the direct suppliers of processing plants or exporters. In some

instances, they act as the buying stations of the processors such that there are no trading transactions that happen between them; provincial traders simply manage the buying of seaweeds from farmers and send it to the processing plants. They usually have employees to work in their buying stations and storehouses. Unlike the smaller traders, transactions of the provincial traders with processors are supported by Purchase Orders (POs) to guarantee the buying/selling prices in case of fluctuations.

Farmers are trying to form associations or cooperatives to consolidate their seaweeds and be able to sell collectively to bigger traders where they can earn better profits. Some cooperatives take up the trading function and market the seaweeds directly to the processing plants.

Traders undertake tasks more than just buying, consolidating, and selling seaweeds. Part of the role is to weigh and sort the seaweeds that they purchase. Weighing accounts for the volume, whereas sorting initially determines the quality and species of the seaweeds being bought. The traders will similarly perform the quality inspection by checking if the seaweeds are free from dirt and other foreign materials and subjecting it to laboratory tests for some big traders. The inspection guides the transaction, whether the trade will push through or not, and dictates the buying price during trading. Traders filter and dry the seaweeds further after purchase, particularly for seaweeds bought at inferior quality. This is to make sure that the product is free from foreign matters. As soon as the moisture content level is attained, traders repack and keep seaweeds in storage until there is enough volume to sell. The trader contacts the client to schedule the delivery or pick up of the seaweeds, which is facilitated by mere loading to trucks and boats that will bring the products to the destination of the buyer. Traders are paid via their bank accounts in two tranches. The first 70-80 percent are paid once the goods are certified satisfactory. The remaining payment will have to wait for the results of the laboratory tests that processing plants and exporters carry out.

RDS exporters are a special type of trader. Although they are remarkably similar to the usual seaweed traders, they sell their seaweeds to the global market. Several RDS exporting companies exist in the country. The records of DTI show that there are nearly 50 exporters as of 2018. Among them are the Royal Algaculture Corp. and LM Zamboanga United Trading.

Processors

In general, the processors in the seaweeds industry are known as carrageenan processors. However, the recent efforts of BFAR and other organizations to enhance and diversify seaweed product lines resulted in the creation of value-added products and thus processors of these value-added products. The latter type of processors though is characterized as small and home- or community-based, with production intermittent or seasonal.

The carrageenan processors are the main clients of the local traders for dried seaweed. They source RDS locally at large but also consider buying raw materials abroad during periods of occasional shortages and cheaper seaweed prices. They transform the RDS into carrageenan which is typically in the form of SRC, RC, and carrageenan blended products. Several carrageenan processing plants are situated in the Philippines. In 2016, the W.

Hydrocolloids (25%), Shemberg Corporation (25%); Marcel Trading Corp. (20%), Kerry Food Ingredients (10%), and CP Kelco (10%) are the major carrageenan processors in the industry. The remainder is shared by FMC, TBK, MPCI, and others (DTI, 2016). The most recent list of processors is presented in Table X. Accordingly, DTI noted that 65% of the total dried seaweeds supply are processed into SRC and 22% into RC. The remaining 13% are exported raw (PRDP Visayas Cluster, 2018). The USA and Europe are the principal buyers of carrageenan.

There are at least 16 carrageenan processing plants in the country in 2020. Four are multinational companies and 12 are local businesses, which are mostly located in Cebu. Recently, SIAP reported that two companies in Cebu have closed their processing plants and transferred to Thailand (Stakeholders Consultation, 2021). Table 3 presents the capacities of existing processing plants in the country.

Table 3. Processors in the Philippines, their Products and Plant Capacities

Processor	Plant Location	Plant Capacity (MT)
Refined		
Shemberg Biotech Corporation -Alcohol	Carmen, Cebu	1,800
Marcel Food Sciences Inc. (CPKelco) –KCL	Sibonga, Cebu	1,800
W. H I (PBI) - KCL	Laguna	1,400-1,500
Shemberg Marketing Corp – KCL	Mandaue, Cebu	800
Semi-Refined		
Ceamsia Asia, Inc.	Marilao, Bulacan	1,800
Accel Carrageenan Corp	Carmona, Cavite	1,500
MCPI Corporation	Consolacion, Cebu	1,800
Mioka Biosystems Corporation (Marcel)	Canlubang, Laguna	1,800
TBK Manufacturing Corporation	Tacloban City, Leyte	2,500
Marcel Trading Corporation	Zamboanga City	5,400
Mega Pollygums Corp	Zamboanga City	3,600
LM Zamboanga Carrageenan Manufacturing Corp.	Zamboanga City	1,800
Shemberg Marketing Corporation	Mandaue City, Cebu	3,600
Froilan Trading Corp	Mandaue City, Cebu	1,800
W. Hydrocolloids	Carmona, Cavite	2,400
Cebu Carrageenan Corp	Carmen, Cebu	800
Alkali-Treated Chips		
LM Zamboanga Carrageenan Manufacturing Corp.	Zamboanga City	600
Froilan Trading Corp	Mandaue City, Cebu	1,200
Cebu Carrageenan Corp	Carmen, Cebu	1,600

Source: PRDP (2018); personal interview, Solante, 2021

The production-related activities of the carrageenan processors cover the laboratory analysis on RDS, pre-sampling analysis, processing of carrageenan, packing, labeling, stocking, up to shipping. Laboratory analysis is done to determine if the purchased RDS satisfies their requirements for production. The results of the analysis are the basis for the final payment of the trader. Pre-sampling analysis, on the other hand, is carried out

to create a sample of the product required by a client before mass production. A contract will be executed once the sample is approved by the client. Mass production proceeds from the preparation of the contract. Carrageenan products will be packed and labeled after production. If the product is not yet due for delivery, then it will be stored first. Otherwise, the products will be immediately shipped to the client.

Aside from the production of carrageenan products, the processors also meet up with their clients and participate in food expos.

Carrageenan processors are considered to have the highest investment among all the industry players. They put a significant amount of money on the purchase of machines and the hiring of skilled laborers to prepare each customized product they create. Meanwhile, they are also the most susceptible to risks of fluctuations in seaweed prices and foreign exchange rates, being the player largely involved in the global market. They also face the risk of losing clients if RDS supply is insufficient to deliver the requirement of their clients.

The goal of pushing value-added products is not only for product diversification but also for income augmentation of the seaweed growers. For this reason, processors of value-added products such as seaweed chips and noodles are oftentimes the farmer themselves. While numerous people have been trained and started producing and selling these products, very few are successful in this endeavor. These small producers are challenged in marketing their products. First of all, the demand seems not enough for the volume of seaweed chips and noodles they are producing. Another thing is that their packaging appears uninviting that consumers are not enticed to try the product. Lastly, the producers may lack marketing skills because most of them are housewives not used to sell products.

Industry Performance and Outlook

Production

Global Production

In 1990, the global seaweed production totaled 5.5 million metric tons, wherein three-fourths is supplied by the aquaculture sector while the remaining quarter is harvested from the wild. Seaweed production has climbed throughout the years and after nearly 30 years, world production has displayed a six-fold increase with a total output of 33.3 million metric tons in 2018. This time, the gap in the share in the production of the wild harvests and aquaculture has widened, with aquaculture and wild harvests contributing 97 percent and 3 percent, respectively. Wild harvests of seaweeds have dwindled, from approximately 1.3 million metric tons in 1990 settling to 0.95 million metric tons in 2018. In contrast, the farming sector ascended from nearly 4.2 million metric tons in 1990 to roughly 32.4 million metric tons in 2018, in which it exhibited 28 percent annual growth on average (Figure 1).

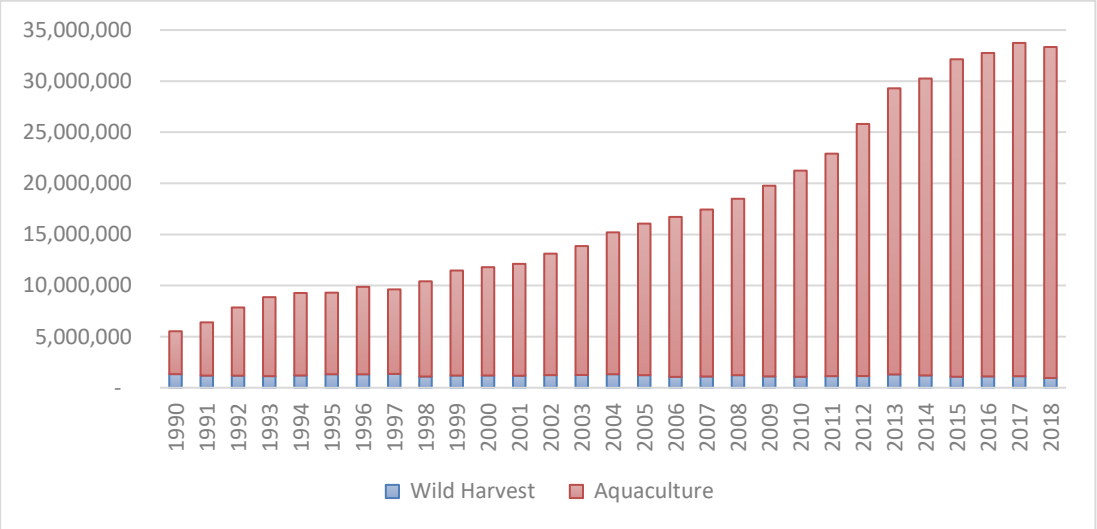


Figure 1. World Total Seaweeds Production, 1990-2018 (in MT)
Source: FAO FishStat, 2021

As exhibited in Figure 2, Asia is greatly responsible for the production growth, contributing close to 98 percent of the seaweed output. As such, the trend in the global seaweed output reflects that of the Asian region. Other regions supplying diminutive volumes have even displayed contraction in their production from 1990 to 2018, except for Africa.

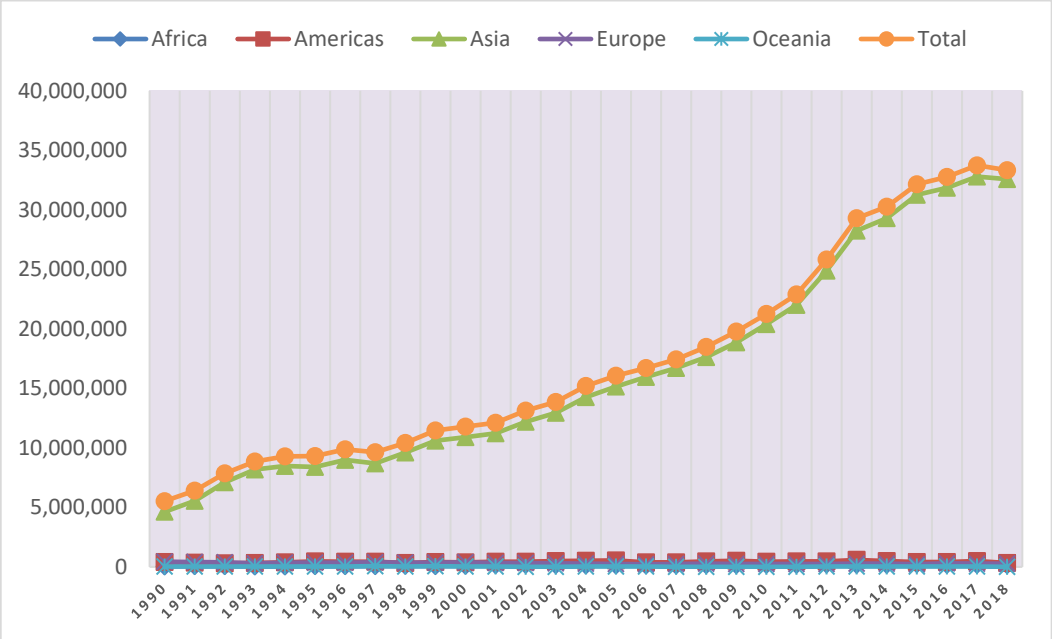


Figure 2. Seaweed Production by Region, 1990-2018 (in MT)
Source: FAO FishStat, 2021

The top producing countries in terms of total production as of 2018 are China, Indonesia, South Korea, the Philippines, North Korea, Japan, Chile, Malaysia, Norway, and Zanzibar. Harvesting of seaweeds from the wild is led by Chile, China, Norway, and Japan. Meanwhile, the cultivation of seaweeds is dominated by China, Indonesia, South Korea, and the Philippines (Table 4).

Table 4. Top Seaweeds Producers, 2018

Total Production	
China	56.3%
Indonesia	28.1%
South Korea	5.2%
Philippines	4.4%
North Korea	1.7%
Japan	1.4%
Chile	0.8%
Malaysia	0.5%
Norway	0.5%
Zanzibar	0.3%

Harvest from Wild	
Chile	25.9%
China	19.2%
Norway	17.7%
Japan	8.0%
Indonesia	4.6%
France	4.3%
Peru	4.0%
Ireland	3.1%
India	2.4%
Iceland	2.0%

Aquaculture	
China	57.4%
Indonesia	28.8%
South Korea	5.3%
Philippines	4.6%
North Korea	1.7%
Japan	1.2%
Malaysia	0.5%
Zanzibar	0.3%
Chile	0.1%
Viet Nam	0.1%

Source: FAO FishStat, 2021

China maintains its stance as the principal seaweed producer of the world. Contributing more than 50 percent of the total seaweeds output at present, China provides seaweed both from wild harvests and aquaculture (Table 4). Notably, its share has increased from 45 percent in 2015 (PRDP, 2018) to 56 percent in 2018. In like manner, the proportion

of South Korea slightly improved from 4 percent in 2015 (PRDP, 2018) to 5 percent in 2018. Conversely, Indonesia and the Philippines came out in 2018 at 28 and 4 percent, respectively from 39 and 5 percent in 2015 (PRDP, 2015). The Philippines is currently at the fourth spot in global production.

Domestic Production

Seaweeds are a very important component of the Philippine aquaculture industry. For years, 60 to 70 percent of aquaculture production consists of seaweeds (PSA, 2021). Seaweed production has developed into a major industry in the country from mere alternative livelihoods for fishers.

Seaweed cultivation in the Philippines is essentially characterized as small-scale. Despite this, the Philippines is known as one of the chief producers of seaweeds in the world. In the past decades, the country upheld its position at number 2, following China, until it was pushed down to the next spot when Indonesia outdid its production volume starting 2007 (FAO, 2018). It appears that the Philippines has been overtaken by South Korea and has dropped to fourth place at present (FAO FishStat, 2021).

As exhibited in Figure 3, the Philippine seaweed production was expanding from the 90s until 2011. However, a downward trend was generally observed in recent years. In 2020, it has registered 1.47 million metric tons, a 2.1 percent drop from the 2019 output of 1.5 million metric tons (PSA, 2021).

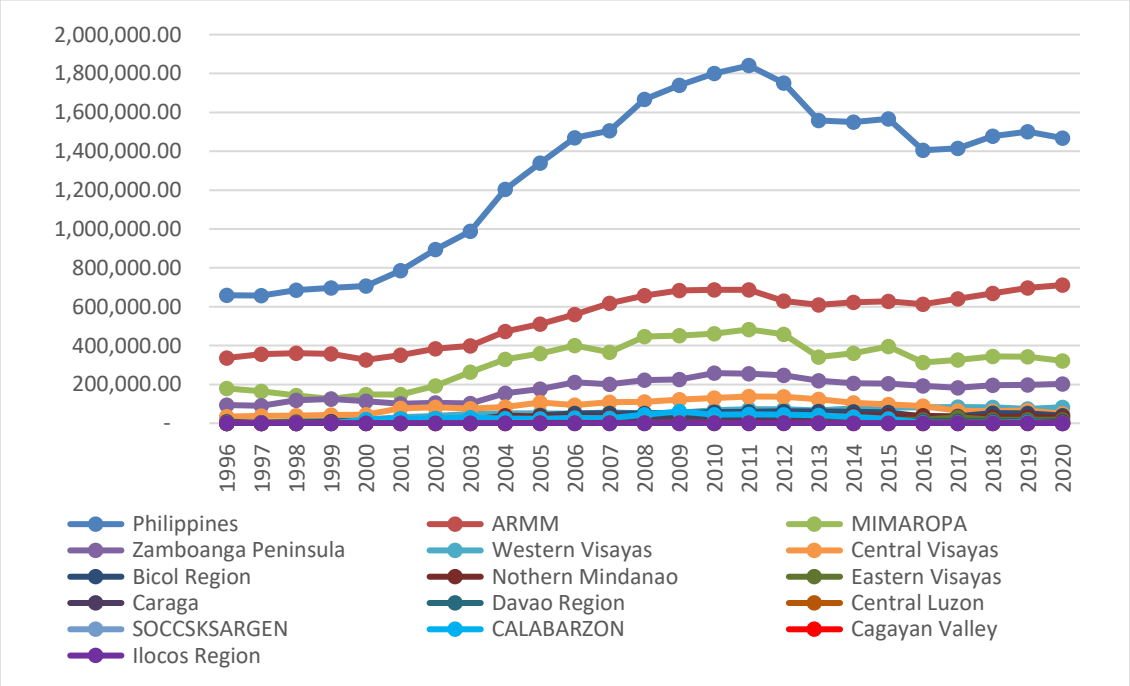


Figure 3. Seaweed Production of the Philippines by Region, 1996-2020
Source: PSA, 2021

The different regions producing seaweeds likewise displayed a decline in their outputs, in general, although some regions showed some improvements. Philippine Statistic Authority (PSA) data reveals that only 7 out of 15 seaweed-producing regions posted a

positive average annual growth rate in the past five years. Production of other regions remained to be significantly challenged.

Farming of seaweeds essentially suffered from climate change-related events such as weather disruptions and typhoons, ice-ice disease, and sea surface temperature rise. Scarcity of planting was also observed. There were also reports that farmers encountered low buying prices of seaweeds from traders which influenced the closure of their operations.

On the contrary, the industry benefitted from favorable weather conditions, reduced occurrences of diseases, lesser attacks of pests (fishes and turtles feeding on the seaweeds) as well from interventions of BFAR and LGUs of providing seedlings and other farm inputs and appreciation of seaweed prices in many recent years. BFAR monitoring reflected that the latest seaweed prices have been stable.

Seaweed production in the Philippines is most predominant in Mindanao accounting for 65 percent of the aggregate output. Roughly 25 and 10 percent are attributed to Luzon and Visayas, respectively. The BARMM remains to be the chief producing region with a total harvest of 0.7 million metric tons or equivalently 48 percent of the country's seaweed output in 2020. Region 4B (MIMAROPA) and Region 9 (Zamboanga Peninsula) rank second and third with respective shares of approximately 22 and 14 percent (Figure 4).

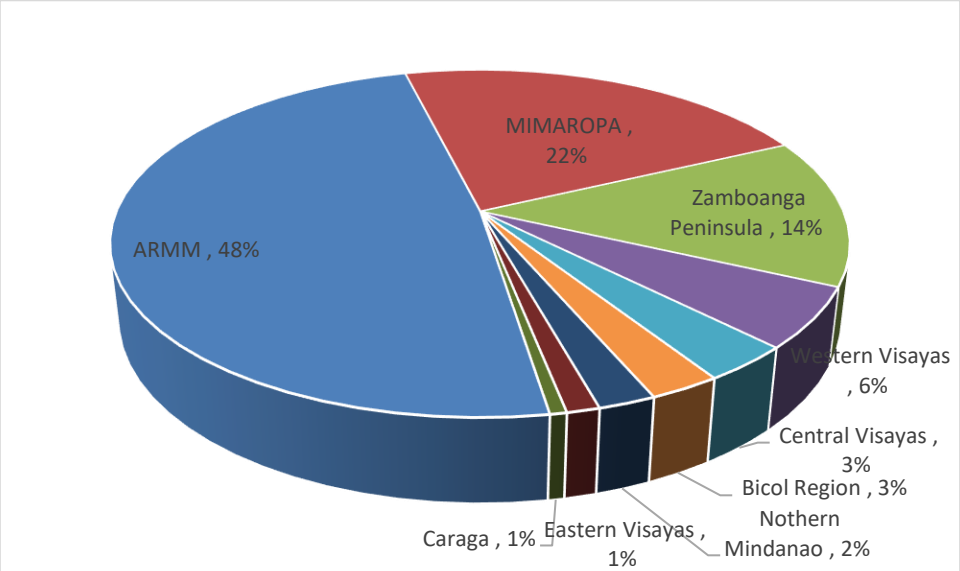


Figure 4. Percentage Share to Total Production, by Region, 2020
Source: PSA, 2021

Accordingly, at the provincial level, Tawi-Tawi regains the top spot since 2018. In 2020, it has a record of 375,617 metric tons which contributed 26 percent to the country's harvest. Now, Palawan ranks second supplying 22 percent to the 2020 production. As shown in Figure 5, other major seaweed provinces are Sulu (16%), Maguindanao (7%), Zamboanga Sibugay (7%), and Antique (6%).

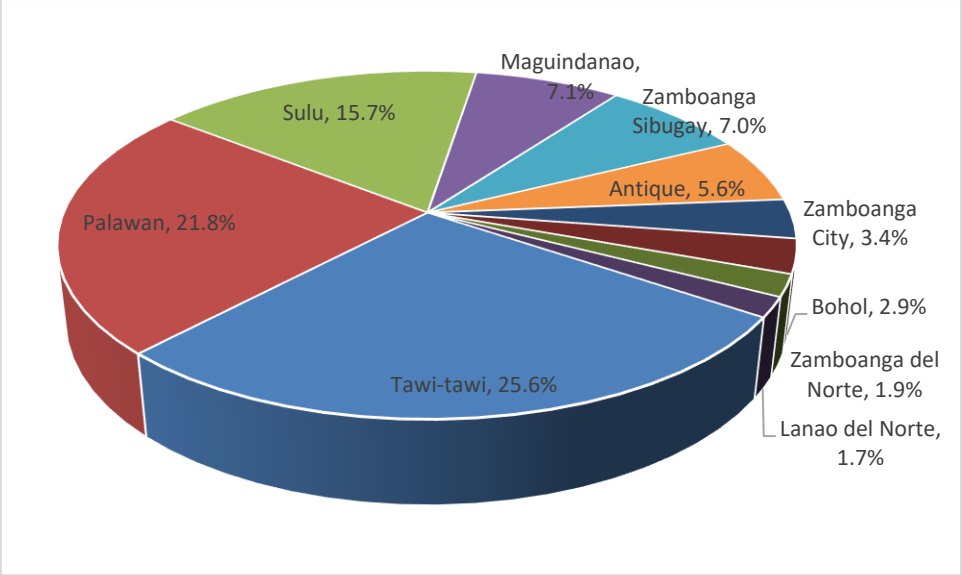


Figure 5. Top Seaweed Producers, by Province, 2020
Source: PSA, 2021

Area Planted/Harvested

SIAP estimated that the Philippines has an aggregated seaweed farmable area of 700,000 ha, in which 200,000 ha are along the coastlines and 500,000 ha are in the deep sea. However, only 60,000 ha along coastlines or equivalently 30 percent of farmable coastlines (8% of the total farmable area) are being planted.

As exhibited in Table 5, BARMM has the most expansive seaweed area in the country with a total area of 95,662 ha. Currently, the area planted totals 68,943 ha and potential expansion sites reach 26,359 ha. Around 91 percent of the existent farms in the region are situated in Tawi-Tawi and the remainder is divided among Basilan, Maguindanao, and Sulu, in which Basilan and Maguindanao farms just make up a little over 1 percent of the total seaweed area of the region. BARMM is only utilizing 72 percent of the total farmable area.

Palawan essentially represents the MIMAROPA region with an aggregate farm area of 13,774 ha, wherein 5,567 ha are utilized at present and 8,206 ha are still available. The municipality of Agutaya has the largest expanse of existing farms at 1,648 ha which is proportionate to about one-third of the province's current farm area. Similarly, the biggest expansion area of 1,956 ha is in Agutaya, followed by Balabac and Brookes Point with 1,000 and 960 ha respectively.

Meanwhile, the Zamboanga Peninsula has a total farmable area of 29,385 ha. At present, only 11,888 ha (40%) are utilized for the cultivation of seaweeds and over 17,000 ha are yet to be tapped. Among the four provinces in the region, Zamboanga Sibugay has the vastest expanse of 5,310 ha of existent farms and 10,300 ha of unutilized area.

Table 5. Areas of Seaweed Farming in Selected Regions, 2018

Region	Existing Seaweed Area (ha)	Potential Seaweed Area (ha)	Total Seaweed Area (ha)	Current Utilization Rate (%)
ARMM	69,303	26,359	95,662	72.45
Palawan (MIMAROPA)	5,567	8,206.50	13,774	40.24
Zamboanga Peninsula	11,888	17,497	29,385	40.46
Western Visayas	2,924.60	2,014.31	4,939	59.22
Central Visayas	4,024.03	504.62	4,529	88.86
Bicol Region	534	387	921	57.98
Eastern Visayas	1,074.47	5,285	6,359	16.9
CARAGA Region	876.65	1,265.50	2,142	40.92

Source: BFAR ARMM, Region IX, Region VIII, and CARAGA, Palawan Provincial Agriculturist Office, Region 5 Provincial Fisheries Offices, and Final Visayas Cluster Seaweeds VCA as cited in PRDP, 2018

Western Visayas, comprising of Aklan, Antique, Capiz, Guimaras, Iloilo, and Negros Occidental, offers a seaweed area amounting to 4,939 ha. Only about 60 percent has already been employed for farming seaweeds.

The Central Visayas region holds the second largest seaweed farm area in the Visayas at 4,529 ha. To date, more than 4,000 ha. been used for the growing of seaweeds. Thus, the region is left with the least farm area of about 500 ha, situated in Cebu, Negros Oriental, and Bohol.

Bicol region has an estimated farmable area of less than a thousand hectares in total. As of the moment, about half of this expanse is grown with seaweeds, with most farms located in Camarines Sur and Camarines Norte.

The total farm area in the Eastern Visayas region corresponds to a total of 6,359 ha. Albeit the region has the largest seaweeds area in the whole Visayas, its utilization is low at approximately 17 percent or 1,074 ha. As such, there is an excessively big potential for cultivating seaweeds in the area.

CARAGA region on the other hand holds 2,142 ha of seaweed area, in which 867 ha (41%) and 1,265 ha (59%) are existent and potential areas, respectively. Only three municipalities, namely Surigao del Norte, Surigao del Sur, and Dinagat Islands, are seaweeds are in the region.

Yield

Harvests of seaweed farms vary depending on the cultural method employed. However, the average yield of farms with floating ropes delivers better output as compared to monoline stake farms.

A one-fourth hectare using monoline stakes are producing 9,000 kilograms of fresh seaweeds per cropping on average or equivalently 36,000 kilograms for a one-hectare

farm. Farms with floating ropes meanwhile get more or less 13,500 kilograms of fresh seaweeds per cropping from a one-fourth hectare of seaweed farm or 54,000 kilograms from a one-hectare farm.

Table 6. The yield of ¼ Ha. Using 2 Methods of Seaweed Farming

Culture Method	Average Farm Size	Average Production per Cropping	Average Yield/Ha/Cropping
Staking Monoline	¼ hectare	9,000 kg FW	36,000 kg FW
Floating Rope	¼ hectare	13,500 kg FW	54,000 kg FW

Consumption

Global Consumption

Consumption of seaweeds globally has displayed a substantial upsurge over the years. It has consistently increased from 1990 to 2018 and registered a total of 32.9 million metric tons in 2018 from 5.05 million metric tons in 1990, resulting in a six-fold growth (FAOSTAT, 2021).

Seaweed has been utilized as human food since ancient times, particularly in the countries of China, Japan, and Korea. The movement of the residents of these countries to other areas has brought consumption of seaweeds along with them thereby encouraging other people to also eat seaweeds. For instance, sushi has gained popularity and is being consumed on a large scale in the United States and Europe. The health benefits of seaweeds also influenced the rising consumption of seaweed products.

FAO data reveals that consumption of seaweeds as human food has been rising from 1990 to 2013. Global seaweed consumed as the food was registered at 2.1 million metric tons in 1990 and settled at 14.3 million metric tons in 2013. This posted an average annual growth rate of 25 percent for the said period (Figure 6).

Seaweeds are also utilized for other commercial uses such as in cosmetics and pharmacy as well as for fertilizer and animal feeds. Carrageenan and alginates are used as thickening agents for food products. They are also utilized as binders, emulsifiers, stabilizers, and creation of molds in pharmaceuticals. Extracts of seaweeds are similarly used in the beauty and wellness industry in the form of diet pills, cosmetics, and other skincare products. In other industrial sectors, because of its nutrients, it is used as a soil fertilizer and it forms part of the feeds given to farmed fish and other animals.

Statistics from FAO show that seaweeds employed for other uses have similarly displayed expansion, though at a relatively lower rate than food. From about 2.5 million metric tons in 1990, it only ended at 8.9 million in 2013. On the contrary, seaweeds utilized in feeds generally contracted during the said period, with 455,000 metric tons in 1990 to just 312,000 metric tons in 2013 (Figure 6).

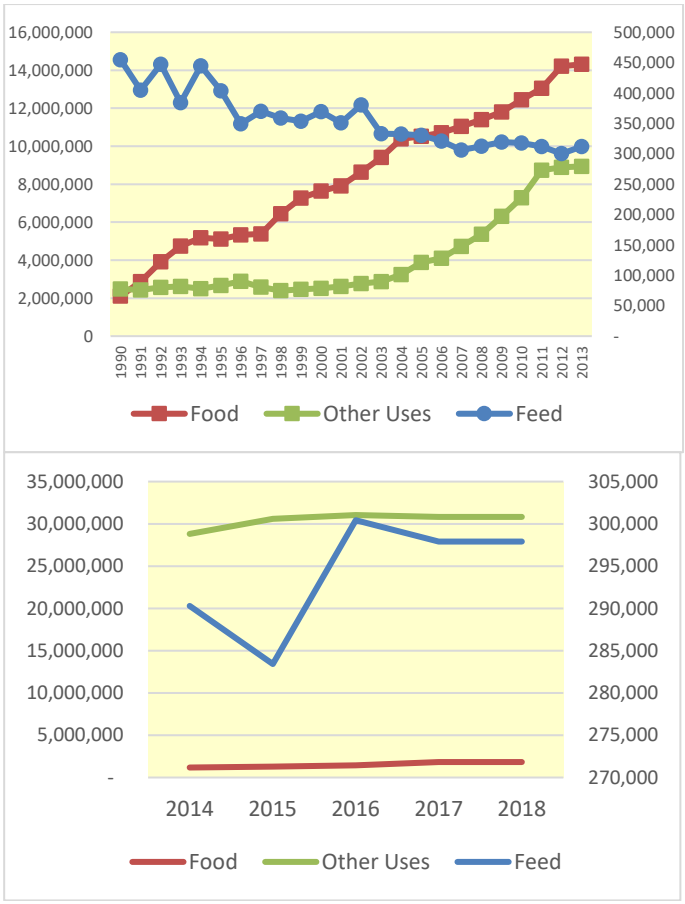


Figure 6. Global Seaweeds Consumption, by Type of Use, 1990-2013 and 2014-2018 (in MT)
Source: FAOSTAT, 2021

Note: FAO had reclassification of food and other uses starting 2014

Domestic Consumption

In the Philippines, seaweeds are utilized for human food, mainly in fresh form, and for the production of carrageenan. The seaweed usage for carrageenan however comprised most of the consumption. Albeit seaweeds are locally recognized to be consumed as food, a statistical report from FAO (2021) shows that consumption of seaweeds in the country is essential for other uses and none for food and feeds. The utilization of seaweeds for non-food uses follows the same pattern of the country's seaweed production - - escalating in the earlier years then declining in recent years (Figure 7).

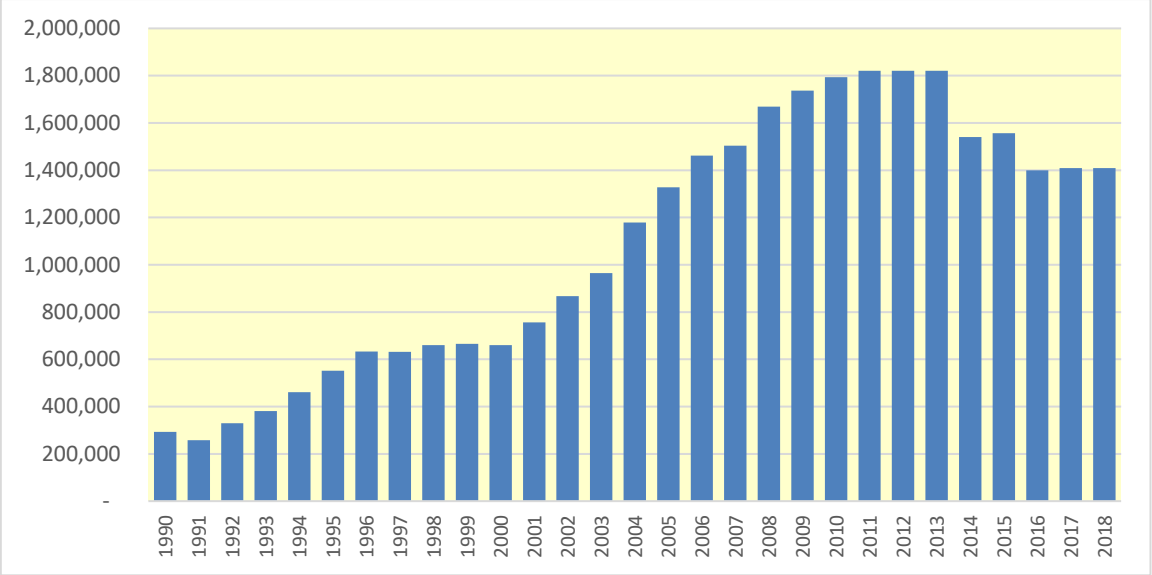


Figure 7. Philippine Consumption of Seaweeds for Other Uses, 1990-2018;
Source: FAOSTAT, 2021

Trade (Import / Export)

There are three types of seaweeds commonly sold in the international market, namely, edible seaweeds for human food, raw dried seaweeds for further processing, and processed hydrocolloids of agar and carrageenan. The dynamics in the market are essentially due to the hydrocolloid products carrageenan and agar which are traded and employed for food and non-food in many countries around the globe.

Imports

Seaweeds are widely traded in the world market. With Asia, Europe, and North America being the major destinations for trade, it is imported by nearly 100 markets around the world. Among the seaweed products, hydrocolloids are the most dynamic import product, which is traded and utilized in various applications in many countries. Meanwhile, the trade for dried seaweeds for further processing, mostly to agar-agar, alginate, and carrageenan, is led by the developing countries as the major producers, whereas the seaweeds for food are almost limited to countries in the Far East, such as Japan, Korea, China and Taiwan (FAO, 2018).

The importation of seaweeds is on the rise. From 2012 to 2019, the import quantity of seaweeds grew from 432,171 metric tons to 598,387 metric tons. Total imports in 2019 are valued at $1.16 billion (Figure 8).

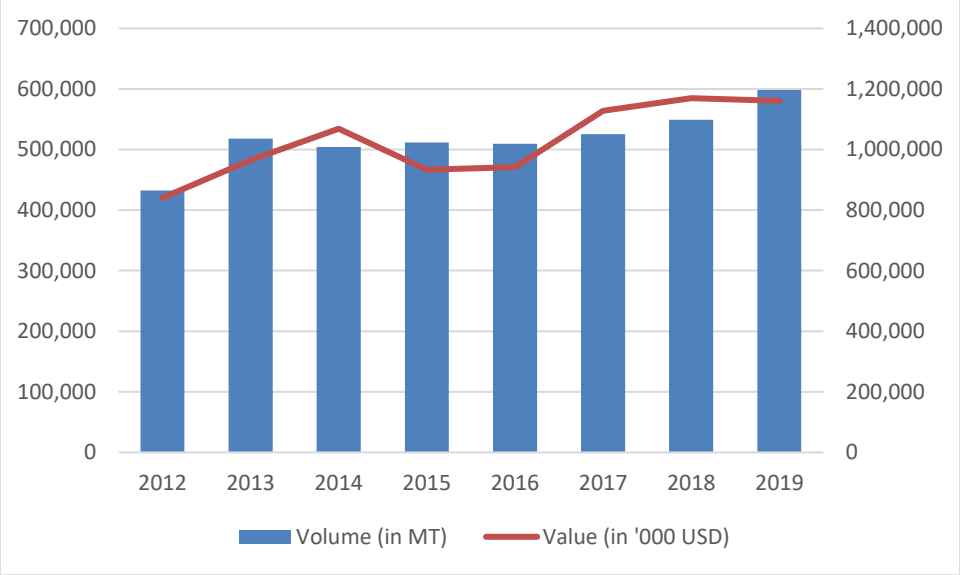


Figure 8. Volume and Value of Global Seaweed Imports, 2012-2019;
Source: International Trade Centre, 2021Note: Seaweeds HS Classification 121221 (Seaweeds and other algae, fresh, chilled, frozen or dried, whether or not ground, fit for human) and 121229 (Seaweeds and other algae, fresh, chilled, frozen or dried, whether or not ground, unfit for human).

In general, imports of carrageenan are equally rising. The total volume was 91,640 metric tons in 2001 and settled at 144,949 in 2019, indicating an average annual growth of 3 percent. Carrageenan imports amounted to approximately $1.19 billion in 2019. Albeit the value of the imports is likewise on an upward trend, it is remarkable that import values were depressed in 2016 and 2017 (Figure 9).

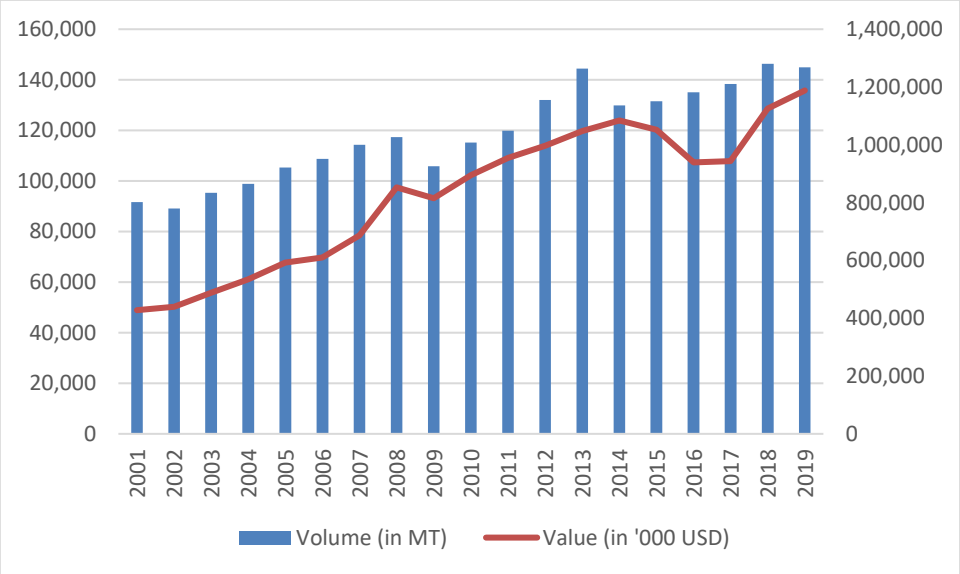


Figure 9. Volume and Value of Global Carrageenan Imports, 2001-2019
Source: International Trade Centre, 2021

Note: Carrageenan HS Classification 120239 (Mucilages and thickeners derived from vegetable products, whether or not modified).

Remarkably, China has surfaced as the largest seaweed importer both for direct consumption and for processing that it has a significant influence on international market prices for seaweeds. The United States and European Union remain to be a major market for dried seaweeds which are used for processing carrageenan and other industrial products. However, China has turned into a major center for reprocessing and developing countries such as Indonesia and the Philippines have developed processing industries. For this reason, imports of raw dried seaweeds into European markets have decreased (FAO, 2018).

At present, China is the most important partner in international seaweed trade, in terms of volume. Most of its edible dried seaweeds are imported from Indonesia, while non-edible ones are mainly supplied by Chile and Peru (FAO, 2018).

In terms of import value, European Union is the world's top seaweed import market. It is the second, after China, in terms of import volume. The main importers for dried seaweeds are Denmark, Germany, Portugal, and Spain. In 2019, total non-edible seaweed imports of EU countries France, Spain, Ireland, Denmark, and the United Kingdom reached $95.7 million (International Trade Center, 2021). Meanwhile, the top countries importing carrageenan are Belgium, Denmark, France, Germany, Poland, Spain, and the United Kingdom (FAO, 2018).

Because of its importance in Japanese cuisine, most seaweed imports of Japan are for edible ones. Japan is regarded as the largest importer of edible seaweeds, which are mostly supplied by Chile, China, and Korea. Edible seaweed imports of Japan registered at 37,180 metric tons in 2019 (International Trade Centre, 2021). Agar imports are sourced from Chile, China, Korea, and Morocco, while carrageenan came from Asian countries namely Indonesia, the Philippines, and Thailand along with Denmark and the United States of America (FAO, 2018).

The United States is another important destination for semi-processed and processed seaweeds. Its imports are mainly composed of carrageenan, estimated at 60 percent of their total carrageenan consumption. Chile, followed by the Philippines, continues to be the main supplier of carrageenan to the United States. Malaysia and Indonesia are also two other sources of US carrageenan imports. Agar supplies on the other hand are predominantly from Chile, China, Morocco, and Spain (FAO, 2018).

Philippine imports of seaweeds are comparably minimal with its exports. The records of the International Trade Center (2021) indicate that importation started only in 2018; no import registered in previous years. Imports of edible seaweeds are 2,089 and 2,625 metric tons in 2018 and 2019, respectively. Meanwhile, non-edible seaweed imports for 2018 and 2019 are only 230 and 40 metric tons accordingly.

Exports

In like manner, seaweed exports are moderately expanding (Figure 10). The total reported export volume reached 482,943 metric tons in 2019 from 370,875 metric tons in 2012, which exhibited a 30 percent improvement during the said period. The top export sources are Indonesia, Ireland, Chile, Korea, the Philippines, and China

(International Trade Centre, 2021). Meanwhile, because of higher value carrageenan, the Philippines together with China, the EU, and China are the main suppliers in terms of export values. The supply of seaweeds to the international market was observed to be increasing moderately, except for the Philippines (FAO, 2018 and International Trade Centre, 2021).

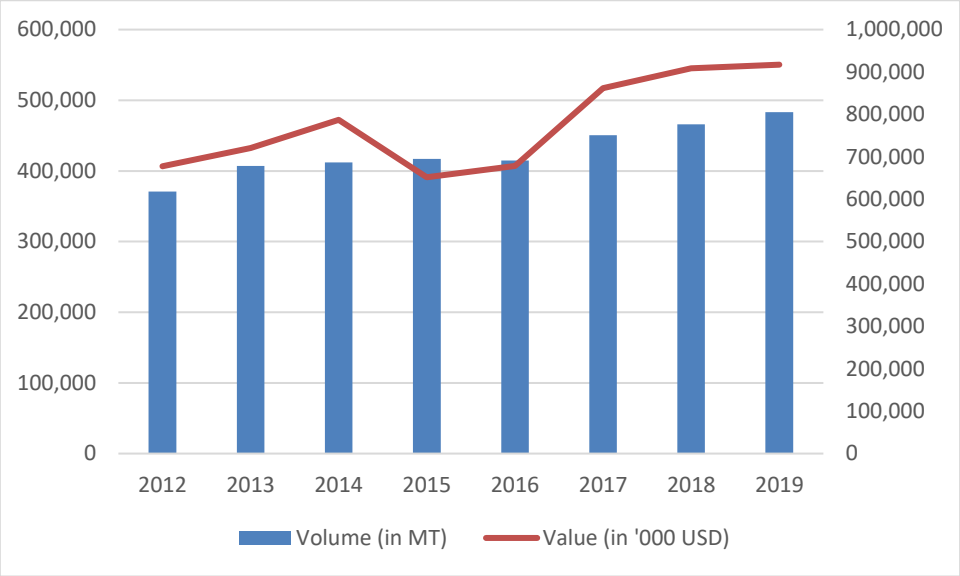


Figure 10. Volume and Value of Global Seaweed Exports, 2012-2019
Source: International Trade Centre, 2021
Note: Seaweeds HS Classification 121221 (Seaweeds and other algae, fresh, chilled, frozen or dried, whether or not ground, fit for human) and 121229 (Seaweeds and other algae, fresh, chilled, frozen or dried, whether or not ground, unfit for human).

Carrageenan exports for nearly the past two decades were observed to increase. The total export volume in 2019 was more than double the volume created in 2001 (Figure 11). The top carrageenan exporters are China, countries in European Union (EU), the Philippines, and Indonesia.

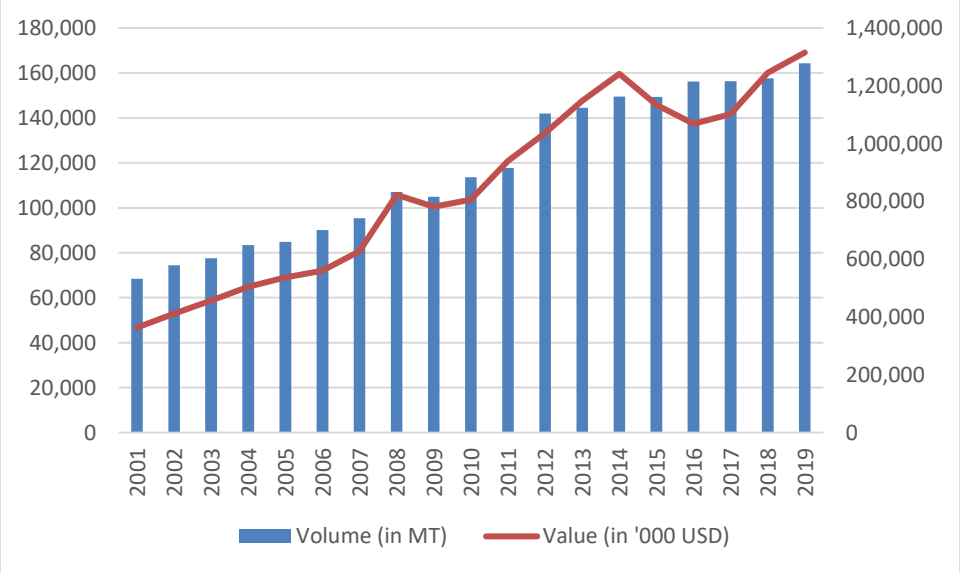


Figure 11. Volume and Value of Global Carrageenan Exports, 2001-2019

Source: International Trade Centre, 2021
Note: Carrageenan HS Classification 120239 (Mucilages and thickeners derived from vegetable products, whether or not modified).

Exports of dried seaweeds for human food are dominated by China, Indonesia, Japan, and South Korea. Export value-wise, South Korea is the largest exporter, selling largely dried seaweed for direct human consumption to Japan (FAO, 2018).

Exports from Indonesia have mostly dried seaweeds both for food and non-food use, which have lower value relative to the semi-processed carrageenan and agar. China is the primary market of Indonesia. Other major destinations of Indonesian raw dried seaweeds are Chile, Malaysia, and the Philippines, which utilize the supplies for carrageenan and agar processing. On the other hand, their markets for carrageenan are the EU, Japan, and the US (FAO, 2018).

Chile exports are mainly non-edible dried seaweeds, primarily supplied to China. Carrageenan exports are marketed principally to the EU and US, with increasing supply to Argentina, Brazil, Ecuador, Mexico, and Peru (FAO, 2018).

Seaweed exports from the EU consist of non-edible dried seaweeds, carrageenan, and agar. Key exporters of dried seaweeds are France and Ireland, with some coming from Germany, Portugal, and Spain. France, Germany, Netherlands, and Spain are the main exporters of carrageenan, while France, Germany, and Spain are the leading exports of agar. Due to its high grade, French agar is the most expensive (FAO, 2018).

China is a major exporter of processed seaweeds. Nonetheless, its relatively low exports of dried seaweeds consist of *wakame and nori* for direct consumption. Its main markets are Japan, Russia, and Southeast Asia. Carrageenan, the biggest component of their exports, is marketed to Asia, the EU, and the US. Agar's main exports markets are Germany, Italy, Spain, Malaysia, Russia, and Thailand (FAO, 2018).

The seaweed export trade of the Philippines is composed largely of semi-processed and processed seaweeds. Though, it also markets a small volume of dried seaweeds at present. Following China, it is the second-largest supplier of semi-processed and processed carrageenan in Asia. Its main market for carrageenan continues to be the US. It also exports to Brazil, the EU, Indonesia, Japan, Mexico, and Thailand. It has also expanded to new markets such as Argentina, Australia and, Russia (FAO, 2018).

Total seaweed exports of the Philippines have been fluctuating in the past years. Nevertheless, it has posted growth of about 29 percent between 1996 to 2019, with a total volume of 37,148 metric tons in 1996 and 48,026 metric tons in 2019. The statistics are evidence of the intensification of the carrageenan exports that now comprise more than half of the seaweed exports of the country (Figure 12).

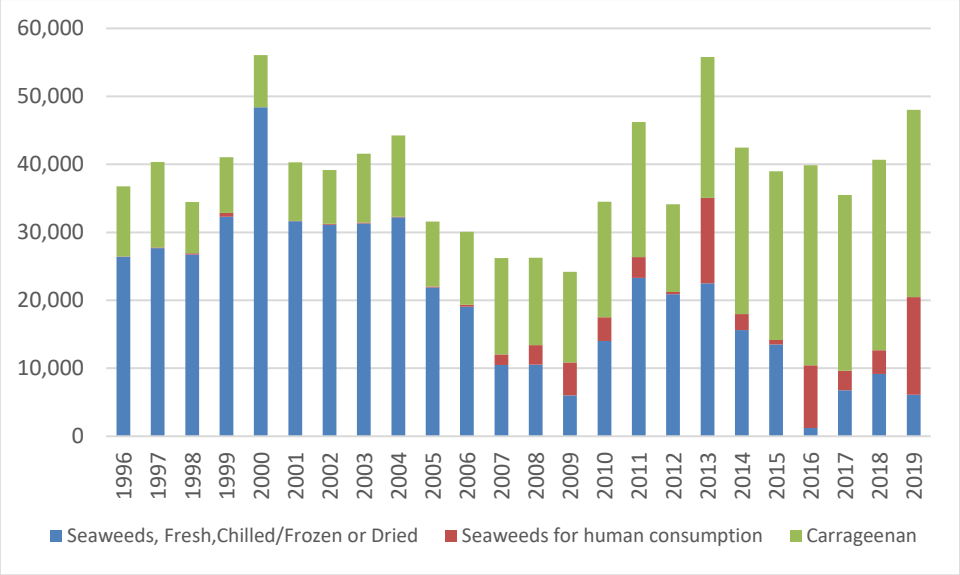


Figure 12. The volume of Philippine Seaweed Exports, by Product Type, 1996-2019
Source: BFAR, 1996-2019

Prices

Seaweed prices differ depending on several factors, such as species, product forms, quality, and country of origin, among others. Fluctuations in the prices, as expected, are moreover influenced by the demand and supply. When demand is booming, farmers ramp up production which results to oversupply that subsequently pulls the price down. When prices drop, farmers tend to leave their farms and look for alternate livelihoods. In consequence, supply declines, and prices move up again.

International prices of dried seaweeds, particularly of the carrageenophytes *Kappaphycus alvarezii* and *E. deliticulatum (E.spinosum)*, are dictated by China, the largest importer of dried seaweeds. Notably, prices of dried seaweeds from the countries Indonesia, Malaysia, and the Philippines are lower compared to those of seaweeds coming from Chile, Japan, and Taiwan (FAO, 2018).

Export prices of carrageenan meanwhile are higher for those originating from Chile and France, most likely due to high-value species and product quality. Carrageenan from Asia, China, Indonesia, and the Philippines, tend to be in the same price range (FAO, 2018).

Statistics reported by the International Trade Centre (2021) indicate that the per metric ton import and export prices of seaweeds were unstable from 2012 to 2019. Nonetheless, both export and import prices displayed remarkably similar trends (Figure 13).

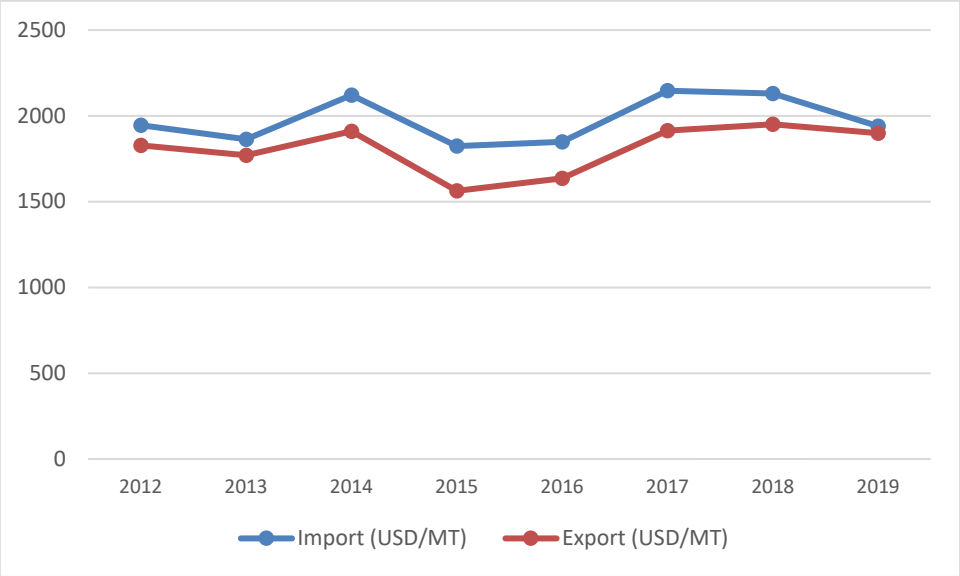


Figure 13. Global Price of Seaweed Exports and Imports, 2012-2019
Source: International Trade Centre, 2021

Export and import prices of carrageenan were likewise volatile in the past years. Carrageenan exports were higher than import prices from 2001 to 2008. It fell below import prices from 2009 to 2012 as well in 2015, 2016, and 2019. Although it exhibited an increase in recent years, its variance with the import prices was modest (Figure 14).

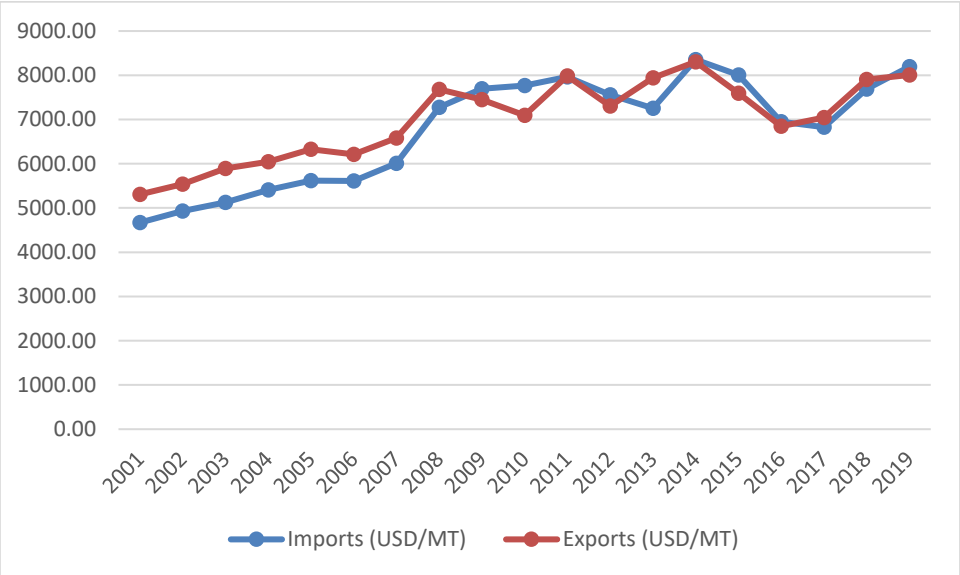


Figure 14. Global Prices of Carrageenan Exports and Imports, 2001-2019
Source: International Trade Centre, 2021

The dynamics in the international prices of seaweeds affect the domestic seaweed market. As presented in Figure 15, the farm gate prices of seaweeds in the past 25 years were variable albeit its ascending trend. A sharp increase was observed in 2008 with an average price of Php7.71 per kilogram and a substantial drop in 2016 at Php4.35 per kilogram. Recently, the price started to go up again, staying steady above Php7 per kilogram.

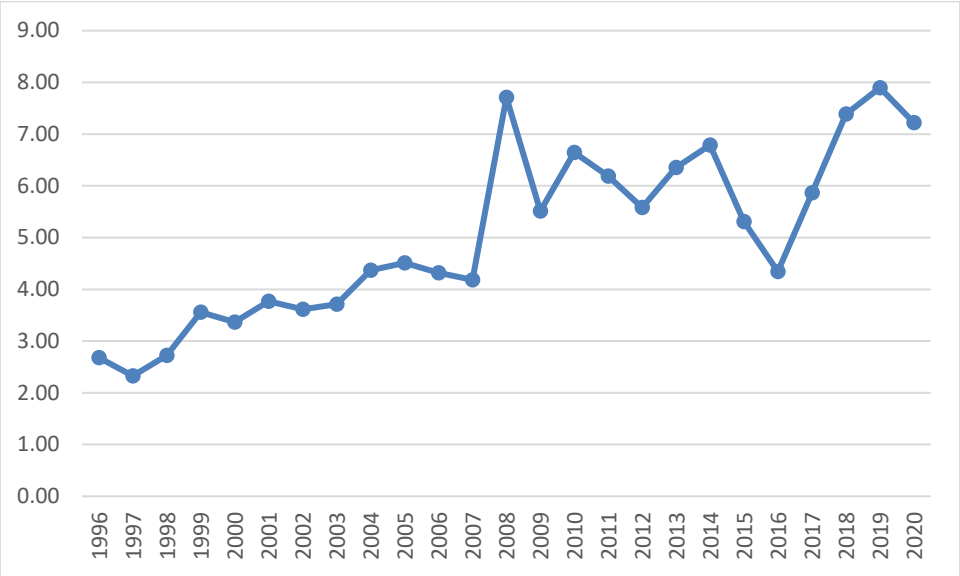


Figure 15. Farm Gate Prices of Philippine Seaweeds, 1996-2020 (Php per Kilogram)
Source: Calculated from PSA Data

III. ANALYSIS OF THE SEAWEEDS INDUSTRY

Value Chain Map

Geographical Flow of Seaweed Products

Figure 16 illustrates both the production distribution and the general flow of seaweeds and seaweed products in the Philippines. Seaweeds from provinces in Luzon normally end up in Manila, Cavite, and Laguna while in the Visayas, seaweeds are observed to have shorter movement and concentrated landing just in Cebu (PRDP, 2018). Most seaweeds from the provinces of Mindanao initially flow to Zamboanga City but overall, Philippine seaweeds largely converge in Cebu at the end (PRDP, 2018).

Each product form has its value chain map. While there are variations in the maps, the illustrations exhibit that individual value chain maps of the seaweed products are essentially the same.

Value Chain Map of Raw Fresh Seaweeds

The value chain of RFS is comprised of four segments, namely, (1) Input Provision; (2) Production; (3) Post-Harvest; and (4) Trading before the final sale (Figure 17).

The Input Provision segment is responsible for providing the necessary materials and/or knowledge for the cultivation of the seaweeds in the next phase of the chain, Production. People involved in this stage can be the farmers themselves, hardware stores, agri-vet shops, fishing supplies stores as well as BFAR, LGUs, and NGOs who usually distribute seedlings and farm implements.

The production follows the Input Provision segment. Herein, seaweed plants are being grown by individuals or groups of farmers. Once the seaweeds are harvested, the farmers also perform post-harvest cleaning and packing.

In the next phase, the seaweeds that were cleaned and packed are transacted to their buyers, for distribution to the final consumers of the product. One possible scenario here is that the farmers sell the produce to the small local traders or directly to the wet market where the fresh seaweeds will be marketed to the locals that will be consumed as the food of humans or feed for some fish, such as siganids, in other places. Alternately, the farmers can sell their seaweeds to seedlings contractor, who in turn market it to BFAR or LGUs that distributes propagules as assistance to farmers.

Key enablers along the various seaweeds value chains include national agencies such as DA-BFAR, DTI, Department of Science and Technology (DOST), Department of Social Welfare and Development (DSWD), Department of Environment and Natural Resources (DENR), the local government units, SIAP, NGOs, SUCs, among others.

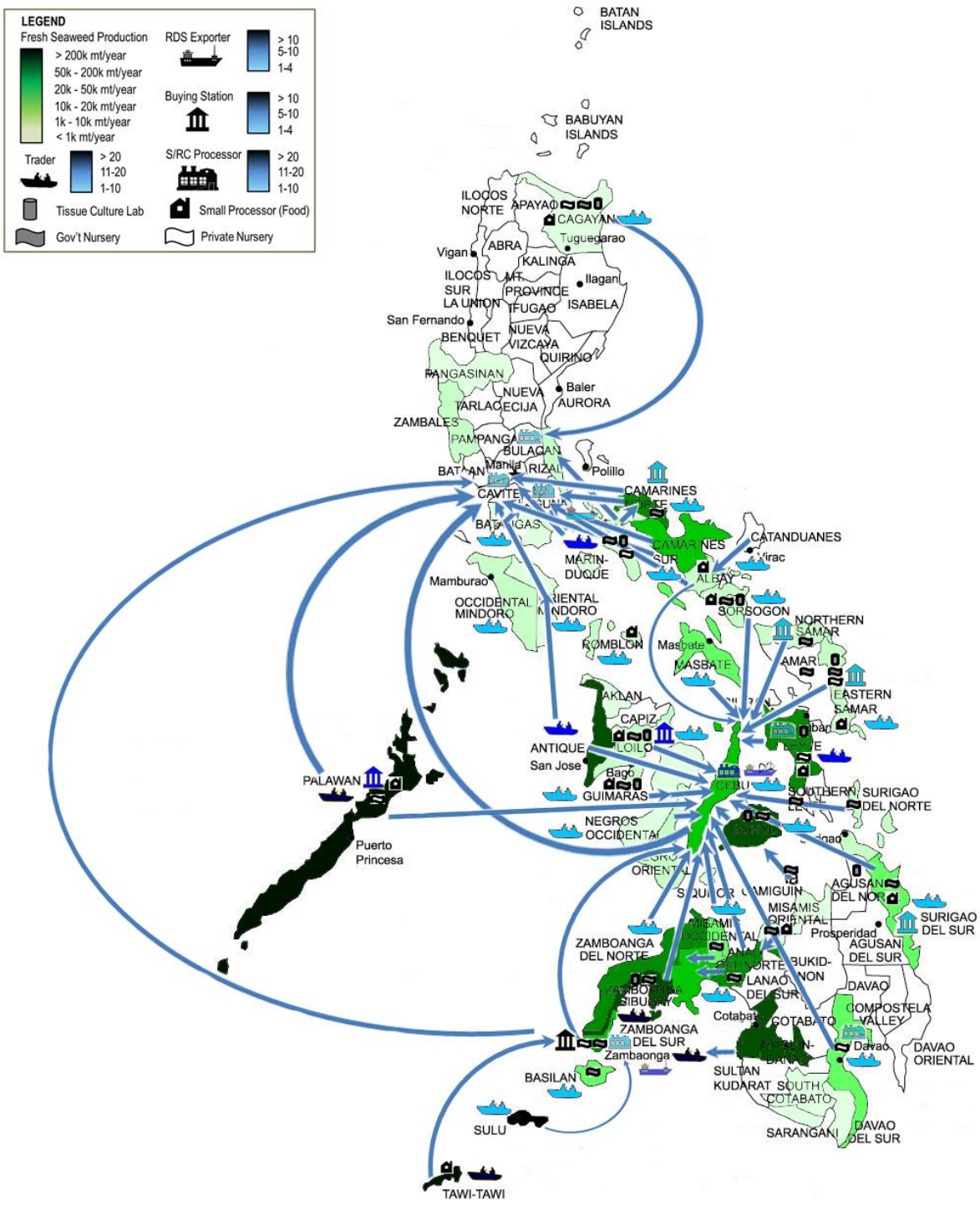


Figure 16. Production Distribution and Geographical Flow of Seaweeds in the Philippines (Source: PRDP, 2018)

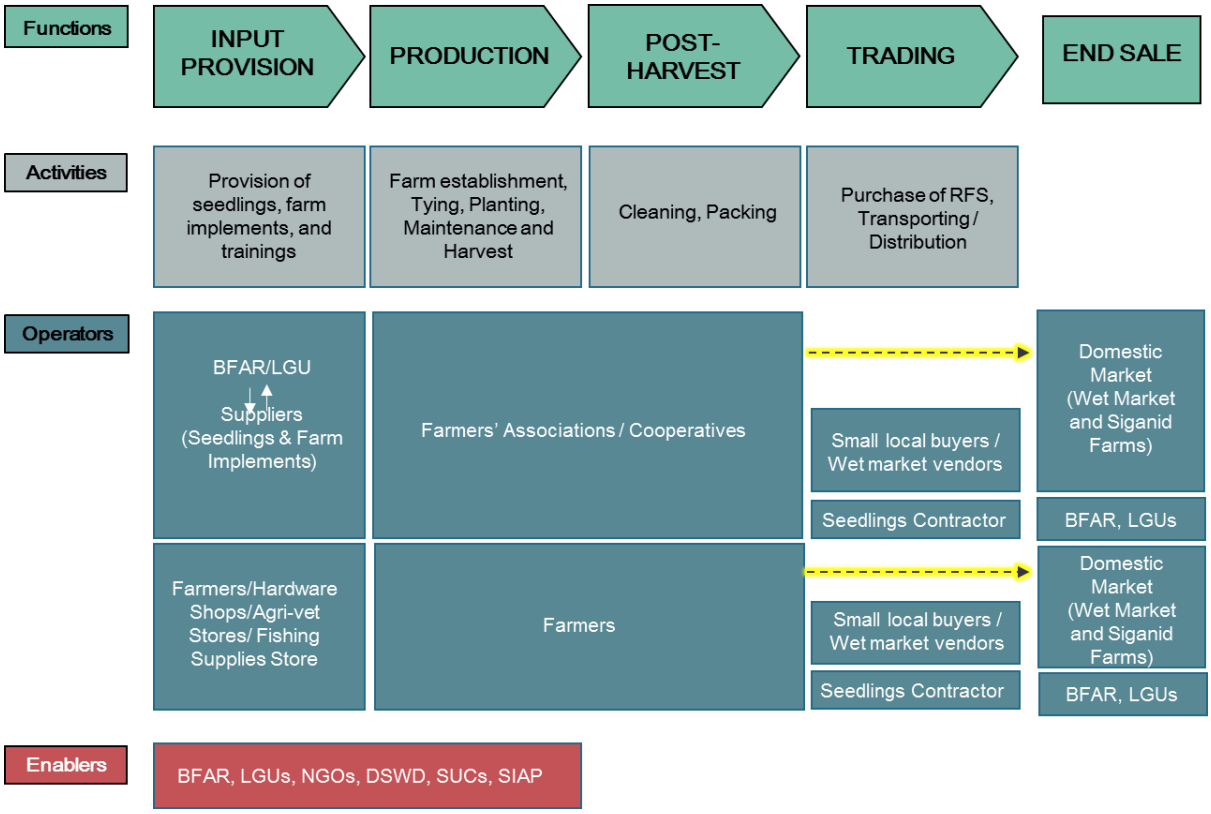


Figure 17. Value Chain Map of Raw Fresh Seaweeds in the Philippines
(Source: PRDP, 2018)

Value Chain Map of Raw Dried Seaweeds

The value chain map of raw dried seaweeds similarly consists of four important sections, namely the Input Provision, Production, Post-Harvest, and Trading (Figure 18).

The activities in the input provision and production segments of the chain are the same in the RFS value chain. The post-harvest and trading segments however have additional important activities.

Drying seaweeds is an integral undertaking in the RDS chain. Good quality seaweeds are assessed through their moisture content, which is displayed primarily in the dryness of the seaweeds. For this reason, drying of seaweeds is performed in the post-harvest stage after the cleaning and before the packing of the seaweeds. The additional effort placed on drying the seaweeds nonetheless is compensated by the higher price per kilogram of seaweeds relative to the raw fresh ones. The volume of the fresh seaweeds though would not be the same after drying. The weight of the seaweeds is reduced upon drying.

The trading function in the RDS value chain involves the conventional tasks of seaweed purchase, transport, and distribution along with other activities such as quality inspection, further re-drying (if needed), collection or consolidation, storage, packaging, and baling of the dried seaweeds. The trading segment is variable depending on the number of layers of traders involved in the movement of the seaweeds. Though, the

product flow through at least one relatively smaller trader before it advances to the exporters who sell the seaweeds outside the Philippines.

The dried seaweeds assembled by the traders are procured by other countries to a large extent. Philippine RDS remains to be the preferred seaweeds by other countries due to its quality albeit the availability of comparatively lower-priced Indonesian seaweeds. A limited volume of dried seaweeds meanwhile is being supplied to some BFAR offices that need seaweeds for their livelihood programs.

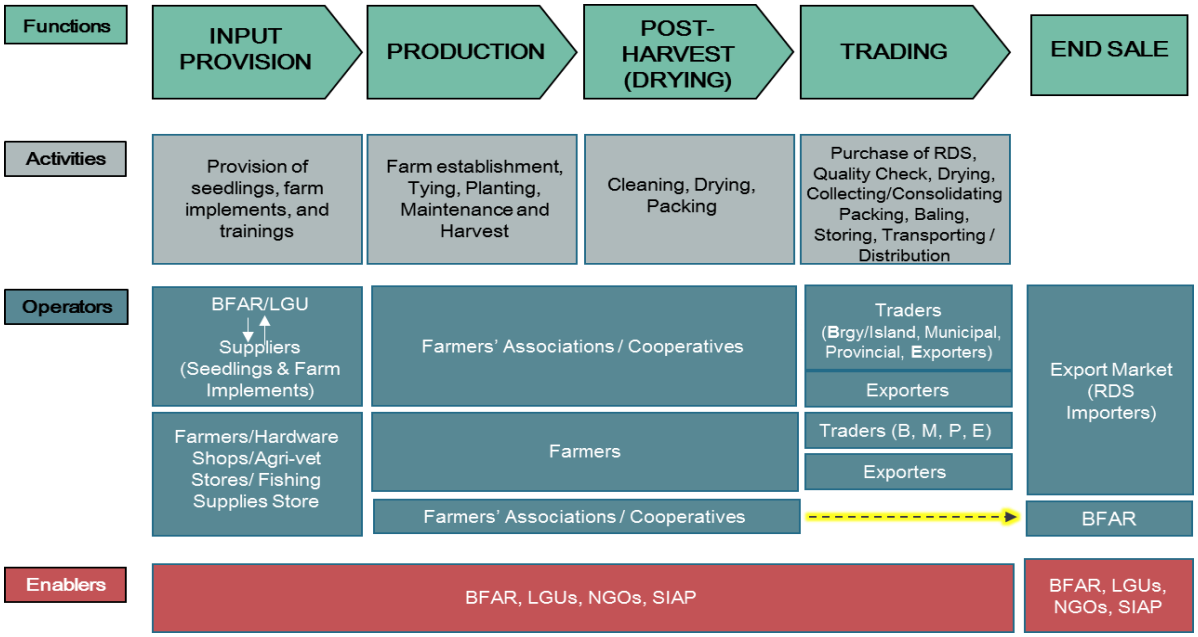


Figure 18. Value Chain Map of Raw Dried Seaweeds in the Philippines
(Source: PRDP, 2018)

Value Chain Map of Semi-Refined and Refined Carrageenan

The transformation of dried seaweeds to carrageenan suggests a longer value chain map associated with the production of semi-refined (SRC) and refined carrageenan (RC). Figure 19 shows the additional segment of processing. Processing usually corresponds to the fifth section of the chain. Albeit it would be intercepted with a marketing segment before the processing, these two generally come together.

The four segments essentially resemble that of the RDS value chain. The extended parts of marketing and processing in the chain entail some more activities such as the purchase and quality check and control of the dried seaweeds, the transformation of dried seaweeds to carrageenan, packaging, and distribution, or marketing of carrageenan. While the majority of the carrageenan produced in the country is marketed globally, the domestic market, the food processing industry in particular, similarly benefit from the production.

The semi-refined and refined carrageenan value chain in the country is generally segmented into six unless for some situations wherein farmers/farmer associations have

direct access to the processors. The trading stage moreover displays variability depending on the layers of traders involved.

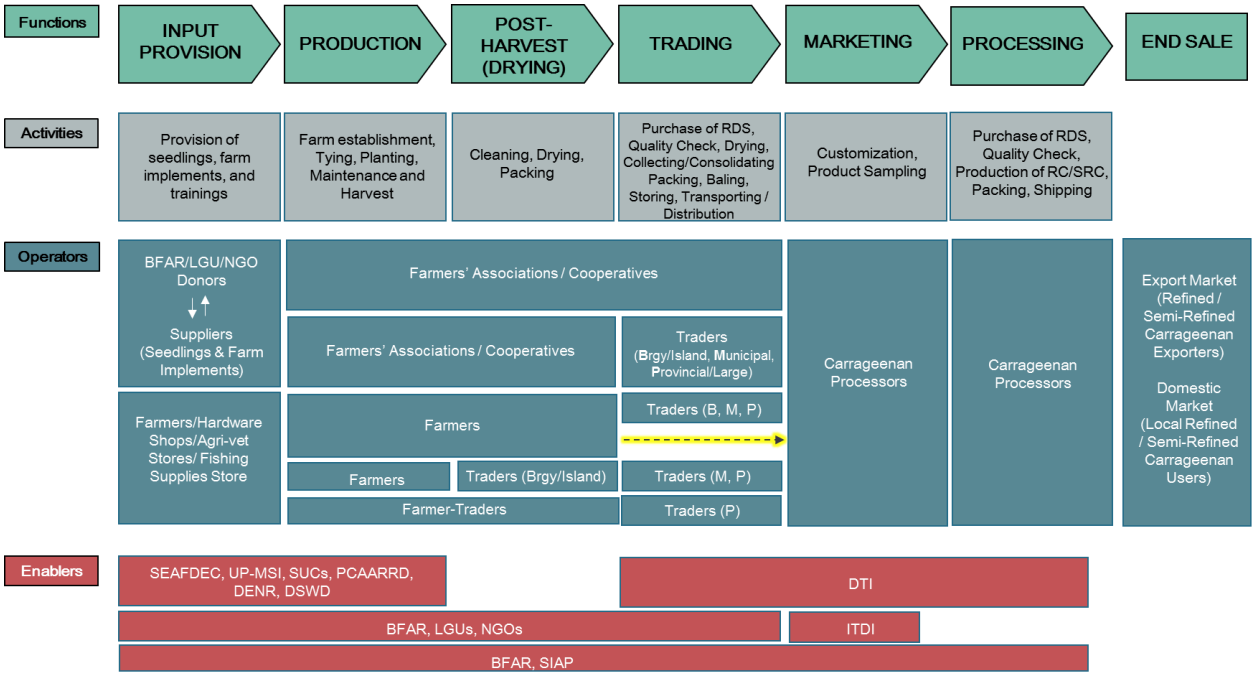


Figure 19. Value Chain Map of Semi-Refined and Refined Carrageenan in the Philippines
(Source: PRDP, 2018)

Value Chain Map of Seaweed Noodles and Chips

The value chain map of seaweed noodles and chips is merely composed of four important segments, namely the input provision, production, post-harvest, and processing (Figure 20). The distinct feature of these value chains is the omission of the trading section considering that the dried seaweeds used in producing the noodles and chips are directly sourced from the farmers, who are also members of the same association or cooperative. In some instances, the producers of the noodles and chips are farmers themselves.

Seaweed noodles and chips are largely sold domestically in trade fairs and exhibits, conferences, and *pasalubong* centers. These are also made by order in some areas for occasions such as birthdays and weddings, and visitors and *balikbayans*. Local offices of the Department of Education (DepEd), Department of Health (DOH), and DSWD patronize these seaweed products as part of their programs.

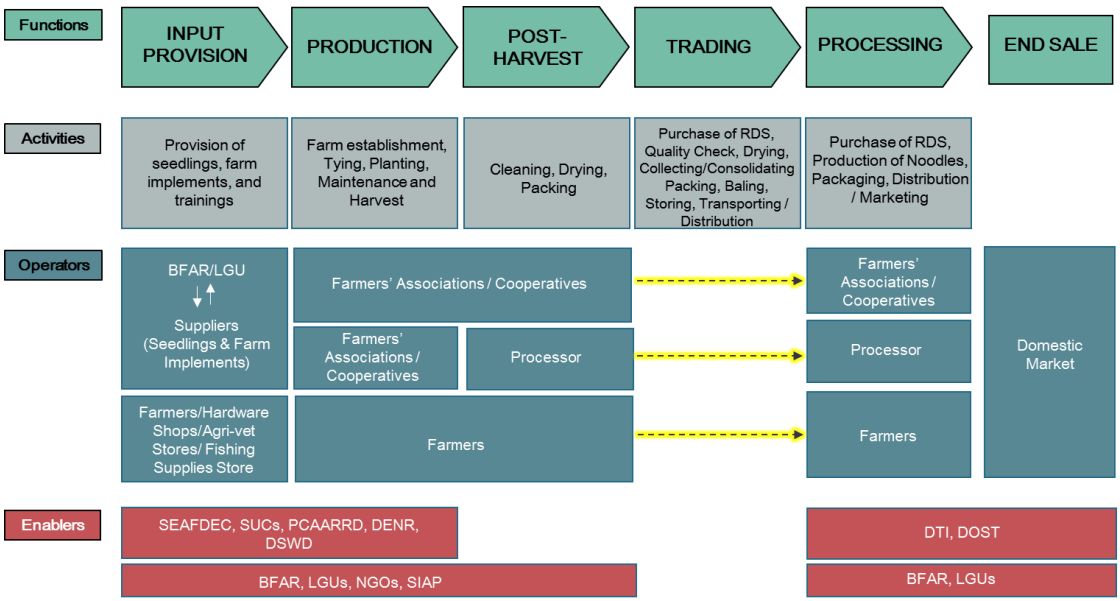


Figure 20. Value Chain Map of Seaweed Noodles and Chips in the Philippines (Source: PRDP, 2018)

IV. SWOT ANALYSIS

Table 6 summarizes the key strengths and weaknesses of the Philippine seaweeds industry as well as the opportunities and threats the industry faces across the various segments of the seaweeds value chain. Appendix 2 also provides region-specific SWOT in key production areas in the country.

Table 7. SWOT Analysis per Segment

Production Segment	
Strengths	• Existence of NSTDC and regional seaweed laboratories • Presence of competent scientists in state universities/colleges and research centers to conduct research and development - R&D on existing and new cultivars, and farming technologies • Existence of diverse species and wild populations of seaweeds that can be used as cultivars and/or for selection processes as mother plants and for natural selective breeding program. • Known technology for mass production of good quality seedlings • Presence of technology brochures (IEC Materials) in different major languages • Adequate number of seaweed farmers to sustain seaweed production that will satisfy the demand of processors • Existence of Seaweed Development Program at BFAR to shepherd the growth of the seaweed industry • Access/ availability of financial grants and credit from government financial institutions and Philippine Crop Insurance Corporation (PCIC) insurance by the seaweed producers. • Philippines being a part of the Coral Triangle with ideal agro-climatic endowment • Existence of viable seaweed cooperatives in 7 seaweed producing provinces • Availability of vast area for seaweed farm expansion • Cost effectiveness of seaweed farming as a family based enterprise.

	• Mass production of seaweeds developed from tissue culture laboratories and land based nursery
Weaknesses	• Low productivity and production of present cultivars • Lack of economy of scale in seaweed farming • Inadequate supply of good quality seedlings • Lack of compliance to good farming practices and biosecurity measures • Limited technical staff to transfer to the fisherfolk the knowledge on technical and developmental aspects of seaweed farming especially on innovations • Inability of the fisherfolk to access formal financing institutions due to strict documentary requirements. • Limited reach and assistance at some remote islands and islets. • Insufficient and / or no ordinance to address zoning problem at LGU level and weak implementation of existing ordinances. • Insufficient budget for R&D activities • Long process of documents due to many red tapes in each office • Slow delivery of needed equipment, materials and consumables, in some areas, hence delays in the execution of activities are experienced • Inherent vulnerability to weather disturbances (e.g. monsoons and typhoons)
Opportunities	• Existence of seaweed culture facilities (Laboratories, land-based nurseries) at BFAR National Seaweed Center, regional offices, Philippine-based International Research Institution and SUCs • Availability of capacity building programs for seaweed stakeholders (e.g. TESDA certification NCII) • Collaboration with international institutions and agencies for funding and grants (e.g. GCRF-UKRI, WWF-GEF) • Established networking with local and international institutions • Increasing demand of seaweed of good quality propagules • Potential alternative uses of seaweeds for feeds, fertilizers and other important applications (bioplastics, hand sanitizer, etc.) • Market potential for new varieties • High potential for farm productivity enhancement and quality • Investment priority project to attract private investors in seaweed far
Threats	• Vulnerability to seasonal weather disturbances and impacts of climate change • Prevalence of seaweed pests and diseases (ice-ice) • Indiscriminate, improper use and discharge of artificial fertilizer in field cultivation. • Increasing competition with other seaweed producing countries
Post-Harvest Segment	
Strengths	• Long daylight period of the country being a tropical • Strong, committed and dedicated working relationship among family members as part of the Filipino Culture • Availability of PNS for RDS • Favorable weather condition for solar drying • Availability of drying technologies depending on the season • Provision of seaweed dryers and storage facilities by BFAR and other institutions (e.g. PRDP, DOST, DOLE, and DTI)
Weaknesses	• Limited budget for the provision of drying and storage facilities and other post-harvest equipment • Poor and inconsistent quality of dried seaweed that impacts on carrageenan recovery (Immature harvested seaweeds, Adulterated RDS, High percentage of impurities) • Lack of compliance to Philippine National Standard on RDS
Opportunities	• Premium price for good quality RDS • Huge market for good quality RDS both in the local and export levels.

	• Strong working relationship and linkages among processors and traders, farmers and traders • Availability of technologies on innovative seaweed products and packaging.
Threats	• Unpredictable weather condition in some areas during drying • Competition with other countries in terms of market opportunities for carrageenan seaweed • Declining pool of competent technical experts • Rising logistic costs
Marketing/Trading	
Strengths	• Good demand at local and export markets • Presence of Seaweed Marketing Cooperatives in 7 seaweed producing provinces • Established market niche of local carrageenan in the international markets • Proven marketing and distribution system • Existence of Philippine Seaweed Industry Association which serves as a source of information on the trends and current Seaweed Industry situation both in the international and local levels. • Available programs for organizing of seaweed cooperatives
Weaknesses	• Lack of equipment for testing moisture content of the seaweed in the farmer and trader sectors • Poor RDS quality due to high presence of contaminants • Fluctuating RDS production volume • Presence of excessive layers of middlemen in the trading chain • Presence of 'fly-by-night' traders • Limited direct access between the processors and farmers • Inability to adapt to RDS price fluctuation. • Institutional limitations in organizing seaweed cooperatives • Low credit worthiness attitude of farmers. • Seaweed farmers access to financing facility of Government Controlled Corporation (GCC) and private institutions. • Lack of infrastructure for seaweed trading (e.g. fish landing not equipped for seaweed trading)
Opportunities	• Good export market and potential growth for carrageenan • Increasing demand of US and EU Consumers • Diversification of market and new product applications • Existence of trade agreement incentives with foreign economic block
Threats	• Existence of cheaper carrageenan substitutes • Delisting of carrageenan as acceptable ingredients for organic product in US • Negative marketing ploy against carrageenan (e.g. carrageenan free product labeling) • Increasing logistic cost (transport, arrastre, stevedoring & other fees
Processing (Industry Level / Carrageenan)	
Strengths	• Presence of 4 RC and 11 SRC processors in the country with enough capacity to meet demand increase. • Highly competitive carrageenan export price • No. 1 in quality of RDS in terms of carrageenan yield and the overall quality parameters – BMP, BAP, GAP • Manufacturing, process technology - capability to extract carrageenan and tailored-fit to specific applications. • Advance processing technology and facilities. • Availability of Seaweed Carrageenan Processing Experts • Fiscal and non-fiscal incentives to new and/or expansion of carrageenan production processing under the government investment priority program
Weaknesses	Usage of seaweed biomass to limited product such as RC, SRC and Alkali treated Cottonii (ATC). Potential product application includes use of biomass as fertilizer, bioplastic and animal feeds. •

	• Lack of awareness of consuming seaweed among non-coastal communities • Limited seaweed cooperatives with direct linkage to processors
Opportunities	• Projected growth of Asian and Middle-east markets. • Diversification of seaweed biomass use for food, feed, fertilizer, personal care, and cosmetic products, nutraceutical, fuel and bioplastics applications • Joint-venture or partnership with off-shore companies • Potential of seaweed as fresh seafood to contribute to Philippine food security program
Threats	• Delisting of carrageenan as an organic food ingredient USDA in 2023 • Strong competition with Indonesian carrageenan price • Re-evaluation of carrageenan and seaweed products as acceptable food ingredients as required by European Food Safety Authority (EFSA) • Costly implication of ASC-MSC seaweed standards • Trade barrier through strong government support and subsidy (technical and financial) in seaweed production and processing in other competing countries i.e. Indonesia
Processing (Village Level / Value-Added Products)	
Strengths	• Varied applications of RDS as food ingredient • Availability of seaweed products for commercialization • Crafted the training regulation for seaweed processing (NC II) to be promulgated by Technical Education and Skills Development Authority (TESDA). • Availability of technologies for seaweed-based products being promoted and transferred by the government institutions as an alternative source of livelihood • Great potential to develop seaweeds as a fresh sea food for 110 M Filipinos • Existence of viable seaweed farmer coops that can be tapped as vehicle for village level processing and promotion of its processed products. • Nutritional value of seaweed at minimal cost
Weaknesses	• Limited type/species of RDS being commercially produced • Inadequate support (government and financing institutions) for the provision of equipment for value-adding of seaweed and seaweed products • Limited access of micro small and medium seaweed processors to the government and financing institutions to make the locally available seaweed products to be competitive (enhancement/packaging/FDA requirements, commercialization) in the market. • Economy of scale relative to local market demand • Lack of awareness on Intellectual Property licensing
Opportunities	• Favorable prospect of local and export market • Untapped local market for seaweed as fresh food • Supplemental income to seaweed farmers • Promotion/popularization of seaweed-based food convenient item • Commercialization of production of seaweed-based fertilizer
Threats	• Low/non-acceptance of locally processed seaweed products so products produced cannot be marketed on a grand scale • Low compliance to the market requirements/specifications.

V. COST AND RETURNS ANALYSIS

This section estimates the cost and returns among players in key seaweeds value chains originating from three major production areas in the country namely Palawan in Luzon, Bohol in the Visayas, and Tawi-Tawi in Mindanao. In each chain, the relative financial positions of the value chain players are also evaluated.

Palawan

Seaweed Farmer

Appendix Table 1 details the estimated costs of production and output sales of the seaweed farm in Agutaya, Palawan producing *cottonii* seaweeds.

The farm employs floating monoline in cultivating the seaweeds in a 1/8 hectare, with five cropping periods every year. For the farm structure, several materials are utilized: (a) 4 rolls of PE rope #9 priced at Php450/roll and are being used for five years; (b) 3 rolls of PE rope #22 costing Php850/roll also having five years lifespan; (c) 1 kilogram of nylon with a price of Php380/kilogram with the usage of three cropping cycles; (d) 10 rolls of soft ties priced at 135/roll, useful for three cycles; and (e) 40 pieces of wooden stakes at Php15 each that is good for one year. Three laborers are hired to finish the farm preparation and paid a wage of Php300 each.

Sourcing of initial planting materials amounts to Php10,280 which covers the cost of propagules and transportation. Planting involves the tying of the propagules in the cultivating lines and floaters. Workers are employed to perform this task with an associated labor cost of Php1,900.

Farm monitoring is done every other day for a half-day. Expenses for this activity include gasoline for the trips to the farm as well as the repairs and maintenance of the structure and the boat, which amounts to Php9,000.

Seaweed harvesting is performed roughly for 2.5 days by a hired laborer at an estimated cost of Php2,250. The farm yields an average of 8,000 kilograms of fresh seaweeds, of which 1,000 kilograms are set aside and the remaining 7,000 kilograms are subjected to drying. Cost of drying seaweeds amounts to Php984.92 from the usage drying platform, materials for sealing and packing seaweeds, and labor. The farm can produce 1,000 kilograms of dried seaweeds which are sold at Php58/kilogram.

Overall, the farm is spending a total of Php27,769.92, while earning Php68,000 from the harvest of 1,000 kilograms of dried seaweeds and another 1,000 kilograms of wet seaweeds. Therefore, the farm earns Php40,230.08 for one cropping period. However, the investment cost on all the materials necessary to start production cannot be fully recovered in just one cropping. The calculated Return on Investment (ROI) indicates that full recovery will be achieved after the third cropping.

Large/Provincial Trader

The large trader in Agutaya, Palawan is a cooperative that procures *cottonii* and *spinosum* seaweeds from member and non-member farmers. The trader directly supplies 20MT of seaweeds to a processor every month. On average, 60% of the seaweeds traded are *cottonii* and 40% are *spinosum*.

As shown in Appendix Table 2, the trader's fixed expenses are mainly from the investments on weighing scale and storehouse. Considering the lifespan of these items, the total depreciation cost for one cycle is estimated at Php333.33. On the other hand, the operating expenses are from the purchase of RDS, sacks, straw, transportation cost, labor for loading seaweeds, auxiliary taxes, and communication expenses. The trader consolidates 12,000 kilograms and 8,000 kilograms of *cottonii* and *spinosum* respectively. Thus, a total of Php696,000 is being spent for buying *cottonii* and Php208,000 for *spinosum*.

The cost of packing seaweeds is estimated at Php4,194.13. For the delivery, the trader takes charge of the expenses involved in transporting the seaweeds from Agutaya to Batangas port while the processor shoulders the rest. The estimated transportation expense of the trader from Agutaya to Batangas is Php90,000. Before the shipping, the trader also disburses payment for the auxiliary taxes which is equivalent to Php10,000. Adding to that, laborers are employed to help in loading the seaweeds to the vehicle and are paid Php5,340. With a minimal cost of Php200 for communication every month, the total expenditures of the trader for one cycle sum up to Php1,013,867.46.

Revenues of the trader are estimated at Php1.096 million from the sales of *cottonii* seaweeds at Php66/kilogram and *spinosum* at Php38/kilogram. Deducting the production cost, the estimated net income of the trader is Php82,132.54 per trading cycle.

Processor

The business performance of the carrageenan manufacturer/processor is presented in Appendix Table 3. Every month, the processor ships a total of 216MT of SRC. Its average selling price is 5% higher than the price of other producers. Assuming that other processor sells $9/kilogram on average, this processor is selling its carrageenan for $9.45/kilogram or Php472.50/kilogram (using $1:Php50 conversion rate). This translates to revenues of about Php102.06 million for the 216MT of carrageenan sold by the processor.

In the process of producing the carrageenan, the company's extraction rate from seaweeds is at 26%. According to the processor, spending is over Php46 million on raw material, which is 60% of the operating cost. Other operating costs include expenses on chemicals (10%), salary (5%), utilities (8%), maintenance (10%), and logistics (7%). The total operations cost was computed at Php77.5 million.

The processor has several investment items, which were estimated to have a monthly depreciation equivalent to Php100,000. Moreover, the expense on permits and licenses secured every year is at Php1.45 million or equivalent to an average monthly cost is

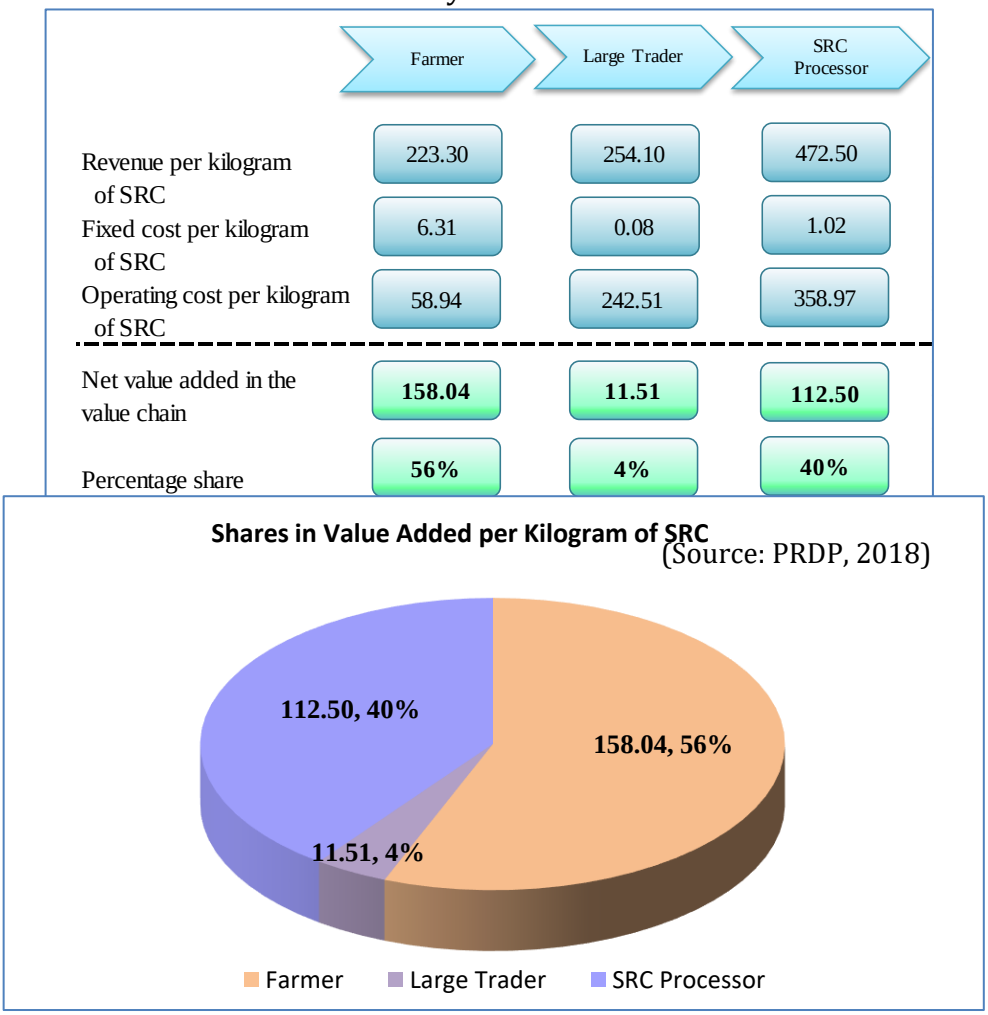
Php120,833.33. The monthly fixed cost is equivalent to Php220,833.33 from these two fixed cost items.

The estimated total production cost for production for the 216MT of semi-refined carrageenan is nearly Php77.76 million. Reckoning this against the total receipts of Php102 million reveals that the processor is making a net profit of about Php24.3 million every month.

Relative Financial Position of the Players in the Palawan (Luzon) Chain

The seaweeds chain observed in Palawan appears to be short -- the farmer goes straight to the large trader to market its seaweed. The large trader supplies raw seaweeds to the processor (Figure 21).

The assessment shows that the processor has the biggest additional cost in the production of one kilogram of SRC. Remarkably, the farmer holds the greatest value-added in the chain, obtaining 56 percent of the total profit for a one kilogram SRC. The trader turns out to have the smallest share in the earnings. This presents that players in this chain more or less earn commensurately to its activities in the chain.



(Source: PRDP, 2018)

Figure 21. Shares in the Value-Added (Per Kilo of SRC) of Players in the Palawan Chain

Bohol

Seaweed Farmer

The costs and returns for a one-hectare spinosum farm in Talibon, Bohol was examined in Appendix Table 4.

The expenditures for the farm preparation consist of the payment for permits, rental of municipal waters, as well as the materials and labor for the construction of the farm. Since the seedlings are bought within the community, the farmer only spends Php15,000 on seedling procurement. Soft ties are used and laborers are hired in tying off the seedlings. The cost of planting and harvesting involves payment to hired labor while the monitoring, maintenance, and necessary repair of the farm are carried out by the farmer. Total expenditures on both fixed and operating inputs are estimated at Php43,241.

A total of 8,500 kilograms of wet seaweeds is gathered and harvested after 45 days. At post-harvest, the farmer will dry 7,000 kilograms of seaweeds by hanging the monolines on nails for about three days. The farmer spends roughly Php1,133.93 on the establishment of the dryer and labor.

Upon drying, the farmer gets 1,000 kilograms of dried seaweeds which will be packed and sealed. The materials for packing and labor make up an expense of Php310.63. The delivery to the trader in the town proper corresponds to an outlay of Php3,600 that covers the rentals for boat and tricycle and an assistant to carry the product.

The result of the financial analysis shows that the farm spends a total of Php29,385.74 in operating and depreciation expenses for producing 1,000 kilograms of dried seaweeds. Selling the dried seaweeds at Php23/kilogram, the farm makes a total sales amounting to Php23,000. The maintained 1,500 kilograms of wet seaweeds, priced at Php10/kilogram, adds up to the earnings of the farm by Php15,000. As a result, the total revenue of the farm aggregates to Php38,000. Matching this to the production costs, the net income of the farm equals Php8,614.26. If the fixed costs are assumed in full, the farmer will be at loss in the initial production cycle and would have to wait until the third cropping to recover all investments spent for production.

Large /Provincial Trade

The large trader in Talibon, Bohol is similarly a cooperative that acquires seaweeds from farmer-members and non-members alike. The trader has direct contact with a processor, shipping generally *spinosum*, though, also buying some *cotttonii*.

The analysis of the costs and returns of the large trader in Talibon, Bohol is shown in Appendix Table 5. The financial analysis assumes that the trader is delivering an average of 25MT of dried spinosum seaweeds every month to the processor. Using the buying price of the processor which is Php27/kilogram, the delivery of 25MT gives the trader a total revenue of Php675,000. However, the trader also faces the following expense items enumerated below that total to Php629,726.51:

- Weighing scale (platform) – 1 unit at Php17,000 and 10 years lifespan; computed usage value for one cycle is Php141.67
- Sorting screen – 1 unit at Php500 and 5 years lifespan; computed depreciation is Php8.33 per cycle
- Wooden pestle – 2 pieces at Php300/pc. And 5 years lifespan; computed cost of usage for one cycle is Php10
- Raw dried seaweeds – 25,000 kilograms at Php23/kilogram
- Salary of personnel – 48 man/days (4 people working three days a week, four weeks per month) at Php310/day
- Sacks – 358 pieces (70 kilograms seaweeds/sack) at Php15/piece
- Straw – 3.6 rolls (358 meters; 100 meters per roll) at Php65/roll
- Storehouse rental – Php2,500/month
- Transportation cost – 358 sacks at Php63/sack (Php20 from storehouse to port, average Php40 for a ship from Talibon to Cebu and Php3 for PPA)
- Labor for loading of seaweeds – 4.5 man/days (3 people loading for three hours; three loading times) at Php300/day
- Arrastre – 358 sacks at Php9.61 (9.42+2% VAT)/sack
- Auxiliary tax –358 sacks at Php5/sack
- Municipal clearance – 3 trips at Php20/trip
- Local transport permit – 3 trips at Php100/trip
- Dumping/Unloading fee – 358 sacks at Php5/sack
- Communication – Php300/month (cellphone and internet)

The summation of the expenses, as opposed to the final sales, resulted in a net return of Php45,273.49 received by the trader from the business.

Processor

To effectively acquire seaweeds from different seaweed locations, the carrageenan processor strategically placed buying stations that capture the overall expense in seaweed raw materials procurement.

The semi-refined kappa-carrageenan business of the processor was analyzed in Appendix Table 6. In this analysis, it was supposed that the company can sell 100MT of kappa SRC from *spinosum* every month, for $5/kilogram or Php250/kilogram ($1=Php50).

The estimated expense for 100MT of RDS raw material is estimated at Php14.705 million which is 75 percent of the total operating costs. Chemicals, on the other hand, are 5 percent of the operating expense. An additional 13 percent constitutes the salary and logistics, and the utilities and communication at 7 percent, which essentially incorporates the allocation for the buying stations. All of these make nearly Php14.4 million. On the fixed cost, the monthly depreciation of the equipment is estimated at Php257,916.67 and the permits and licenses are Php46,666.67.

The selling price of the spinosum SRC in the world market is assumed at $5/kilogram offers Php25 million sales revenues to the producer. Therefore, the producer earns close to Php10.295 million for this activity.

Relative Financial Position of Players in the Bohol (Visayas) Chain

The *spinosum* SRC chain in Bohol is similarly shortened, consisting of the farmer, large trader, and the processor. Figure 22 below exhibits that the per-kilogram revenue is greatest for the carrageenan processor, followed by the trader. The income per unit of SRC produced is likewise highest for the processor with a share of 71 percent. The farmer only earns about 24 percent of the total per kilogram profit.

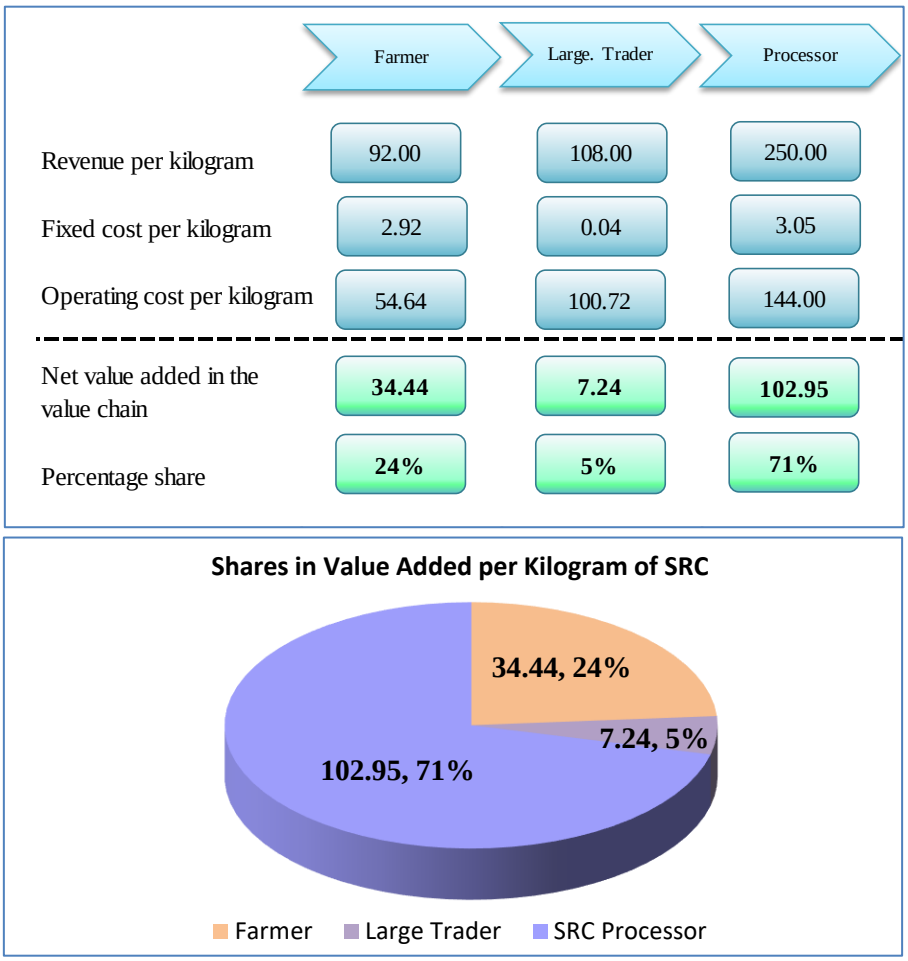


Figure 22. Shares in the Value-Added (Per Kilo of SRC) of Players in the Bohol Chain (Source: PRDP, 2018)

Tawi-Tawi

Seaweed Farmer

The dried seaweed producer's expenses and revenues in Subutu, Tawi-Tawi is estimated using the actual inputs and outputs of a representative farmer interviewed. This is presented in Appendix Table 7.

In this estimation, the materials of the farmer consist of the following:

- 5 pcs. Stainless steel knife – Php50/pc, with four years lifespan
- 13 rolls PE Rope #6 – Php200/rolls, useful for one year
- 10 rolls of Soft tie – Php220/rolls, with half-year usage
- 150 pcs. Mangrove stick – Php5/pc., may be used for one year
- 100 pcs Styrofoam – Php20/pc., with one year lifetime
- 2 pcs. Basket – Php200/pc., useful for one year
- 1 unit Non-motorized Banca – Php15,000, with 15 years usage
- 5 meters Cover tent – Php50/meter may be used for one year
- 5 meters Screen dryer – Php50/meter, with one-year lifespan
- 330 kilograms of seedlings – Php6.67/kilogram (Php1,000 for approximately 150 kilograms)

Meanwhile, the labor input is comprised of:

- Tying of seedlings in 280 lines at Php2 per line
- 1 man/day for installation and planting at Php250/day
- 2 months for maintenance at Php3,000/month
- Harvesting of 280 lines at Php200/boat containing 20 lines or equivalently Php10/line
- Cleaning of seaweed harvest at Php5/line
- 2 man/day for drying at Php250
- 0.375 man/day for packing (20 mins. Per sack) at Php250

In addition, the transportation cost to move the seaweeds from the place of the farmer to the trader is Php20/sack. At harvest time, the average farm output reaches 3,920 kilograms. The farmer sets aside 330 kilograms of wet seaweeds to be utilized in the next cropping. The remaining 3,590 kilograms undergo 2 days of drying. The farm's dried seaweeds output is 513 kilograms. At a per kilogram price of Php6.67 and Php67 for wet and dried seaweeds, respectively, the farm begets a value of Php2,200 for the saved wet seaweeds and Php34,361.43 for the dried seaweeds, totaling Php36,561.43 of gross receipts.

Taking away all the expenses for the materials and labor of Php18,571.64, the estimated net income of the farm is Php17,989.79. The totality of the fixed cost nevertheless can only be repaid with the second cycle harvest.

Trader

Two types of traders are engaged in this seaweeds chain: the barangay trader and the large trader.

Barangay Trader

The trading activity of a barangay trader in Sibutu, Tawi-Tawi involves buying dried seaweeds from farmers and selling them directly to a big trader in Zamboanga City. The transaction involves 10,000 kilograms of dried seaweeds carried out three times a month for the entire year.

Appendix Table 8 shows that delivery of the barangay trader to the large trader is being paid at Php700,000. To make this sale, the trader has to dispense a total amount of Php697,882.81 for the purchase of dried seaweeds from the farmers, at Php67/kilogram, labor expense for redrying, repacking, loading, and unloading of sacks in the ports, payment for auxiliary tax, transportation cost from Sibutu to Zamboanga City, communication expense for calls and texts to farmers and the large trader, and investment on a weighing scale.

The financial evaluation demonstrates that the trader merely makes Php2,117.19 due to high operating costs.

Large / Provincial

The economic analysis of the trading activity of a large seaweed trader in Zamboanga City is displayed in Appendix Table 9. In this case, the trader consolidates and sends seaweeds outside of Zamboanga City. Although the trader is marketing both *cottonii* and *spinosum*, the latter has a smaller share of approximately 5 percent. The trader ships an average of 18MT of collected seaweeds to the processor twice a month.

Presuming the processor's buying price of Php80 for *cottonii* and Php38 for *spinosum*, the trader receives Php1.368 million and Php34,200 for the marketed *cottonii* and *spinosum* seaweeds, respectively.

The cost of maintaining trading-related equipment such as a tucks scale, platform weighing scale, forklift, baling machine, and warehouse is estimated at Php20,000 for a half month. Adding to these are the operational expense, mainly, *Cottonii* seaweeds bought from suppliers at Php70/kilogram and *spinosum* at Php30/kilogram. For these alone, the trader is shelling out Php1.224 million. The trader still allots the budget for sacks and straw for packing the seaweeds, which makes an outlay of Php5,370. Moreover, the average payment for shipping from Zamboanga to Cebu plus local trucking services is Php24,000 per delivery. Apart from the transport costs, an auxiliary tax of Php0.10/kilogram and a BFAR permit of Php100 is being paid before the delivery. The trader is hiring about 10 workers to perform tasks of receiving the seaweeds as well weighing, cleaning, drying, packing, and loading them during deliveries. Their salary is Php1,800/pax/week.

The fixed cost and operating cost add up to Php1,314,249.17. The gross receipts turn out to be Php1,402,200. As a result, the trader earns Php87,950.83 from this activity.

Processor

The processor is producing both SRC and RC. About 70 percent of its production is SRC and the remainder 30 percent is RC. The refined carrageenan is further subdivided into alcohol precipitated and gel press carrageenan. The former gets the bigger proportion of the output of about 90 percent and the latter only at 10 percent. The producer sells a total of 200MT of SRC and RC products every month. The shares denote that the monthly output of the processor is estimated at 140MT SRC and 60MT RC (54MT alcohol precipitated and 6MT gel press).

The economic analysis of the SRC production is presented in Appendix Table 10. Based on the values and lifespan of the equipment provided by the processor, the monthly depreciation is computed to be Php267,916.67. The annual total spending on permits and licenses is roughly Php800,000. The 70 percent share of the SRC was used to calculate the monthly portion of the spending accrued to SRC, which is approximately Php32,666.67.

The processor uses 466,667 kilograms of dried seaweeds to produce 140MT of SRC. At Php80/kilogram, the full expense on dried seaweeds is Php37.33 million. According to the processor, the volume of dried seaweeds accounts for about 80% of the operating cost. Another 5 percent of the cost goes to the chemicals used in the process, whereas 10 percent and an additional 5 percent accrues to salary, logistics, utilities, and communications. Using these values and percentages, the total operating cost of producing 140MT SRC is approximately Php46.67 million.

The processor is selling the SRC at an average price of $8/kilogram. This is tantamount to Php350 using the $1:Php50 conversion rate. The 140MT SRC affords sales to the processor worth Php56 million. Therefore, the processor's profit is Php9.042 million.

The processing of RC is presented in Appendix Table 11. In the case of gel press RC, the spending on chemicals and utilities rises. The additional cost for potassium chloride (KCl) largely pushes chemical spending to go up. Meanwhile, the added processes such as filtration, gelation, and further drying push expenses on utilities up.

The processor generates roughly 6MT of RC monthly. With the extraction rate of 20 percent from the dried seaweeds, the processor utilizes 30MT of dried seaweeds which costs approximately Php2.4 million. Following through the share of dried seaweeds in the operating cost, it can be inferred that the total cost of operations is Php3.117 million. On top of these, the equipment employed for production is approximated to have a depreciation amount of Php328,750 every month. Meanwhile, the cost of permits and licenses to operate is computed at a monthly rate of Php2,000 considering the 3 percent share of gel pressed RC production in the company's total monthly output. Consequently, the fixed cost amounts to Php330,750. From all these calculations, the estimated total cost of production of 6MT gel press RC is Php3,447,633.12.

The processor is marketing Its gel press RC for an average of $13 or equivalently Php650 thereby generating gross revenue of Php3.9 million. This analysis displays that the receipts are over the stream of expenses placed on the production of gel press RC. Therefore, the processor is earning approximately Php452,336.88.

Relative Financial Position of Players in the Mindanao (Tawi-Tawi) Chain

The SRC and RC chains traced from Mindanao were relatively long with the presence of two layers of traders. The assessment of the SRC chain in Figure 23 displays that value-added attributed to the barangay trader is very minimal at Php0.70. Remarkably, the farmer obtains the greatest value-added of Php116.82, garnering almost two-thirds of the total value-added. The processor is also making a significant portion of 33 percent which is equivalent to Php64.59.

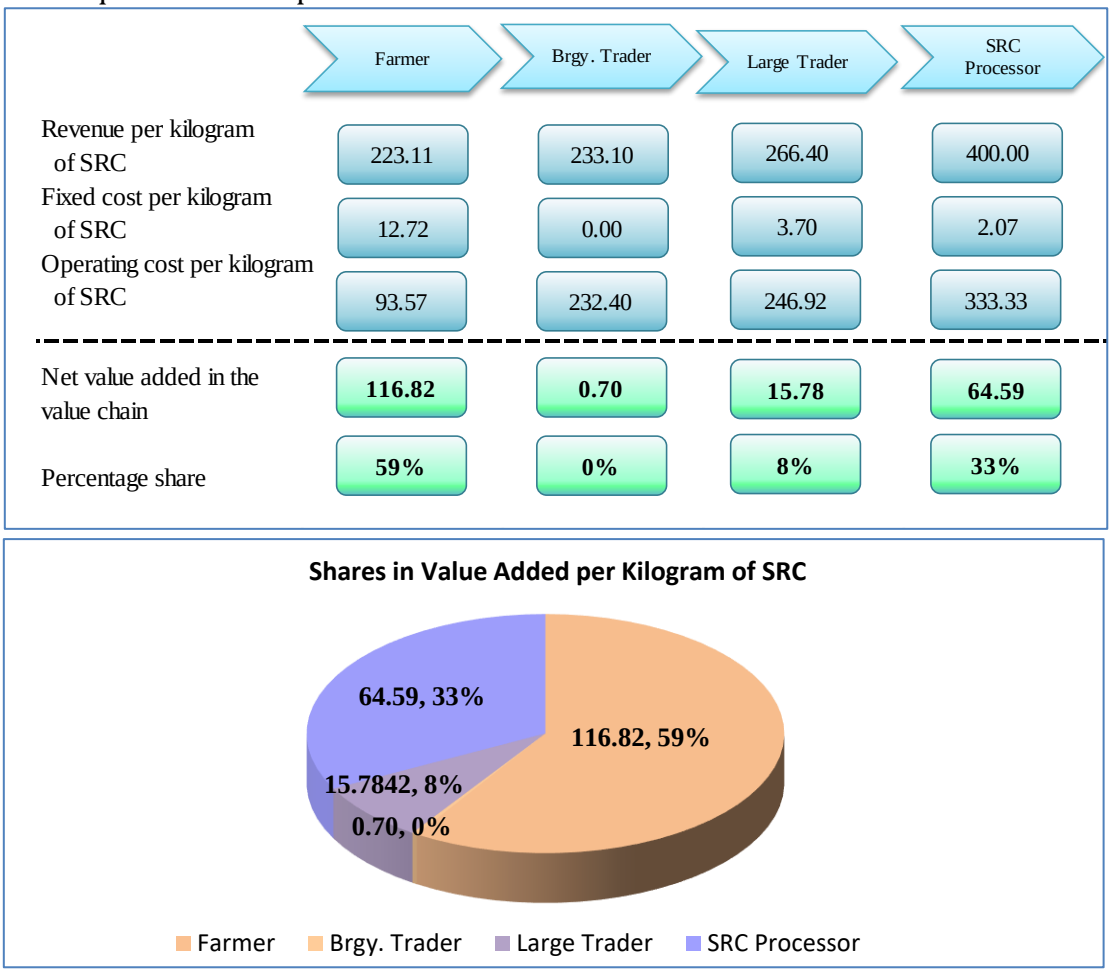


Figure 23. Shares in the Value-Added (Per Kilo of SRC) of Players in the Tawi-Tawi Chain (Source: PRDP, 2018)

In the production of a single kilogram gel press RC, the barangay trader still posted a minimal amount of profit at Php1.05, wherein its share is insignificant as compared to other players. The share of the farmer increased by 69 percent but the portions of the large trader and the processor were reduced to 6 percent and 28 percent accordingly (Figure 24).

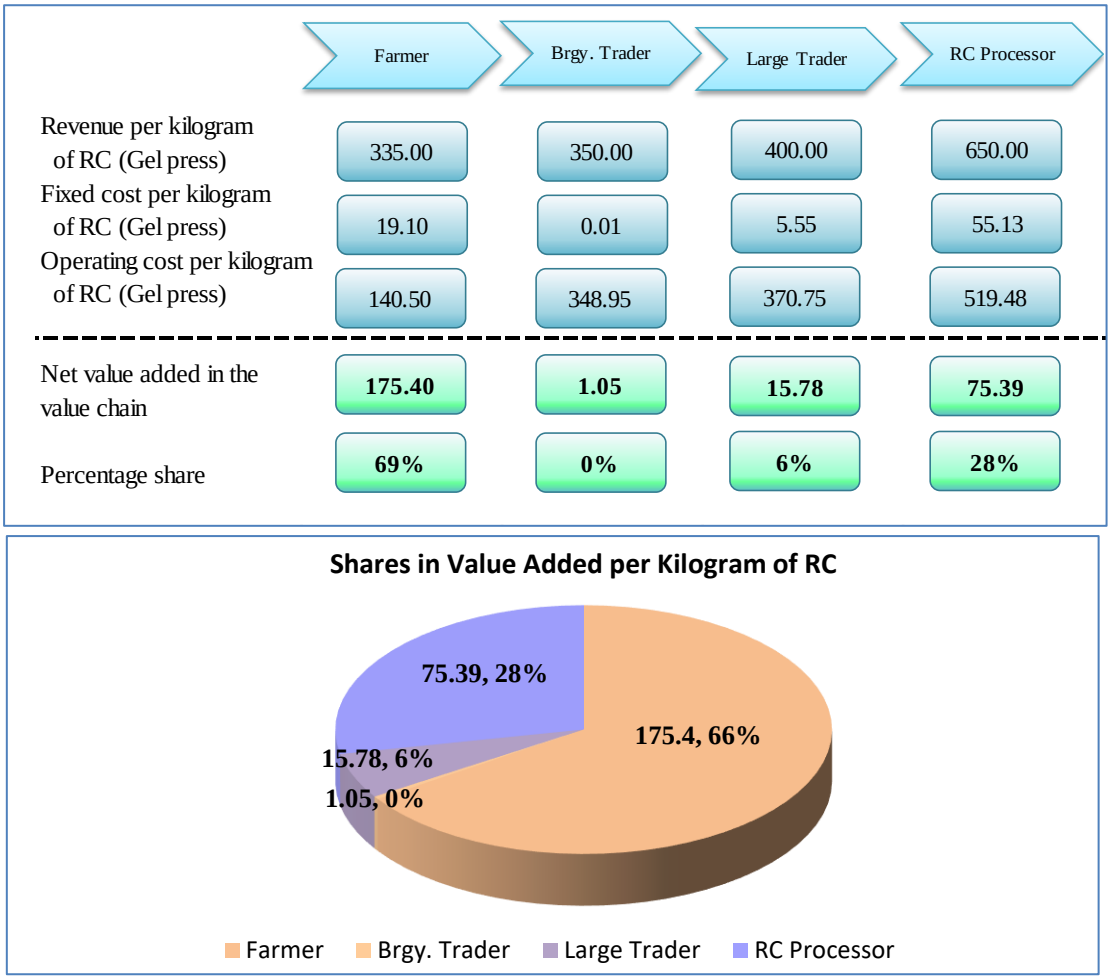


Figure 24. Shares in the Value-Added (Per Kilo of RC) of Players in the Tawi-Tawi Chain (Source: PRDP, 2018)

The cost and returns analyses demonstrated that seaweed/carrageenan production is a viable business endeavor. The evaluation of the relative financial position of the players involved similarly reveals that shares in the income from producing seaweeds/carrageenan are generally proportionate to their share in the work associated with the production.

Benchmark Analysis

The Philippines was compared to Indonesia, which was regarded as the most appropriate international benchmark. Seaweed production in the Philippines and Indonesia is largely concerned with the production of carrageenan. Hence, in the global markets, Indonesia and the Philippines are both traders of seaweeds/carrageenan. Indonesia leads over the Philippines in terms of seaweed production and supplies RDS to Philippine carrageenan processors (DTI, 2016). Moreover, the geographical characteristics of Indonesia are more or less the same as the Philippines, considering that both countries are archipelagos.

Farm Sector (Seaweed Production)

i. Farm Size and Number of Farms

In the Philippines, farms are typically small, having a size of one-fourth hectare on average. Smallholder, family-managed farms dominate the production of seaweeds. As of 2016, a total of 102,000 hectares are being utilized as seaweed farms of about 200,000 seaweed growers (PRDP, 2018).

Meanwhile, farms in South Sulawesi in Indonesia have an average size of one hectare, whereas farm sizes in other areas are varied, restriction-free, and with a size less than three hectares. More than 190,000 households are engaged in seaweeds production and 1.4 million hectares are devoted to seaweed cultivation (DTI, 2016).

The availability of farming areas appears not to be a constraint to both countries. However, the average size of the farms in Indonesia is approximately four times the size of the farms in the Philippines. The total production area of Indonesia is more than ten times the existing cultivation area of the Philippines. To become more competitive, the Philippines should start expanding to areas available for seaweed growing.

ii. Location and Spatial Concentration

Seaweed production in the Philippines is currently concentrated in the southern part of the country. Seaweed areas are predominantly situated in the Mindanao region, principally in BARMM and the Zamboanga Peninsula covering approximately a total of 81,000 hectares or equivalently 80 percent of the total national seaweed area. Other areas are also located in the Visayas region and Palawan, in southern Luzon. For this reason, a substantial proportion of the seaweed output is supplied by these areas (PRDP, 2018).

In Indonesia, seaweeds are produced in the eastern and southern areas of the country, specifically in Sulawesi, Bali-Nusa Tenggara, Maluku-Papua, Java, and Sumatera. In 2013, Sulawesi contributed 49 percent of the national output, followed by Bali-Nusa Tenggara with 31 percent and Maluku-Papua at 9 percent (DTI, 2016).

Seaweed production in the two countries is distributed in the various coastal areas of the archipelago and follows the geographical set-up of their respective countries, such that seaweed farms are situated more in the island parts and not in the areas which are considered to have massive land areas.

There is an opportunity for the Philippines to grow seaweeds in other areas aside from the existing ones. However, the species to be cultivated may need some consideration to ensure that it will be appropriate in the locality.

Processing Sector (Carrageenan Production)

i. Number and Capacity

Carrageenan processing in the Philippines is composed of 18 carrageenan processors, of which five are multinational and the remaining are local companies. The processing capacity of each plant ranges from 1,600 to 5,400 MT. On average, these companies operate at 65 percent capacity at present. The processing plants are producing food grade and non-food grade semi-refined carrageenan as well as gel-pressed and alcohol-precipitated refined carrageenan. Most are manufacturing semi-refined carrageenan, six companies making the non-food grade, and fifteen producing food-grade. Refined carrageenan, on the other hand, is only produced by five companies, with two manufacturing alcohol precipitated refined carrageenan and three supplying gel pressed refined carrageenan (PRDP, 2018).

As of 2015, carrageenan processing in Indonesia is being done by 16 local companies. The processing plants have a capacity ranging from 10 MT to 160 MT per month, which operates at 70 to 80 percent capacity currently. Four plants are processing refined carrageenan; Others manufacture food grade and non-food grade semi-refined carrageenan and alkali-treated chips. The government of Indonesia has established several processing plants, and thus owned some carrageenan processing plants in the country (DTI, 2016).

Carrageenan processors in both countries are not operating at their maximum capacities, but Indonesian companies are performing at a relatively higher capacity. Multinational companies make up a significant proportion of the processors in the Philippines, whereas Indonesian plants are entirely local companies. Though, the Indonesian government has provided support to the industry by establishing processing plants. Carrageenan processing is largely for semi-refined carrageenan in the two countries. The Philippines has more companies processing refined carrageenan.

Philippine processing plants may increase production and maximize plant capacities. The raw seaweed material though should be enough to achieve this. The Philippines may also take advantage of its capacity to process refined carrageenan, especially for the alcohol precipitated one.

ii. Location and Spatial Concentration

Processing plants in the Philippines can be found all over the country. However, it is centered in Cebu in Central Visayas, where the majority of the companies are located. Seven processing plants are currently situated in Cebu, four in Zamboanga, two in Cavite, two in Laguna, one in Bulacan, 1 in Leyte, and 1 in Davao (PRDP, 2018).

Carrageenan processors in Indonesia are assembled in Jawa Timur (East Java) South Sulawesi and Nusa Tanggara Timur. Six companies are found in Jawa Timur, four processors in South Sulawesi and two in Nusa Tanggara Timur. The rest are distributed in other provinces (DTI, 2016).

While carrageenan processors are distributed geographically in both countries, it is observed that there are areas of concentration. It appears that the plants are strategically located considering their accessibility to the supply source and markets which provides ease in logistics for transporting raw materials as well as finished products. Maintaining these processing plants in these strategic areas would be beneficial for the industry.

Performance

i. Production

The national output of wet seaweeds of the Philippines in 1990 was 292,471 MT and settled to 1.48 million MT in 2018 (Figure 25). During the said period, seaweed production has increased by 14 percent per annum on average. For the same year, the wet seaweed production of Indonesia during the same period exhibited exponential growth, supplying 219,276 MT in 1990 to 9.36 million MT.

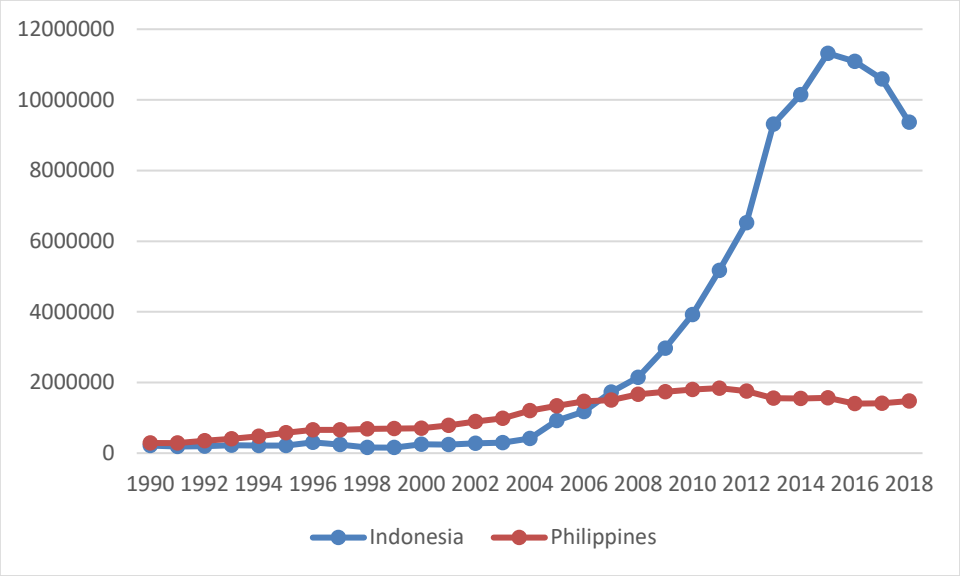


Figure 25. Wet Seaweed Production of Indonesia and the Philippines, 1990-2018
Source: FAO FishStat, 2021

The Philippines used to dominate the global seaweed supply. In the 1990s through the mid-2000s, Indonesia was producing below the output levels of the Philippines. However, Indonesia's production finally overtook the Philippines in 2007 and climbed steeply until 2015. Both countries displayed a downturn in recent years, but the Philippines is slowly recovering while Indonesia is still on its downtrend. Despite the declining seaweed production of Indonesia in recent years, the divergence with the Philippines is still great. The Philippines has yet to boost production to reduce the gap.

ii. Exports

The Philippines used to be the lead exporter of seaweeds. However, the dwindling supply of raw seaweeds in the country resulted in fluctuations in seaweeds exports. Total seaweed exports of the country exhibited slim growth for more than two decades. It only reached 48,026 MT in 2019 from 37,148 MT in 1996. The majority of Philippine exports

are carrageenan which expanded during the same period. Major export markets of the Philippines are China, the USA, and European countries (BFAR, Various Years).

Raw seaweed exports of Indonesia have substantially increased. From 168,280 MT in 2012, it stood at 195,604 MT in 2019, exhibiting a 16 percent expansion. Major trade partners are China, South Korea, and Japan. Carrageenan exports likewise surged. Records of ITC (2021) showed that from merely 993 MT in 2001, it settled at 13,993 MT in 2019. Leading markets are China, the USA, and European countries.

Indonesian exports have significantly outdone the Philippines in past years. The decline in raw seaweed supply in the Philippines has substantially impacted its export potential. The rise in seaweed produce of Indonesia on the other hand has allowed the country to expand its export market.

The competitiveness of the Philippines in the exports market may have tapered off in recent years because of reduced volume supplied, which is very much reliant on raw seaweed production. The country can go back on track with the increased supply of raw wet seaweeds. Nevertheless, the country may continue to uphold its competitiveness in terms of the quality of RDS and carrageenan it is supplying to the global market.

iii. Imports

Seaweeds imports in the Philippines are not as big as its exports. Data of the International Trade Center (ITC) (2021) shows that the Philippines ' seaweed imports are just in 2018 and 2019. Imports of edible seaweeds are 2,089 and 2,625 metric tons in 2018 and 2019, respectively. Meanwhile, non-edible seaweed imports for 2018 and 2019 are only 230 and 40 metric tons accordingly. Carrageenan imports have also been low for the past years, though data indicates that the Philippines have been importing carrageenan for a much longer period than raw seaweeds. Carrageenan imports in 2001 were 1,226 MT and it only reached 2,000 MT levels since 2016. In 2019, total carrageenan imports were 2,887 MT (ITC, 2021). Carrageenan is largely sourced from China.

Data of ITC (2021) displays that raw seaweed imports of Indonesia are minimal. They started to import only in 2012, with the highest import quantity of 356 MT in 2015. In 2019, the import volume was only 296 MT. Albeit higher than raw seaweeds, carrageenan imports were also not that high. The highest volume was in 2018 at 3,419 MT. However, it exhibited an increase from its 2001 level of 1,366 MT. China is also the leading supplier of Indonesia.

Both countries have a little volume of imports of raw seaweeds and carrageenan. Raw seaweed imports of the Philippines appear to be higher than that of Indonesia. Carrageenan imports of Indonesia meanwhile is a bit greater than the Philippines. Reducing or sustaining the import levels at the least would be vital for the superior position of the Philippine seaweed industry.

Prices

i. Export prices

Although ITC (2021) data available for Philippine exports is only for 2018 and 2019, the price of raw seaweeds per metric ton demonstrated an increase. Edible raw seaweeds cost $1,244 in 2018 and $1,664 in 2019, whereas non-edible raw seaweeds were priced at $1,576 in 2018 and $2,162 in 2019. Carrageenan prices also showed growth in the past years. In 2001, the price per metric ton is only $4,344. It has grown to about $7,000 since 2008, settling at $7,488 in 2019.

The price of seaweed exports of Indonesia for edible raw seaweeds has gone up from $721 in 2012 to $1,168 per metric ton in 2019. Contrary, the export price of non-edible seaweeds slid from $878 in 2012 to $433 in 2019. However, it has reached $1,096 in 2014 and declined since then. Meanwhile, the price per metric ton of carrageenan has risen. It was $3,244 in 2001 and arrived at $7,128 in 2019 (ITC, 2021).

Albeit that the prices of Philippine seaweed exports are comparably higher than Indonesian prices, data indicates that prices of Indonesia are slowly closing the gap with the Philippine prices. It is however notable that the price of non-edible seaweeds in the Philippines is much greater as compared to the price of Indonesia.

Higher prices of seaweed products from the Philippines convey the better quality that the country is offering the market. Keeping up the quality therefore would translate to maintaining competitive prices for the Philippines. However, this should be coupled with efforts to ensure a sustainable supply of seaweeds.

ii. Import prices

Import prices of the Philippines for edible seaweeds have posted a slight decrease from $1,286 per MT in 2018 to $1,204 per MT in 2019. Contrary to this, the non-edible seaweeds put up a huge increase from $852 per MT in 2018 to $4,425 per MT in 2019. Per metric ton price of carrageenan likewise built up from $3,751 in 2001 to $9,733 in 2019. It reached as high as $12,880 in 2011 and was at $11,000 levels from 2009 to 2015 (ITC, 2021).

Per metric ton of edible raw seaweeds imported by Indonesia rose from $10,008 in 2012 to $12,066. Though, an all-time high rate was observed in 2017 with $22,748, respectively. In like manner, prices of non-edible raw seaweeds swelled from merely $3,407 in 2012 to $7,786 in 2019. Carrageenan prices moreover expanded from 3,244 in 2001 to $8,259 in 2019 (ITC, 2021).

The prices of imports signify that Indonesia is paying significantly higher than the Philippines for the raw seaweed products they are importing. Conversely, the price of the carrageenan imports of the Philippines was more costly than in Indonesia.

Farm Level Parameters

i. Production Costs

In the Philippines, the average production cost of a ¼ hectare seaweed farm using the floating rope method, including the fixed cost for one year, is estimated at PhP108,500. Seedlings are purchased only during the first cropping and farmers normally set aside seedlings after harvests for the next cropping. The total cost of the 2,500 kg used for the initial planting is PhP37,500. Small-scale seaweeds farming is generally and family venture with specific roles and contributions from each member of the household.

The production cost of growing one hectare of seaweeds in Indonesia amounted to IDR43.3 M (PhP146,311). Seedling cost constitutes 33 percent of this total cost. About two to three members of the family are engaged in farming, including crop maintenance done daily. The per-area production cost is comparatively lower in Indonesia than in the Philippines.

ii. Farm Yield

The average yield in wet equivalent for a ¼ hectare seaweed farm per year is estimated at 46,500 kg (or around 6,643 kg in dry equivalent) in the Philippines. Harvesting is done 45 to 60 days after planting and is usually done by men for two days. Drying is done for two to three days to achieve the desired moisture content of 40 to 42 percent and is usually performed by women using drying platforms and hanging methods.

In Indonesia, the average yield in dry equivalent was 1,000 kg for a ¾ ha farm for a 65-day growing cycle. The price was IDR12,000 (PhP41) per kg (DTI, 2016). Harvesting is done for two days usually by two to three men while drying is done by women for two to three days or until the desired moisture content is achieved. The farm yield/productivity, on average, seems to be higher in the Philippines than in Indonesia but needs to be taken in the context of a wide variety of seaweed farming systems and practices with different farm area requirements.

iii. Farm Incomes

With the average price of RDS per kg in the Philippines at PhP60.00, the gross sales for RDS harvested from a ¼ hectares seaweed farm is around PHP 398,571.60. Considering the total production cost of PHP 108,500.00, the net income before tax is PHP 290,071.60.

Seaweed farming in Indonesia can generate gross revenue of IDR 96 M (PhP330,000) for ¾ hectare. Considering the estimated production cost for the same area, the computed net income was IDR 63.5 M (PhP218,000). The per-area farm income from seaweed farming seems to be comparatively higher in the Philippines than in Indonesia, on average.

iv. Post-harvest

- Wet-Dry Ratio

The standard wet-to-dry ratio of seaweeds in the Philippines is 7:1. This means that the 7 kilograms of wet seaweeds will turn into 1 kilogram of dried seaweeds after drying (PRDP, 2018). On the other hand, the wet-to-dry ratio in Indonesia varies from 6:1 to 9:1, and sometimes even reaches 10:1 (DTI, 2016). This difference in wet-to-dry ratio between the Philippines and Indonesia implies that the Philippines is producing better quality seaweeds as evidenced by the higher recovery from wet to dry basis.

- Moisture Content

The Philippine standard for moisture content is 38 to 40 percent. In some instances, however, farmers sell seaweeds with higher moisture content, which can reach up to 55 percent (PRDP, 2018). In Indonesia, the standard moisture content is 38 percent, but raw dried seaweeds are commonly sold at 40 to 42 percent moisture content (DTI, 2016).

The standards for moisture content for both countries are essentially the same. The farmers, however, sell at higher moisture content levels.

By continuing the good practices in producing seaweeds, the Philippines will be able to keep up the quality of its seaweeds, thereby obtaining the same wet-to-dry ratio. Farmers however have yet to work on and adhere to the standard moisture content.

Processing Level Parameters

i. Carrageenan Yield

The average extraction rate from raw dried seaweeds in the Philippines is 25 percent for semi-refined carrageenan and 20 percent for refined carrageenan. Thus, a processor needs four kilograms of RDS to generate one kilogram of SRC and five kilograms of RDS to obtain one kilogram of RC (PRDP, 2018). Similarly, the average yield in Indonesia for SRC is 25 percent, with variation ranging from 4:1 to 5:1 (DTI, 2016).

The relatively higher average of carrageenan extracted from the RDS of the Philippines can be attributed to the better RDS quality in the country. Once again, the advantage of the country is on the quality of the seaweeds being produced. Managing this quality would be beneficial in maintaining this advantageous position.

ii. Direct Material Cost

The direct material cost, composed of raw dried seaweeds and chemicals used in the processing of carrageenan, is approximately 79 percent of the total costs of producing semi-refined carrageenan, of which 73 percent is RDS and 6 percent is chemicals. The estimated cost is Php238 ($4.86 @ 1$=Php49) for one kilogram of SRC. Meanwhile, the direct material cost for refined carrageenan is about 85 percent. One kilogram of gel-pressed RC costs Php442 ($9.02) to produce (PRDP, 2018).

The computed direct material cost for Indonesia was US$3.73of RDS and US$0.12 of chemicals per kg of SRC (DTI, 2016).

iii. Total Processing Cost

The total processing cost for a kilogram of semi-refined carrageenan in the Philippines is Php304 ($6.20) on average. This cost includes other costs such as salaries for personnel, utilities, logistics, and maintenance (PRDP, 2018).

In Indonesia, SRC yield ranges from 25-to 27 percent. A kilo of SRC requires four kilos of RDS. Other costs include chemicals (US$0.12), power/fuel (US$0.08), environment cost (US$0.04 percent), and overhead including labor (US$0.15). Overhead is higher in Indonesia due to relatively new processing facilities. The computed total processing cost of SRC was US$4.12 per kg (DTI, 2016).

At present, the overall cost associated with processing is still more expensive in the Philippines than in Indonesia due to the relatively higher cost of labor, energy, (imported) chemicals, among others, in the country (personal interview, Solante, 2021).

Farming Practices

i. Species Cultivated

Among the many carrageenan-containing seaweeds available in the Philippines, the *Eucheuma* species are cultivated commercially, dominated primarily by *Kappaphycus alvarezii* also known as *cottonii*. It is the main seaweed species cultivated by farmers, which makes up approximately 80 percent of the total seaweeds of production in the country. In some areas, farmers also cultivate *Eucheuma denticulatum* also known as *spinosum*. *Spinosum* is a less popular and cheaper species compared with *cottonii* (PRDP, 2018).

Indonesia is cultivating several varieties of seaweeds. This consists of *Kappaphycus alvarezii* or *Eucheuma cottonni, Eucheuma striatum,* and *Eucheuma spinosum* (DTI, 2016).

Seaweed cultivation in Indonesia and the Philippines utilizes more or less the same species. However, most of the production uses *Kappaphycus alvarezii* in the Philippines and *Kappaphycus alvarezii* and *Eucheuma denticulatum* in Indonesia.

The Philippines is very much accustomed and knowledgeable of cultivating the *Kappaphycus alvarezii* and *Eucheuma denticulatum*, which has been its edge for the longest time. The emergence of various adverse conditions, such as diseases and pests, that pose unfavorable impacts on the growth of the seaweeds has therefore disturbed cultivation. Learning about these adverse conditions and finding ways to eliminate or alleviate them would be imperative in sustaining the edge of using the same seaweed species for commercial production.

ii. Cultivation Techniques

There are many ways seaweeds are planted in the Philippines. While culture methods vary by location, the two most common techniques adopted by the seaweed growers in

the Philippines are the fixed-off bottom monoline method and floating monoline method (PRDP, 2018).

The two main farming systems currently used by farmers in Indonesia are fixed off-bottom monoline and the floating methods (single floating long line, and multiple floating long lines).

Seaweed cultivation in the Philippines employs more techniques than in Indonesia. Indonesia generally uses only the most common cultivation technique used in the Philippines.

Filipinos are known to be resourceful. While there may be specifications on the cultivation methods, some modifications may be done to adapt to the environment of the seaweed farms, especially since external factors are affecting seaweed production.

iii. Cropping System

Seaweed farmers in the Philippines can do four to six cropping every year (PRDP, 2018). On the other hand, Indonesian seaweed growers cultivate seaweeds continuously throughout the year allowing them to make six to eight harvests in a year (DTI, 2016). Given this, Indonesia has leverage in terms of the number of cropping cycles. The Philippines may explore the continuous planting of seaweeds to increase the number of cropping cycles. However, if weather conditions in the country may not be able to allow this, then farms may just focus on the growth of their plants to make sure they have a plentiful harvest at every end of the cropping period.

iv. Sources of Seedlings

In the Philippines, the planting materials are usually obtained from seedling dispersals of different government agencies, principally of DA-BFAR, a portion of the existing plants saved by farmers or brought from co-farmers. Seaweed nurseries are being maintained by DA-BFAR to supply seedling requirements in some areas. There are also private nurseries and nurseries in-state colleges and universities (PRDP, 2018).

Farms in Indonesia sourced their seedlings from government-owned and maintained nurseries. They also save a portion of the harvest as planting materials for the subsequent croppings, leaving three to five lines of wet seaweeds as seedlings for the next planting cycle (DTI, 2016).

This demonstrates that the supply of seedlings is similar in Indonesia and the Philippines. Nurseries are an important source of seedlings. However, the Indonesian government is maintaining more seaweed nurseries than the Philippines for distribution to farmers.

The higher number of government-owned nurseries in Indonesia may suggest that the Philippines should also do the same thing. However, experience demonstrates that the seedling dispersals of the government have essentially caused reliance of farmers on the seedlings that will be given to them that they no longer keep plants to be used for the next

cropping. Hence, a balance should be made in providing seedlings to the farmers, or else give seedlings only when necessary.

v. Seedling Preparation

The seedlings are prepared by tying 100 to 200 grams of cuttings using "tie-tie" or plastic straw in the Philippines. The cuttings are tied to the monolines at 20-25 cm intervals. Tying of seedling is usually done by the farming household and hired laborers which are paid on a per-line basis. Tying of seedlings is mostly done by women and children (PRDP, 2018).

Indonesian farms prepare their seedlings by tying 50-100 grams of cuttings with soft plastic tying materials, at 20-25 cm intervals. Tying of seedlings involves members of the family and the village, especially women and children. Laborers are hired to speed up the process of tying seedlings. The family members are not paid directly but do incur an opportunity cost (DTI, 2016).

The average weight of seedlings in Indonesia weighs lower than the cuttings in the Philippines. Remarkably, the tying of seedlings is mostly performed by women and children in both countries.

vi. Planting

The common practice of planting seaweeds in the Philippines involves both men and women. Typically, monoline with propagules are brought to the site and tied to the mainlines. Laborers are being hired in case the planting materials are plenty (PRDP, 2018).

Seaweed planting is generally a man's job in Indonesia, performed by two family members and one to two hired laborers to expedite the process. Women are also engaged in planting in areas of shallow waters (DTI, 2016).

Both men and women are engaged in seaweed planting in the two countries. Though, this activity is mainly performed by men in Indonesia. Hired laborers are also observed in both countries.

vii. Crop Maintenance

Maintenance of the crops in the seaweed farms in the Philippines covers tightening of lines, tying off loose cuttings, shaking the lines to remove dirt and other sediments, driving away fish grazers, removing rotten stakes, and repairing uprooted stakes, among others. This is usually performed by members of the family, commonly daily (PRDP, 2018).

Maintenance of farms in Indonesia comprises weeding out of epiphytes, cleaning of seaweed of silt and dirt, replacing lost plants, and repairing the farm support system, which is done for a half-day on six days in each production cycle (DTI, 2016).

Farm maintenance activities are identical in the two countries. In the Philippines, this is performed by men and women, but this is done chiefly by men in Indonesia.

viii. Harvesting

The majority of the Philippine seaweed farmers harvest their plants after 45 days of planting. Nonetheless, some farmers harvest earlier or later. They either untie the plants from the monoline, leaving the monoline tied on the main stake lines, or removing the entire monoline of plants. The latter is the method widely practiced by farmers. Harvesting is mostly performed by men due to the weight of the plants. Aside from male members of the family, men laborers are commonly hired to help in the harvesting. The best plants are kept by the farmers to serve as their propagules in the planting season (PRDP, 2018).

In Indonesia, harvesting is commonly done 45 days after planting, though, some also harvest earlier than 45 days. It is done by removing the entire monoline from the stakes and moving them to the drying area through a boat (DTI, 2016).

Harvesting after 45 days of planting and removal of entire monoline to gather the seaweeds are harvesting practices common to both countries.

Seaweed farmers must follow the recommended 45 days in harvesting their plants to maintain the good quality of the seaweeds. Adding fertilizer to make it grow the soonest would only give bigger plants. The carrageenan that can be extracted will still be less.

ix. Post-harvesting

Soon after harvest, Filipino farmers clean, sort, and remove dirt and other foreign materials from the seaweeds before the seaweeds are sun-dried. Drying is commonly done by spreading out the seaweeds on the sand, drying mats, or drying platforms. Others do it by hanging the removed monoline. Drying requires turning over the seaweeds to ensure complete drying, which usually takes two to five days depending on the weather. It may extend to seven days if it's rainy. The dried seaweeds are packed tightly in sacks and stored in a dry place until ready for selling to the traders. Farmers who need immediate cash, however, do not perform drying but sell fresh seaweeds to their traders at once (PRDP, 2018).

Drying of seaweeds in Indonesia is done on net-covered platforms commonly known as "flakes" or "para-para". Others use concrete platforms with a slope for better draining. Seaweeds are turned over regularly. During rainy days, seaweeds are piled into a heap by pulling the lining net to one part of the platform and then covered by the waterproof sheet. Drying only takes two to three days during sunny weather. The dried seaweeds are tightly packed in sacks and stored in dry areas before bringing to the traders (DTI, 2016).

Post-harvest activities, particularly drying, are comparable in the two countries. Indonesia and the Philippines are both reliant on the sun for drying the seaweeds.

The quality of the dried seaweeds does not only pertain to the moisture content of the seaweeds but also the absence of sand and dirt. Drying the seaweeds onshore as commonly done makes the seaweed prone to sand and dirt. Thus, farmers should consider employing other drying platforms or techniques that lessen contamination of the seaweeds to be competitive in terms of dried seaweeds.

x. RDS Marketing

The marketing of dried seaweeds in the Philippines usually passes through layers of traders. Small consolidators usually work for bigger traders are found in the villages. They buy a relatively smaller volume of seaweeds from the farmers and gather them until they have collected enough to send to the bigger traders. The big traders in the town or provincial proper handle the marketing to the processors. These big processors usually have dry facilities wherein re-drying is performed to meet the moisture content requirement of the processors. In some instances, farmer associations or cooperatives perform the consolidation from the member farmers and directly sell the collected seaweeds to a big trader or a processor (PRDP, 2018).

The traders also act as financiers. The small traders finance or provide loans to the seaweed growers, whereas the big traders provide money to small traders for buying the seaweeds from the farmers (PRDP, 2018).

In Indonesia, there are village collectors who buy seaweeds even in remote areas. These village collectors sell to big consolidators. Commercial consolidators are usually ex-farmers and come from the same locality and villages as the farmer. There is a relatively high degree of trust and commitment between farmers and collectors in Indonesia. Trust and integrity sustain the good business relationship between farmers and collectors. In Indonesia, farmer associations reduce the layers of intermediaries by collecting seaweeds from member farmers, drying the seaweeds, and then selling them directly to processors with the assistance of government agencies on non-government organizations (NGOs) (DTI, 2016).

The marketing channels in both countries are similar. Consolidation through farmer associations to reduce layers of intermediaries is also common in the two sites.

The layers of traders in the marketing of seaweeds do not necessarily mean that the traders should be eliminated from the chain because there are circumstances that demonstrate that the layers of traders are indispensable in the process. There is just a need to identify in which occasions a trader can be bypassed in the aim to make the chain more efficient and provide fairer compensation to the players.

xi. RDS Exporting

RDS export in the Philippines is led by five RDS exporters, three of which are located in Cebu City and two in Zamboanga City (personal interview, Solante, 2021). They buy seaweeds mainly from major seaweed locations through their consolidators. Aside from supplying seaweeds outside the country, they also serve the local carrageenan processors, depending on the prevailing market price of RDS (PRDP, 2018).

Seaweed exporters are plenty in Indonesia. Just in South Sulawesi, there are more than 50 RDS exporters. Exporters are big traders that maintain big warehouses and employ several employees for operations. Depending on the requirement of the importing country, RDS are shipped in sacks or bales in 20- or 40-footer container vans. Exports to the Philippines are all in 20-footer vans shipped to Cebu or Manila. Exporters maintain a big number of suppliers and own farms to ensure seaweed supply (DTI, 2016).

There are more traders engaged in exporting RDS in Indonesia than in the Philippines. The processing of carrageen in the Philippines must be the primary reason for fewer RDS exporters in the country.

The deficit in the supply of the raw seaweeds for processing into carrageenan in the country implies that the Philippines should not be exporting RDS, as much as possible, to make up for the shortfall, especially when it shows that processing it into carrageenan is much profitable than selling it as RDS. The Philippines have to determine whether it would be more beneficial to keep the RDS for processing in the country or export RDS immediately.

Processing

i. Processing Technology

In the Philippines, SRC or PNG are extracted by boiling/cooking the seaweed in a hot alkali mix to get the residue. On the other hand, RC is processed through the alcohol precipitation or gel press method. The alcohol method is employed by Shemberg Biotech in Cebu (PRDP, 2018).

In Indonesia, the processing of carrageenan is done using the gel press method and the KCL gel method (DTI, 2016).

Processing of SRC in both countries is done using the alkali mix. RC manufacturing through alcohol precipitation though is only performed in the Philippines by Shemberg Biotech.

The Philippines may look into the prospect of alcohol precipitated RC in the market and take advantage of the available facilities and technology in the country.

ii. Products

Processors in the Philippines generally turn RDS into semi-refined carrageenan and refined carrageenan. There are however some processors that produce blended carrageenan and alkali-treated chips. Small processors also produce seaweeds chips and noodles from RDS (PRDP, 2018).

Processors in Indonesia produce alkali-treated seaweed (ATS), alkali-treated *cottonii* chips (ATCC), semi-refined carrageenan (SRC), and refined carrageenan (RC). SRC is the major product produced in Indonesia (DTI, 2016).

Both countries produce the same carrageenan products. However, the Philippines focuses on the production of SRC and RC. Indonesia meanwhile produces more ATS and ATCC.

The Philippines has a comparative advantage in producing SRC and RC. The efforts devoted to its production must be sustained or enhanced to uphold this position. Nonetheless, the Philippines may also consider exploring other potential products that it can champion aside from these two products.

iii. Marketing of Carrageenan

Ingredient Solutions Inc. (ISI) is one of the largest independent suppliers of carrageenan. Some processing companies market their carrageenan products through ISI, while multinational companies sell through their mother company abroad. Other local processors have marketing arms abroad to promote and market their products. About 95 percent and 90 percent of RC and SRC respectively are marketed internationally (DTI, 2016).

The majority of the carrageenan produced in Indonesia are also traded in the world market. Marketing is done independently by the Indonesian processors (DTI, 2016).

The Philippines has more channels of marketing their carrageenan products than Indonesia.

Getting accreditation in ISI and observing the rules to retain the accreditation would be helpful in marketing carrageenan products, particularly when SRC and RC essentially export products. Ensuring the multinational processing companies stay in the country would also be vital in safeguarding that the Philippines has a link that can market its products abroad.

iv. Support Services

The development of the seaweed industry in the Philippines is being supported by various organizations. Mainly DA-BFAR, DOST, and DTI are involved in the seaweeds industry. DA-BFAR provides support related to the production of seaweeds. DOST helps in developing new products from seaweeds and DTI assists in marketing seaweed products, particularly abroad. On some occasions, DSWD, as well as LGUs, were likewise engaged in helping seaweed producers (PRDP, 2018).

Table 8. Key Institutions in the Seaweeds Industry, Philippines

Key Institution	Functions/Objective
DA-BFAR	Provide technical assistance and seaweeds production support to farmers.
DTI	Trade promotion and marketing support Provide post-harvest facilities (drying platforms for seaweeds
DOST	Research and Development support
DENR	Issues permits, clearances under The Clean Water Act and Environmental Impact Statement System. Responsible for the protection and conservation of our Fisheries and Aquatic Resources
SEAFDEC/AQD	Seaweed production, research and development support
TESDA	Formulate training regulations for technical, education, skills and development training support for the competitiveness of the seaweed farmers nationwide
UP-MSI	Extensive research and development studies covering the Central Visayas to Western Mindanao, including Zamboanga, Sulu and Tawi-tawi provinces have gained economic importance of seaweed to the development of the most important livelihood among the coastal communities
Other Universities	Mapping of areas on seaweed, culture techniques and other relevant information in each farm through GIS

The key institution in charge of extension services for the seaweeds industry in Indonesia is the Ministry of Maritime Affairs and Fisheries (MOMAF). The Ministry of Industry is likewise involved in the development of the industry (DTI, 2016).

The government agencies are very much involved in the progress of the seaweeds industry in both countries. While the Philippine government aims to assist as much as it can to the industry, it should figure out the most appropriate assistance it should give to guarantee effective support to the industry.

Competitive Analysis

The key competitive advantage of the Philippine seaweeds industry is the quality of its seaweeds products. Out of this, the country gains preference from buyers and receives better prices for its products. However, the industry is being prevented from progressing significantly because of the inadequate growth in raw seaweed production. The processing plants are not able to maximize their production capacities, and thus the industry is not able to leverage on its advantage of having the facilities, technology, and even the skilled workers to supply a substantial volume to the market that will consequently build upon the industry's income.

VI. MARKET TRENDS AND PROSPECTS

The seaweeds industry has displayed persistent growth in the past years. Expanding usage in both food and non-food sectors and worldwide trade has resulted in increased global production. The global seaweed industry is currently worth more than $6 billion per year, of which 85 percent are food products for human consumption (FAO, 2018).

The consumption of fresh and preserved seaweeds is rising. Considerable media attention has promoted seaweeds as healthy food, particularly in the European Union and the United States of America. Korea is specifically pushing for its dried seaweeds as a crispy flavored snack, which has received substantial acceptance in the US due to its perception of a healthy, sugar-free snack. In Europe, the consumer view of seaweed as a healthy type of food is likewise expanding. The majority of the seaweed food products carry an organic label, thereby being sold at a premium. Sushi has also become popular in restaurant menus. The people from Japan who moved to the US and Europe have brought with them Japanese cuisines which were also well-received by the local population. Meanwhile, a growing market trend is observed in Indonesia wherein various products such as noodles, drinks, crackers, cookies, and sweets among others are being produced by small family businesses (FAO, 2018). For these reasons, the demand for seaweeds for human consumption has increased albeit it remains largely limited to East Asian markets and wherever Japanese cuisine is present.

Seaweeds have equivalently gained popularity in other industries. In the beauty and wellness industry, it is utilized in the development of pills or skincare packages and cosmetics. In the industrial sector, it is used in producing soil fertilizers, paints, paper, textile printing, bacterial culture, explosives, pesticides, and fire retardants, among

others. Similarly, it is employed in water filtration as well as in the production of livestock and fish feeds.

Seaweed-derived extracts had a far more extensive effect in the global markets both in the food and non-food sectors. The usage of seaweed as a binder and thickener increased significantly in food processing in Asia, Latin America, and the Middle East. Seaweed-based products imports, such as jelly, are growing in the markets of South Asia and hydrocolloid imports for the food processing industry have increased in Latin American countries namely Argentina, Brazil, and Mexico (FAO, 2018).

The hydrocolloid carrageenan, specifically, has many purposes and is a widely used hydrocolloid. International trade of carrageenan is huge, with main markets in EU and US. Worldwide demand for carrageenan thus is increasing and is particularly growing for non-producing countries. For instance, Thailand is importing more and more carrageenan that is utilized in a large export-oriented pet food industry, which uses the seaweeds as a binder. The increased utilization of carrageenan in food and non-food sectors in Malaysia, on the other hand, consequently boosted domestic demand for carrageenan, which led to a rise in their seaweed imports. Meanwhile, carrageenan is sought for by the local industries, particularly the food processing industry, in Indonesia. With the rising demand, Indonesia however does not use any of its domestically produced carrageenans. The possible delisting of carrageenan in the upcoming review of the US Department of Agriculture in 2023 may however affect the demand of one of the major destinations of carrageenan, the US. Correspondingly, processors may be discouraged by this.

The heightened popularity of seaweeds, especially for food, however, prompted consumers to seek evidence that the seaweeds they consume are produced and processed sustainably, contaminant-free and safe to eat. As such, certification schemes are being developed, and certified products are sold at higher prices. While certifications may present better prices for seaweed products, they may also pose as a barrier to small seaweed farmers.

Cultivation of seaweeds in Southeast Asian countries is essentially a response to the rising demand for the raw seaweeds used in processing hydrocolloids. With its low-cost and easy setup characteristics, seaweed farming is often promoted as a sustainable activity that can potentially provide alternative livelihoods to small-scale fishers and offer an avenue for women to earn income for themselves and their families in many developing countries. The market prospects for carrageenan are favorable. The increasing trend is likely to extend to developing countries and positive growth is expected in many new markets and market segments. It is estimated that the industry, mainly in Asia and the Pacific region, will be growing at 2-3 percent annually. However, there is also an increasing need to address the challenges imposed by trade and market demand for the sustainability of the industry.

Research that would lead to new technologies and product innovation is likewise a driver for the industry growth. In Europe, they are finding new processing technologies and innovative uses of seaweeds. In other countries, researchers are also looking for greener

techniques for the cultivation and utilization of seaweeds as well as promoting the genetic diversity of seaweed stocks.

In the local scene, seaweeds for food have remained stagnant. Demand for new food products such as noodles and chips is still low. Nevertheless, the Philippines similarly experienced rising domestic demand for carrageenan and stable market prices of seaweeds in the recent past. In addition, the country is benefitting from the rising global demand for carrageenan, especially since the Philippines is a world major producer of carrageenan. The favorable outlook for the global carrageenan industry would also be advantageous for the country.

The raw seaweed production therefore should show improvement to match the demand for carrageenan processing. Aside from the considerable volume of the raw material requirement of the carrageenan plants that it can serve, the stability of seaweed prices would invite continued production of farmers. With special attention given to production, specifically for *Cottonii* and *Spinosum*, the Philippines may take actions to lay hold of the potential markets such as China, which is already a huge market, but it is still growing its demand for seaweeds. Consideration for utilization of potential areas for seaweed farming and seaweed cultivation may moreover be encouraged so that areas available for production may be put into use. Government intervention to improve production may also be considered, principally for the adequate supply of quality propagules.

VII. SWOT ANALYSIS (INDUSTRY LEVEL)

Table 7 summarizes the industry-level strengths and weaknesses of the Philippine seaweeds industry as well as the opportunities and threats the industry faces. The summary table is a result of multi-stakeholder consultation and discussion to prioritize and determine industry-level SWOT arising from the segment-level SWOT presented earlier. Specific issues and concerns highlighted by experts and stakeholders participating in the series of consultations and meetings were also briefly discussed below.

Table 9. SWOT Analysis at Industry Level

STRENGTHS

Production	Presence of diversified seaweeds and species of wild populations for selective breeding for possible domestication purposes of new and improved cultivars	**INDUSTRY-LEVEL STRENGTH** The reputation of the Philippine Seaweed Industry's capacity to generate and expand production of world-class quality RDS given its technological innovativeness, human and technical expertise, and rich species
	Presence of NSTDC, regional seaweed laboratories, SUCs, international R&D Centers supported by competent authorities/scientist to undertake R&D / R&I	
	Existence of NSDP of BFAR to shape and propel the growth of the seaweed industry especially in seaweed farming as a cost-effective family-based enterprise	
Post-Harvest	Long day-light period of the country being a tropical country favorable for solar drying	
	Availability of drying technologies depending on the season	

Marketing	Established market niche of local carrageenan with proven marketing and distribution system	endowment and favorable climate supported by programs to sustain upgrade of existing facilities, engagement in R&D, and improvement in marketing/distribution system responsive to global market needs
Processing	Presence of 3 RC and 12 SRC processors in the country with enough capacity to meet the global market	
	Number 1 in quality of RDS in terms of carrageenan yield and the overall quality parameters	
	Existence of a pool of technical experts	
	Availability of seaweed products for commercialization	
	Varied application of RDS as food ingredient	

WEAKNESSES

Production	Declining of seaweed production and quality of seaweed propagules due to: • Poor and insufficient supply of good quality seedlings • Non-compliance to PNS good farming practices • Impact of climate change • Slow climate change adoption • Lack of post-harvest marketing and financing infrastructure • Lack of linkage among govt and private institution regarding the development of the seaweed industry	**INDUSTRY-LEVEL WEAKNESS** The uncertainty in seaweed raw material prices and supply volume due to insufficient supply of quality of seaweed propagules, some stakeholders engaged in poor farming and unfair trade practices, and relatively high costs of operation and investment which affects the profitability and investment potential among players in the Philippine Seaweed Indsutry
Marketing	Limited application and high-cost investment Unstable price of RDS due to ff reason • Flyby night and fronting foreign buyers • Limited access of supplier, cannot supply volume to the processing • Limited infrastructure of farm to market access	
Processing	Non-upgraded processing facility reasons • Upgrading of machinery • High cost of investment requirement for establishment of processing plant • Lack of processing technology	

OPPORTUNITIES

Production, Post-Harvest, Marketing and Processing	Re-utilization of idle seaweeds and large potential areas for expansion (pilot testing for deep water seaweed farming). WWF Blue Horizon: Ocean Relief through Seaweed Aquaculture	**INDUSTRY-LEVEL OPPORTUNITY** The capability of the Philippine Seaweed Industry to take advantage of the increasing demand for carrageenan and other potential uses of seaweeds given its unutilized farm areas and processing plant capacities
	Wide elbow room for local RDS demand	
	High demand for RDS by local carrageenan processors	
	Price incentives for quality RDS from processors	
	Increasing demand for seaweeds for new applications	
	Availability of other seaweed species	
	High local and global demand for carrageenan Republic Act (RA) No. 11534 or the Corporate Recovery and Tax Incentives for Enterprises (CREATE) Act.	

THREATS

Production	Lack of compliance to good farming practices and biosecurity measures	**INDUSTRY-LEVEL THREAT** The inability of the Philippine Seaweed
	Increasing competition with other seaweed producing countries	
	Pests and disease infestation	

Post-Harvest	Absence of technology & equipment that could remove the tie-tie, sand and other impurities	Industry to immediately comply with international standards and requirements can lead to delisting due to the absence of technology and equipment to remove impurities
Marketing	Increasing competition with other seaweed and carrageenan producing countries	
	Removal of the Philippine-made carrageenan from the European and US market due to non-compliance on food safety and biosecurity requirements	
Processing (Commercial level)	Re-evaluation of carrageenan and seaweed products as acceptable food ingredients as required by the European Food Safety Authority and US Food Safety Authority	
Processing (Village level)	Non-acceptable of locally seaweed products. Hence, it could not be marketed in a grand scale	
	Low compliance to the market requirements/specifications	

Input Provision

Propagules are supplied by contractors who won the bidding. These winning contractors are businessmen who only have a superficial knowledge of seaweeds. Usually, they buy the seedlings from seaweed farmers but because they only have a cursory familiarity with the plant, they are supplied by unscrupulous farmers with fresh seaweeds that are already matured and no longer suitable for replanting.

Because of their unfamiliarity with the plants they are supplying, they do not know that these are very volatile and sensitive especially when in transit. So they do not know how to properly take care of it and end up supplying propagules no longer fit for planting when it reaches its destination. That is why many beneficiaries will just dry this knowing that they will only be wasting their time, effort, and money cultivating impotent propagules to survive and thrive.

The major source of financing of seaweed farmers in cultivating the plant is the trader/middleman embedded in the community who supports the farmer with everything he needs for planting as well as his daily survival expenses such as food. This is called “pang-konsumo” in the communities. In exchange, the harvest can only be sold to the financier/trader/middleman usually at a lower price than the already low price prevailing in the community. And the consumption goods supplied to the farmer and his family during the cropping season are priced higher than the prevailing retail prices when bought in cash. No matter we look at it, this credit arrangement is usually usurious.

Trading

Farmers who got their financing from a Trader/Middleman can only sell their produce to the Trader/Middleman who financed the planting. Although it is a prevalent practice where farmers make “palusot” and secretly sell a couple of sacks to other buyers so they can have cash. These farmers resort to this practice because they are neck-deep in debt to their suki traders where the value of the harvest is insufficient to offset the debt they have incurred from the trader/middlemen. This situation occurs when calamity strikes losing the crops and the farmer has to incur loans on top of the previous loans. The

trader/financier has to extend financing even if the farmer has already incurred huge debts because not doing so will mean nonrecovery of the previous debts.

But there is an alternative to this. And that is the cooperatives. However, the cooperatives shouldn't assume financing of the farmers cropping. The same negative symbiosis between the trader/financier and the farmer will continue to exist even if financing is done thru the cooperatives. And this negativity cannot be absorbed by the cooperative. It will be ruined if it extends crop financing to the farmers.

Processing

Table 10: Recommendations of Shemberg Marketing Corporation (Carrageenan Processor) to be addressed in the roadmap

Concern	Expected Result	Beneficiaries
1. Regulation of Seaweed Prices	Protect Carrageenan Industry in the Philippines	Processors/ Farmers
2. Insurance for Farmers	Protection of Crops Seaweeds	Farmers
3. Establishment and Maintenance of Seaweed Culture Laboratories or Indoor Nursery in Collaboration with the Processor	Better Quality Seaweed	Farmers/ Processor/ BFAR
4. Established Micro-Finance program to the Farmers	Proper Cash Flows	Farmers

Relationship among Industry Players

There is animosity between the trader who advanced financing and the farmer who availed of this financing. The trader becomes strict and watchful of the crops and harvest of the farmer who was financed. The farmer on the other hand is resentful of his suki trader/financier because of the high price of the consumption goods he advances from the trader and the lower price of RDS he is paid. The farmer is aware that he is being exploited. And he also felt insulted that his financier/trader is always watching his crops as if sending the subliminal message that he is a thief that cannot be trusted.

Both parties resent each other but need each other. One cannot exist without the other. Without the trader/financier, there is no Raw Dried Seaweeds to trade because the farmer cannot plant for lack of capital. Without the farmer, the money of the trader/financier is useless. There is a negative symbiotic relationship between the two. Like the atom which has a negative and a positive element that is opposite but attracts each other. Remove one of them, and the atom dies. In much the same way, remove one of them and the industry dies. Financing is the lifeblood that sustains both the trader/financier and the farmer.

Support from Enablers

Access to crop insurance from PCIC is currently limited especially to farmers located in remote communities. Enabling farmers to easily access this support service can dampen the risks associated with seaweed farming and would allow sustained production even during unfortunate times.

VIII. ANALYSIS OF POTENTIAL INTERVENTIONS

Based on the list of segment-level and industry-level issues/constraints and threats, Table 8 presents potential interventions in line with the identified strengths and opportunities for the Philippine seaweed industry

Table 11. Constraints and Potential Interventions for the Philippine Seaweeds Industry

Constraints	Potential Interventions
Input Provision	
Inadequate supply of good quality seedlings	**Upgrading of current seedling production system to sufficiently supply quality seedlings through establishment and maintenance of seaweed nurseries and culture laboratories** • Identification of strains of good traits which includes resilience to changes in temperature and salinity through scientific research • Establishment of seaweed culture laboratories in strategic seaweed regions and expansion of some existing culture laboratories • Technology transfer and utilization of the latest micro-propagation techniques and tissue culture technology to develop and mass-produce seaweed varieties of good traits • Creation of land-based and sea-based nurseries at major production areas • Setting up of on-farm sea-based nurseries in identified seaweed communities serving as seedling pool for farmers within the community that will ensure availability and accessibility of good quality seedlings • Conduct of trainings on nursery operations and seedling handling • Information campaign on best nursery practices through creation of model farms demonstrating efficacy of different strains according to production technologies, seasonality and site characteristics • Development of quality strains • Creation of gene bank where different seaweed cultivars can be stored
Lack of capital and access to financial resources	**Providing access to financial resources to farmers for purchase of inputs and day-to-day operations by presenting options and/or linking to loan providers, and/or provision of seaweed propagules and farm implements** • Information dissemination on available loan programs for seaweed farmers, particularly the Production Loan Easy Access (PLEA), through conduct of roadshows and reproduction of information and education materials • Providing assistance on preparation of documentary requirements and processes • Creation of payment arrangements for farm inputs supplied rather than simple dispersals and dole outs • Formulating special non-collateral and easy repayment loans for seaweed farmers • Conduct of scientific research on the acceptable loan terms, rates and repayment schemes, etc. and the viability of the special loan program • Link to other institutions like DSWD Loan Programs

Production	
Poor farming practices Poor knowledge on technical and developmental aspects of seaweed farming Unwillingness to adopt new technologies Presence of pests and incidences of diseases Limited reach and quality of technical trainings and assistance	**Development of capacity of farmers on production** • Capacity building on, but not limited to, (1) Good Aquaculture Practices or Good Seaweed Farming Practices, (2) Early detection and prevention techniques for pests and diseases, (3) Basic Financial Management and Entrepreneurship; and (4) New seaweed technologies • Database of seaweed farmers, farm area, level of competency, and seaweed farming practices • Classroom type seminars on farming practices complemented with on-site training considering existing local practices • Classroom type sessions on elementary finance for seaweed farming • Benchmarking and information campaign on good aquaculture practices, cultivar and site selection and appropriate farm technologies through demo seaweed farms • Promoting new farming technologies through set-up demo farms • Reproduction and distribution of materials on Good Aquaculture Practices or Good Seaweed Farming Practices, Basic Cost and Return Analysis and other technologies
Lack of capital and access to financial resources	**Providing access to financial resources to farmers for purchase of inputs and day-to-day operations by presenting options and/or linking to loan providers, and/or provision of seaweed propagules and farm implements** • Information dissemination on available loan programs for seaweed farmers, particularly the PLEA, through conduct of roadshows and reproduction of information and education materials • Providing assistance on preparation of documentary requirements and processes • Creation of payment arrangements for farm inputs supplied rather than simple dispersals and dole outs • Formulating special non-collateral and easy repayment loans for seaweed farmers • Conduct of scientific research on the acceptable loan terms, rates and repayment schemes, etc. and the viability of the special loan program
Lack of motorized boats	**Making seaweed farming activities efficient through provision of motorized boats** • Validation of proposed sites and selection of qualified beneficiaries • Turning over of motorized boats to qualified beneficiaries
Unpredictable weather conditions Other natural disasters (eg. volcanic eruption, erosion Lack of climate resiliency measures and tools	**Guaranteeing seaweed production and incomes through crop protection** • Identifying and certifying qualified seaweed insurance policy holders • Processing of insurance application of seaweed farmers
Post-Harvest	
Lack of moisture content analyzer Limited drying and storage facilities	**Expanding economic returns to the industry with improved RDS quality and carrageenan recovery through provision of dryers and other post-harvest facilities** • Setting up of drying facilities in strategic seaweed producing areas (e.g. areas without shared service facilities) • Investment on other post-harvest facilities such as warehouses to be established in strategic locations

Dried seaweeds contaminated with dirt, sand and other foreign objects affecting quality Inconsistent RDS quality	• Information dissemination on national standards and quality control measures to ensure quality of RDS • Establishment of reference laboratories for quality analyses for farmers and traders
Trading	
Lack of moisture content analyzer Dried seaweeds contaminated with dirt, sand and other foreign objects affecting quality Inconsistent RDS quality Unstable price/ market of RDS	**Expanding economic returns to the industry with improved RDS quality and carrageenan recovery through provision of dryers and other post-harvest facilities** • Information dissemination on national standards and quality control measures to ensure quality of RDS • Establishment of reference laboratories for quality analyses for farmers and traders
Processing	
Poor knowledge on developmental aspects of seaweed farming Limited reach and quality of technical trainings and assistance	**Development of capacity of farmers on processing** • Capacity building on, but not limited to, (1) Processing of value-added products, (2) Packaging and labelling, and (3) Basic Financial Management and Entrepreneurship. • Hands-on training on processing of value added products accompanied with basic financial and entrepreneurship training • Seminar and assistance on packaging and labelling of products • Reproduction and distribution of materials on Value-Added Products , Basic Cost and Return Analysis and other technologies
Possible delisting of carrageenan in US list Limited promotion of value-added products	**Enhancing economic gains of farmers in the value chain and diversification of seaweed products by product development, complementary processing facilities and tools and equipment provision, and effective consumer marketing strategies** • Modification or creation of new seaweed products • Providing processing facilities or tools related to processing of value-added products • Developing a database of trainees and trainings completed • Identifying qualified beneficiaries and turning over of the facilities or equipment • Monitoring and evaluation of the status of the processing facilities • Developing marketing approaches to tap consumers to try other seaweed products • Promotion of naturally-grown seaweeds
Enabling Environment	
Lack of zoning ordinances Weak implementation of municipal ordinances	**Enhancing seaweed farming conditions with enactment and implementation of favorable policies** • Creation / Upgrading of zoning ordinances in seaweed municipalities in relation to coastal resource management • Zoning of coastal resources based on holistic considerations which includes scientific, environmental, economic and socio-cultural dimensions

Illegal fishing activities Use of inorganic fertilizer and other substances Incidences of poaching	• Proper and well-represented consultations with concerned sectors for coastal area zoning process • Enactment of legislations awarding special use rights on selected areas for seaweed farmer groups, particularly indigenous groups • Passing of legislations to sanction malpractices on seaweeds • Creation/Enhancement of implementing groups

Source: Adopted from PRDP, 2018 (National VCA for Seaweeds), Stakeholder's Consultation Workshop

IX. TARGET SETTINGS

Overall, the seaweeds roadmap aims at improving or securing the Philippines ' current fourth rank in the global standing of seaweed and carrageenan production, improving equity of seaweed farmers in the value chain, and exploring species diversification and product development both for food and non-food applications. The Philippine seaweed industry vision and mission are as follows:

Vision

A primary producer of Eucheumatoids and preferred supplier of premium quality RDS and Carrageenan in the world market

Misson

To develop and apply innovative farming and processing technologies for improved productivity, efficiency, and profitability

In line with this vision and mission, the goal is to achieve 5 key outcomes for the seaweeds industry in the next 5 years, namely:

1. Increased Production of Quality Raw Dried Seaweeds to 2% Annually in the Next 5 Years (2022-2026)
2. Provided access to financial resources to seaweed farmers through credit/loans.
3. Improved Marketing Linkages of Seaweed Farmers
4. Capacitated Seaweed Farmers and Farmer Organizations
5. Promoted Community-based Value-added Products and Fresh Seaweeds for Food and Nutrition Security.
6. Addressed threats affecting the integrity and superiority of the Philippine seaweed/carrageenan.

In 2019, total (wet) seaweeds production was 1,499,961.25 MT while total seaweed export was 33,627 MT with a total value of PHP 11,638,717,000.00. Seaweeds had a 22% share of the fisheries export and carrageenan (SRC and RC) was 94% of the total seaweed export value in pesos. Based on this data, one of the primary goals of the roadmap is to sustain the RDS requirement of the Carrageenan Processing Plants (CPP) to supply the export demand of the international market (Table 9). Likewise, there is a need to intensify

the production to satisfy the demand for RDS export, as well as the local market for fresh and value-added seaweed products for food and non-food applications. The recommended policies, strategies, and programs to achieve this key outcome in the short term are presented in the next section (Table 10).

Table 12. Fresh Seaweeds, RDS, and Carrageenan Targets based on CPP Requirements

Nos. CPP	Component	Carrageenan (MT)	ASSUMPTION	
			RDS (MT)	FRESH (MT) (7:1)
3	Refined Carrageenan	5,850	25,250 (5:1)	176,750
12	Semi- Refined Carrageenan	28,800	115,200 (4:1)	806,400
4	Alkali – Treated Cottonii Chips	3,400	10,200 (3:1)	71,400
(19)	**Sub Total**	**38,050**	**150,650**	**1,054,550**
	Fresh Market			200,000
	RDS Export		42,857	300,000
	TOTAL (19)	**38,050**	**193,507**	**1,554,550**

X. RECOMMENDATIONS FOR POLICIES, STRATEGIES, AND PROGRAMS

Table 13. Recommendations for Policies, Strategies and Programs

Objectives/ Targets	Strategies/Policies/ Programs	Issues/Constraints being addressed	Key Result Areas	Key Performance Indicators	Time Frame	Responsibility Entity	
						Lead	Support
1. Increase seaweed production by 2% growth annually for 5 consecutive years (2022-2026) *	* Improvement/ maintenance of existing BFAR Seaweed Culture Laboratories in collaboration with the private sector *Establishment of state of the art Seaweed Culture Laboratory *Establishment of satellite seaweed land based nursery/seedling bank (Seaweed Phonics) in partnership with	Inadequate supply of good quality seaweed propagules Low productivity and production of present cultivars Inadequate supply of good quality seaweed propagules Low productivity and production of currently available cultivars Inadequate supply of seaweed propagules during off season and devastation of seaweed farms due to impact of	*Improved/maintained BFAR SCLs in collaboration with the private sector Established a state of the art SCL Established satellite seaweed land-based nursery/seedling bank (Seaweed Phonics) in	*No. of BFAR SCLs improved *No. of BFAR SCLs maintained No. of a state of the art SCL established No. of satellite seaweed land-based nursery/seedling bank (Seaweed	Short-term (2022-2026) Short-term (2024) Short-term (2023)	BFAR & Private Sector, NFRDI BFAR BFAR, Private Sector, Seaweeds Coop	SUCs, SEAFDEC SUCs, SEAFDEC ,NFRDI LGUs PAFES

	cooperatives (Sorsogon, Bohol, Hinatuan) and in collaboration with the private sector Establishment & Maintenance of Seaweed Nurseries in collaboration with Private Sectors -BFAR managed -Coop managed *Provision of Propagules by BFAR & LGUs Provision of Solar Dryers (Hanging method) *Establish and operate laboratories for seaweed quality analysis in collaboration with NFLD	adverse weather condition Low productivity and production of present cultivars Inadequate supply of good quality seaweed propagules Low productivity and production of present cultivars Inadequate supply of good quality seaweed propagules Low productivity and production of present cultivars Limited drying facilities Poor and inconsistent quality of dried seaweed	partnership with coops and in collaboration with the private sector Established and maintained BFAR/Coop managed Seaweed Nurseries Provided propagules Provided hanging type solar dryers Established and operated laboratories for	Phonics) established No. Seaweed Nurseries established and maintained -BFAR managed -Coop managed Volume of propagules provided by BFAR Volume of propagules provided by LGUs No. of hanging type solar dryers provided No. of beneficiaries	Short-term (2022-2026) Short-term (2022-2026) Short-term (2022-2026) Short-term (2023-2026)	BFAR, Private Sector, Seaweeds Coop BFAR, LGUs BFAR, LGUs	LGUs PAFES PAFES Seaweed Farmers, Seaweeds Coop Seaweed Farmers, Seaweed Coop

	*Improve strains of *Eucheuma/Kappaphycus* Application of Digital warning device (FISHVOOL) *Guarantee seaweed production through crop protection Promote new farming technologies through setting-up of techno-demo farms Modernization of farming and harvesting techniques Introduce climate resilient farming and post-harvest	Quality of Seaweeds determined Inadequate supply of good quality propagules Low productivity and production of present cultivars Incidence of diseases Unpredictable weather condition Lack of climate resiliency measures and tools Poor knowledge on technical and developmental aspects of seaweed farming Limited technical know-how of the focal point persons	seaweed quality analysis Improved strains of *Eucheuma/Kappaphycus* CC impact in seaweed farms mitigated Guaranteed production through acquisition of an insurance policy Promoted new farming technologies Increased Productivity	No. of laboratories for seaweed quality analysis established No. of laboratories operated No. of analysis conducted No. of strains improved No. of farms that improve production due to CC mitigation No. of insurance policy acquired	Short-term (2022-2026) Short Term (2022-2026) Short Term (2022-2026) Short Term (2022-2026)	BFAR, NFRDI, DOST UPMSI SUCs, NFRDI, DOST, BFAR NFRDI PCIC, Seaweed Farmers, LGUs	Seaweed Farmers, Seaweeds Coop Industry stakeholders BFAR COOPs LGUs Seaweed Farmers LGUs

	materials and techniques	Low productivity Poor farming practices Impact of Climate Change	Improved farming practices Impact of Climate Change Mitigated	No. of new technologies promoted Increased in production in kilogram/tons No. of improved technologies No. of seminars conducted No. of Farmer adaptors. Survey on the effectivity of resilient farming and postharvest materials and techniques introduced	Short Term 2022-2026 Short Term 2022-2026	SUCs, DOST NFRDI, BFAR BFAR DOST SUCs NFRDI DOST	LGUs Seaweed Farmers LGUs Seaweed Farmers
2.Provide access to financial resources to farmers	•Survey/Review available loan programs for seaweed farmers *Information dissemination on	Lack of capital and access to financial resources Lack of information on available loan	Capital/additional capital provided to seaweed farmers Created awareness on available loans	*Identified Available financing institutions that could cater to the seaweed farmers	No. of available loan programs or inst.	2022-2026	DA ACPC BFAR/ FISSD

(Credit Support)	available loan programs for seaweed farmers, through seminars *Recommend to ACPC to request Central Bank to designate Micro-Financing Organization (MFO) to major seaweed producing areas *Conduct Orientation Seminar on Financial Literacy to seaweed farmers *Reproduction of information and education materials *Provide assistance on preparation of documentary requirements and processes *Creation of payment arrangements *Formulate special non-collateral and easy repayment loans for seaweed farmers *Conduct of scientific research on the acceptable loan terms, rates and repayment schemes, and the viability of the special loan program	assistance from financing institutions Created awareness/ consciousness on the importance of financial management	from financing institutions Microfinancing made available to seaweed farmers in major seaweed producing regions	*Conducted seminars on the identified financing facility *Recommended to ACPC the establishment of MFOs to seaweed producing regions *Information materials reproduced *Provided assistance on the processing of loans *Payment arrangement created *Formulated non-collateral easy payment *Conducted research on the acceptable loan terms, repayment schemes and the viability of the special loan programs	No. of seminars conducted No. of Consultation Meetings with ACPC Letter of recommendation to ACPC No. of Information materials produced No. of loan assistance provided No. of payment arrangement created No. of special non-collateral and easy payment schemes No. of scientific research re		Landbank Central Bank

					loans conducted		
3. Improve linkages of seaweed farmers to major local markets	Intensify the Organization of seaweed farmers into Coop to be able to comply to the requirements of seaweed processors Organize the Seaweed Coops into Federations Conduct of convention, symposium Conduct of Inventors Meet Investors especially to those new seaweed applications with potential market Provision of Warehouse to Coops	Presence of several 'tiers' in the trading chain Presence of 'fly-by-night' traders No direct linkage between the processors and farmers Poor/weak business/working relationship with seaweed farmers Low compliance to the market requirements/ specifications Inconsistent RDS quantity Limited drying and storage facilities Poor and inconsistent quality of dried seaweed	Layers of traders were minimized Fly-by-night Traders controlled Farmers had direct link to buyers/ processors Improved business working relationship with farmers Improved Market requirements of Seaweed products (RDS) Secure market of Coops through MOA with direct buyers Farmers stored high volume of RDS Higher volume higher RDS price higher income	No. of traders and 'fly-by-night' traders eliminated between farmers and direct buyers No. of farmers with direct link to buyers, processors No. of coops with improved relationship with direct market No. of coops organized No. of coops federated No. pf COOPs complied to market requirements	Short Term 2022-2026	BFAR-FISSD SIAP DTI CDA LGUs	Farmers COOPs

		Low income of seaweed farmers no storage to consolidate their produce	RDS quality are improved/maintained	No. of MOA signed between Coops and Direct Buyers. No. of new applications with prospective investors No. of Coop warehouse establish or provided			
4. Capacitate seaweed farmers and farmer's organization	Attendance to regular Trainers' and Fishefolks' trainings/seminars/workshops *TR for Seaweed Production and Processing – NC II *GAqP for seaweeds *PNS for RDS Climate Change Mitigation *Agriculture Career System Establishment of Training & Assessment Centers for Seaweed production – NC II and Seaweed Processing – NC II in	Lack of compliance to good farming practices and biosecurity measures Vulnerability to seasonal weather disturbances and impacts of climate change Prevalence of seaweed pests and diseases (ice-ice) Indiscriminate, improper use and discharge of artificial fertilizer in field cultivation.	Trainers and Farmers complied to GAqP, PNS on Seaweed Production and Processing Impact of CC and prevalence of Pests, epiphytes, ice-ice and improper use of artificial fertilizer mitigated Competitiveness of farmers are at par with other countries Exposure to countries with advance technologies	No. of Trainings/ Seminars/ Workshops Conducted No. of trainers trained No. of farmers trained No. of Farmers complied to GAqP and PNS No. of farmers effectively mitigated impact of CC in the farms, seaweed epiphytes and improper use	Short Term 2022-2026	BFAR NSTDC TESDA PAG-ASA	SUCs COOPS, International Organizations LGUs

	Luzon, Visayas and Mindanao *Students will be accommodated to the training and assessment through a TESDA scholarship. Graduates with National Certificate II will be tapped as resource persons during the conduct of trainings by BFAR. They will also be provided with the necessary equipment & materials to start their own business Cross-country/area visits to successful seaweed areas/farmers and the sharing of knowledge and best Practices Collaboration and networking with the national and international seaweed community and those working on the conservation of marine resources.	Increasing competition with other seaweed producing countries Competition with other countries in terms of market opportunities for carrageenan seaweed Declining pool of competent technical experts Encourage young generations to engaged in seaweed sector industry by opening attractive opportunities Collaboration with international institutions and agencies for funding and grants (e.g. GCRF-UKRI, WWF-GEF) Declining pool of competent technical experts	Acquired additional knowledge/technology Established networking with local and international institutions Access to information of farmers with expertise on seaweed technology	and discharged artificial fertilizer Benchmarking result of local and farmers in other countries No. of countries visited No. and profile of participants in the cross country visits No. of technology acquired No. of projects in collaboration with other countries established No. of benefits to the industry Established BFAR database on seaweed farmers expertise		BFAR SIAP ASIC International Organi-zations ASIC BFAR	LGUs COOPs DENR BFAR NSTDC other BFAR Training Centers, BFAR RFOs TESDA

	Develop a BFAR database of trainees and trainings of seaweed farmers beneficiaries						
5. Promote community-based value-added products and fresh seaweeds for food and nutrition security	A. Techno transfer *Identification of beneficiaries *Conduct of trainings to beneficiaries based on the TR for Seaweed Processing-NC II *Provision of processing equipment/materials /tools *Enhancement, production & commercialization of seaweed-based products *Technical assistance on packaging &	Poor knowledge on developmental aspects of seaweed processing Limited reach and quality of technical trainings and assistance Limited promotion of value-added products	*Identified the beneficiaries Conducted trainings to beneficiaries (coops) Provided start-up processing equipment/materials/tools Enhanced, produced and commercialized seaweed-based products Assisted in packaging and labelling of	No. of identified beneficiaries No. of trainings conducted No. of processing equipment/materials/tools distributed No. of products enhanced No. of products produced and commercialized	Short-term (2022-2026) Short term (2022-2026) Short term (2022-2026) Short-term (2022 & 2026)	BFAR & LGU BFAR & TESDA BFAR & DTI & LGU BFAR & DOST & SUCs DTI	Seaweed Coop LGU & Seaweed Coop Seaweed Coop LGU & Seaweed Coop LGU & Seaweed Coop

	labelling of seaweed-based products B. Product Promotion *Participation to trade fairs *Link to market through conduct of annual inventors-investors forum C. Establishment & operation of VLSPF *Extraction of carrageenan, agar, alginate & other phycocolloids *Monitoring and evaluation of the status of the processing facilities D. Development of new seaweed applications (R & D) *Conduct of trial applications *Analysis of the developed products *Technology transfer	Limited promotion of seaweed-based products Limited promotion of seaweed products *Limited technical staff to work on seaweed applications *Limited budget for R & D	seaweed-based products Participated to trade fairs Conducted inventors-investors forum Established and operated VLSPF Monitored and evaluated the status of processing facilities Developed new seaweed applications	No. of assistance rendered on packaging and labelling No. of participations to trade fairs No. of inventors-investors for a conducted No. of VLSPF established No. of VLSPF operated No. of VLSPF monitored No. of VLSPF evaluated No. of new seaweed applications developed	Short-term (2022 & 2024) Short-term (2021-2025) Short-term (2021-2025) Short-term (2022-2026) Short-term (2022-2026) Short-term (2022 & 2026)	DTI, SIAP & BFAR BFAR & DTI, SIAP BFAR & LGU BFAR & LGU NFDRI, DOST, SUCs & BFAR	BFAR, LGU & Seaweed Coop LGU & Seaweed Coop LGU & Seaweed Coop SIAP, Seaweed Coop SIAP, Seaweed Coop

	* Production & distribution of IEC materials on the products developed E. Distribution of Carts (with complete accessories including ref, freezer, oven) for seaweed products F. Formulation of policies relating to food safety	*Possible delisting of carrageenan as an organic food additive *Potential alternative uses of seaweeds for feeds & fertilizers Limited promotion of new seaweed products Limited policies on the safety of eating fresh seaweeds and seaweed-enriched food products	Produced and distributed IEC materials on the products developed Distributed Carts for seaweed products Formulated food safety policies/guidelines for fresh seaweeds and seaweed-enriched food products	No. of IEC materials produced and distributed No. of Carts distributed No. of policies/guidelines formulated	Short-term (2022 & 2026) Short-term (2022-2026)	BFAR, DOLE, LGU BFAR, Food Safety Section of DA BFAR, LGU, Seaweed Coop, DOST	LGU & Seaweed Coop Seaweed Coop Seaweed Coop SUCs
6. Addressed threats affecting the integrity and superiority	A. Proposal for the Peer Review of Latest research, and other development on carrageenan, relevant	Delisting of carrageenan as acceptable ingredients for organic product in US	Proposal Prepared to address Carrageenan delisting on the list of ingredients of	No. of Proposal Prepared	Short Term 2021-2023	DTI BFAR SIAP	UPMSI SUCs

of Philippine carrageenan.	documents that have positive and negative impact on the quality of carrageenan for submission to the International Journal in preparation to the next NOSB Sunset Review on 29 May 2023 B. Conduct Bi-annual Stakeholders' Consultation to address issues that affect the industry's integrity, RDS, Carrageenan C. Update of scientific studies on carrageenan D. Crafting of documents relative to the integrity and superiority of the Philippine RC and SRC E. Update the Market Requirement compliance to export and local Market	Negative marketing ploy against carrageenan (e.g. carrageenan free product labeling) Existence of cheaper carrageenan substitutes Insufficient budget for R&D activities for Isotope Analysis of Carrageenan Indiscriminate, improper use and discharge of artificial fertilizer in field cultivation. Increasing competition with other countries in terms of market opportunities for carrageenan seaweed Poor and inconsistent quality of dried seaweed that impacts on carrageenan recovery (Immature harvested seaweeds, Adulterated RDS, High	processing organic food Bi-annual Stakeholders Consultation Conducted Scientific Studies on Carrageenan Conducted Market Requirement for export and Local updated Documents to address NOSB decision crafted	No. of Consultation Conducted No. of updated studies on carrageenan No. of documents crafted	Short Term 2022-2026 Short Term 2022-2026 Short Term 2022-2023 Short Term 2022-2025 Short Term	Carrageenan Processors BFAR DTI BFAR UPMSI SIAP DTI Carrageenan processors DTI SIAP	Seaweed Stakeholders SUCS BFAR

	F. Attendance to ASIC and USDA Sunset Review Meetings G. Conduct of R & D to prevent or control on the Phil. SRC and RC	percentage of impurities) Lack of compliance to Philippine National Standard on RDS Contamination of carrageenan	Market Requirement for export and Local updated Participated the Sunset Review Meetings R & D conducted	Data of updated market requirements No. of Delegates/ Participants No. of Meetings No. of R&D activities conducted No. of R&D completed	2022-2023 Short Term 2022-2026	DTI BFAR SIAP	Carrageenan Processors Stakeholders NGOs, NGAs

XI. OVERALL STRATEGY FOR BFAR

The major factor that contributed to Indonesia's success is by coursing their seaweed programs thru cooperatives (personal interview, Solante, 2021) where these cooperatives implemented the program at the grassroots level. According to the expert, Indonesia funded the cooperatives as the prime mover in increased production.

Fortunately, BFAR has already piloted this scheme by partnering with 10 seaweed farmer cooperatives in the provinces of Palawan, Albay, Sorsogon, Bohol, Dinagat Province and Surigao del Sur. BFAR downloaded Php 500,000 each to these 10 cooperatives to establish and manage a seaweed nursery to be run as a business enterprise. The seed fund provided by BFAR will be rolled over to other viable cooperatives after the cropping season. Whatever profits earned after they have rolled over the Php 500,000 to other viable cooperatives, will be divided among the shareholders of the cooperative, the farmer who bought seedlings from the cooperative nursery, and the community as a whole. So, the earnings from the nursery do not go to someone else's pocket but to everyone in the community. There is inclusivity and shared prosperity under this business model.

This prototype of a project now being implemented by the National Coordinating Unit of the Seaweeds Development Program of BFAR is formally called Cooperative Managed Seaweeds Nursery Business Enterprise (CMSNBE).

Under the concept of the Pareto Principle commonly used in corporate business and even in government nowadays, BFAR should identify the top 20 seaweeds producing municipalities in the entire country and undertake the organizing of a viable cooperative to be engaged by BFAR in implementing a seaweeds development program as an incubator business proposition.

As a general strategy, BFAR will organize these cooperatives and provide the following support until they have become viable and able to stand on their own:

1. Human resources development program thru training in governance and enterprise management to be facilitated by Training Institutions duly accredited by the Cooperatives Development Authority;

2. Appropriate and adequate funding support for these cooperatives to achieve their Strategic Plans (this is the incubation stage);

3. Organization of a cooperative consortium from among BFAR partner cooperatives and provide appropriate and adequate operational support for it to undertake missionary seaweeds development to process seaweeds into products like food, fertilizer, and feeds with the end given attaining national food security;

4. Link this cooperative consortium with institutions/agencies that will enable it to formulate and perfect products from seaweeds as food, fertilizer, and feeds;

5. After 3 years or once the cooperative has become viable as a business enterprise, able to stand on its own and eligible to access formal bank financing, BFAR will link the cooperatives to access credit from the Land Bank of the Philippines. This is the accelerator stage where the cooperative has graduated from the incubation stage and is now ready to go big time to implement projects perfected in the incubation stage.

6. Link the cooperatives with the MLGUs for the allocation of 50 hectares or more in the municipal waters for the establishment of cooperative farms using a corporate farming approach;

7. Support the establishment of seaweed farms in offshore areas for carbon capture and minimizing eutrophication of marine waters.

XII. INDUSTRY CLUSTER GOVERNANCE NETWORK (Implementation Team)

Table 11 presents the suggested seaweeds industry governance matrix for the implementation and monitoring of the activities and targets in the Philippine Seaweeds Industry Roadmap. The Oversight and Advisory Group, as well as the various Action Teams, would require support funds and resources to effectively perform their assigned responsibilities.

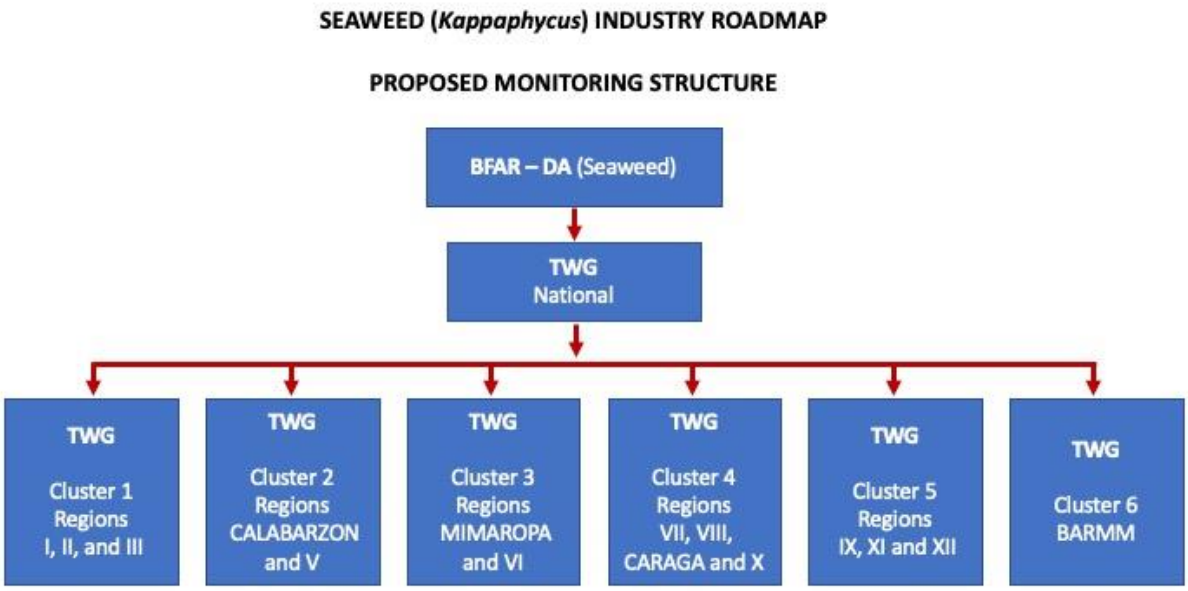
Table 14. Seaweeds Industry Governance Matrix

Role	Actors	Responsibilities
Oversight and Advisory	Technical Working Group composed of representatives from DA-BFAR, DTI, SIAP, private sector (farmers, cooperatives, traders, processors, exporters, academe, and the LGUs)	1. ensure the implementation of the seaweeds industry roadmap, 2. update the roadmap, 3. conduct advocacy work, 4. liaise with policy makers, and 5. assist the formation of action teams
Action Team: Farm Production	Representatives from DA-BFAR (lead), seaweeds farmers, cooperatives, processors, traders, exporters, and LGU	1. Seek LGU support for seaweeds farming 2. Facilitate financing 3. Coordinate with DA-BFAR for counterpart support 4. Help package projects for ODA and investors 5. Assign point person for every key activity 6. Monitor progress of various related activities as stated in the roadmap
Action Team: Policy Reform	Representatives from DA-BFAR (lead), seaweeds farmers, cooperatives, processors, traders, exporters, and LGU	1. Monitor, facilitate and connect with the national agencies to address issues on seaweeds 2. Monitor progress of various related activities as stated in the roadmap
Action Team: Market Intelligence	Representatives from DTI (lead), DA-BFAR, cooperatives, processors, traders, exporters	1. Seek government support for market intelligence 2. Facilitate fund sourcing for market intelligence

		3. Coordinate with BFAR-DA and DTI for counterpart support 4. Help package projects for ODA and investors 5. Assign point person for every key activity 6. Monitor progress of various related activities as stated in the roadmap
Action Team: Research & Development	Representatives from DOST (lead), DA-NFRDI, SEAFDEC, processors and academe	1. Facilitate research and development in seaweeds and carrageenan 2. Seek support for R&D efforts 3. Coordinate with BFAR-DA and DTI for counterpart support 4. Help package projects for ODA and investors 5. Assign point person for every key activity 6. Monitor progress of various related activities as stated in the roadmap
Action Team: Investment & Financing	Representatives from DTI (lead), DA-BFAR, cooperatives, processors, traders, exporters	1. Seek LGU support for seaweeds farming 2. Facilitate financing 3. Coordinate with BFAR-DA and DTI for counterpart support 4. Help package projects for ODA and investors 5. Assign point person for every key activity 6. Monitor progress of various related activities as stated in the roadmap

Source: *Adopted from DTI Seaweeds Industry Roadmap*

Figure 26. Monitoring Structure



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APPENDIX TABLES: Detailed Cost and Returns Analysis

Appendix Table 1. Cost and Return Analysis for Seaweed Producer in Agutaya, Palawan (Dried Seaweeds)

Species	Cottonii
Farming method	Monoline floating
Farm area	0.125 ha
No. of lines	100
No. of plants per line	140
Seedling / Propagule weight	**~70** grams
Culture period	60 days
Activity Cycle / No. of croppings per year	5

Cost and Returns Per Activity Cycle	Quantity	Unit	Unit Cost	Lifespan (in Years)	Total Cost
TOTAL REVENUE					**68,000.00**
Total yield (fresh)	8,000	kgs.			
Seedling allocation	1,000	kgs.	10.00		10,000.00
Total seaweed for drying	7,000	kgs.			
Dried seaweed output	1,000	kgs.	58.00		58,000.00
PRODUCTION COST					
A. Fixed Cost					**2,455.00**
Culture preparation					
PE Rope #9	14	rolls	450.00	5	252.00
PE Rope #22	3	rolls	850.00	5	102.00
Nylon	1	kgs.	380.00	0.6	126.00
Soft tie	10	rolls	135.00	0.6	450.000
Wooden stakes	40	pcs	15.00	1	120.00
Styrofoam	10	kgs.	50.00	0.6	166.67
Knife	1	pc.	35.00	0.2	35.00
Motorized Banca (planting, maintenance and harvest)	1	unit	65,000.00	15	866.67
Harvest and Post-Harvest					
Basket (Hammock Net)	1	pcs	250.00	3	16.67
Dryer	1	unit	10,000.00	2.5	800.00

B. Operating Cost					**25,314.92**
Culture preparation					
Seedlings	1000	kgs.	10.00		10,000.00
Transportation cost for seedling acquisition	1	gallon	280.00		280.00
Labor for farm Preparation	3	man/day	300.00		900.00
Labor for tying of Seedling	100	lines	10.00		1,000.00
Labor for planting	3	man/day	300.00		900.00
Culture					
Gasoline for farm visits	30	liters	70.00		2,100.00
Labor for farm maintenance	15	man/day	300.00		4,500.00
Repair and maintenance Expense	-	-	-		2,400.00
Harvesting					
Labor for harvesting, cleaning and hanging seaweeds	7.5	man/day	300.00		2,250.00
Drying					
Labor for drying	3	man/day	300.00		900.00
Packing					
Straw	0.12	roll	85.00		9.92
Labor for packing	0.25	man/day	300.00		75.00
TOTAL COST					**27,769.92**
NET INCOME OR VALUE ADDED					**40,230.08**
VALUE ADDED PER UNIT					**40.23**
RETURN ON INVESTMENT					**1.45**
PAYBACK PERIOD					**0.69**
BREAK EVEN VOLUME (Dried Seaweeds in Kg)					**478.79**

Appendix Table 2. Cost and Return Analysis for Large Trader in Agutaya, Palawan (Dried Seaweeds)

Prouduct Type/Form	Raw Dried Seaweed				
Player	Large Traders				
Activity	Local trading of RDS				
Activity Cycle (monthly)	12				
Cost and Returns Per Activity Cycle	**Quantity**	**Unit**	**Unit Cost**	**Lifespan (in Years)**	**Total Cost**
TOTAL REVENUE					**1,096,000.00**
Total RDS output (Cottonii)	12,000	kgs.	66.00		792,000.00
Total RDS output (Spinosum)	8,000	kgs.	38.00		304,000.00
PRODUCTION COST					
A. Fixed Cost					**333.33**
Weighing scale	2	unit	4,000.00	5	133.33
Storehouse	1	unit	120,000.00	50	200.00
B. Operating Cost					**1,013,534.13**
RDS (Cottonii)	12,000	kgs.	58.00		696,000.00
RDS (Spinosum)	8,000	kgs.	26.00		208,000.00
Sacks	267	pcs	15.00		4,005.00
Straw	2.23	rolls	85.00		189.13
Transportation cost (Agutaya to Batangas)	20,000	kgs.	4.50		90,000.00
Labor for loading of seaweeds	267	sacks	20.00		5,340.00
Auxiliary tax	20,000	kgs.	0.50		10,000.00
Communication expense			-		200.00
TOTAL COST					**1,013,867.46**
NET INCOME OR VALUE ADDED					**82,132.54**
VALUE ADDED PER UNIT					**4.11**
RETURN ON INVESTMENT					**0.08**
PAYBACK PERIOD					**12.34**
BREAK EVEN VOLUME (Dried Cottonii Seaweeds in Kg.)					**11,543.04**
BREAK EVEN VOLUME (Dried Spinosum Seaweeds in Kg.)					**6,628.78**

Appendix Table 3. Cost and Return Analysis for Semi-Refined Carrageenan of Processor

Prouduct Type/Form	Semi-Refined Carrageenan				
Player	Processor				
Activity	Processing of Semi-Refined Carrageenan				
Activity Cycle (monthly)	12				
Cost and Returns Per Activity Cycle	**Quantity**	**Unit**	**Unit Cost**	**Lifespan (in Years)**	**Total Cost**
TOTAL REVENUE					**102,060,000.00**
Total semi-carrageenan output	216,000	kgs.	472.50		102,060,000.00
PRODUCTION COST					
A. Fixed Cost					**220,833.33**
Depreciation of Equipment			-		100,000.00
Permits and Licenses			-		120,833.33
B. Operating Cost					**77,538,440.00**
RDS (60%)	830,769	kgs.	56.00		46,523,064.00
Chemicals (10%)			-		7,753,844.00
Salary (5%)			-		3,876,922.00
Utilities (8%)			-		6,203,075.20
Maintenance cost (10%)			-		7,753,844.00
Logistics (7%)			-		5,427,690.80
TOTAL COST					**77,759,273.33**
NET INCOME OR VALUE ADDED					**24,300,726.67**
VALUE ADDED PER UNIT					**112.50**
RETURN ON INVESTMENT					**0.31**
PAYBACK PERIOD					**3.20**
BREAK EVEN VOLUME (SRC in kg.)					**164,569.89**

Appendix Table 4. Cost and Return Analysis for Seaweed Producer in Talibon, Bohol (Dried Seaweeds)

Species	Spinosum
Farming method	Floating Monoline
Farm area	1 ha
No. of lines	100
No. of plants per line	80
Seedling / Propagule weight	188 grams
Culture period	45 days
Activity Cycle / No. of croppings per year	7

Cost and Returns Per Activity Cycle	**Quantity**	**Unit**	**Unit Cost**	**Lifespan (in Years)**	**Total Cost**
TOTAL REVENUE					**38,000.00**
Total yield (fresh)	8,500	kgs.			
Seedling allocation	1,500	kgs.	10.00		15,000.00
Total seaweed for drying	7,000	kgs.			
Dried seaweed output	1,000	kgs.	23.00		23,000.00
PRODUCTION COST					
A. Fixed Cost					**725.12**
Culture preparation					
PE Rope #18	1	roll	600.00	1	85.71
Dove straw	3	rolls	80.00	1	34.29
Soft tie	1.5	rolls	160.00	1	34.29
Wooden stakes	12	pcs	35.00	1	60.00
Floaters (used plastic bottles)	40	pcs	2.00	3	3.81
Stainless steel knife	1	pc	45.00	1	6.43
Non-motorized Banca (planting, maintenance and harvest)	1	unit	10,000.00	15	95.24
Seaweeds Permit	1	application	500.00	1	71.43

Mayor's Permit	1	application	200.00	1	28.57
Lease of municipal water	1	year	500.00	1	71.43
Post-Harvest					
Dryer	1	unit	3,275.00	2	233.93
B. Operating Cost					**28,660.63**
Culture preparation					
Seedlings	1500	kgs.	10.00		15,000.00
Labor for farm preparation	1	man/day	300.00		300.00
Labor for tying of seedling	100	lines	15.00		1,500.00
Labor for planting	0.5	man/day	300.00		150.00
Culture					
Labor for farm maintenance	21	man/day	300.00		6,300.00
Repair and maintenance Expense					300.00
Harvesting					
Labor for harvesting	0.5	man/day	300.00		150.00
Labor for cleaning seaweed Harvest	0.5	man/day	300.00		150.00
Drying					
Labor for drying	3	man/day	300.00		900.00
Packing					
Sacks	15	pc	15.00		225.00
Straw	0.13	roll	85.00		10.63
Labor for packing	0.25	man/day	300.00		75.00
Transportation					
Boat (Island to mainland port)			3,200.00		3,200.00
Tricycle (port to trader)			100.00		100.00

Labor for loading	15	sacks	20.00		300.00
TOTAL COST					**29,385.74**
NET INCOME OR VALUE ADDED					**8,614.26**
VALUE ADDED PER UNIT					**8.61**
RETURN ON INVESTMENT					**0.29**
PAYBACK PERIOD					**3.41**
BREAK EVEN VOLUME (Dried Seaweeds in Kg)					**1,277.64**

Appendix Table 5. Cost and Return Analysis for Large Trader in Talibon, Bohol (Dried Seaweeds)

Prouduct Type/Form	Raw Dried Seaweed
Player	Large Trader
Activity	Local trading of RDS
Activity Cycle (monthly)	12

Cost and Returns Per Activity Cycle	**Quantity**	**Unit**	**Unit Cost**	**Lifespan (in Years)**	**Total Cost**
TOTAL REVENUE					**675,000.00**
Total RDS output	25,000	kgs.	27.00		675,000.00
PRODUCTION COST					
A. Fixed Cost					**160.00**
Weighing scale	1	unit	17,000.00	10	141.67
Sorting screen	1	unit	500.00	5	8.33
Wooden pestle (big)	2	pcs	300.00	5	10.00
B. Operating Cost					**629,566.51**
RDS	25,000	kgs.	23.00		575,000.00
Salary	48	man/day	310.00		14,880.00
Sacks	358	pcs	15.00		5,370.00
Straw	3.6	roll	65.00		232.70
Storehoouse rental	1	monthly	2,500.00		2,500.00

Transportation cost	358	sacks	63.00		22,554.00
Labor for loading of seaweeds	4.5	man/day	300.00		1,350.00
Arastre	358	sacks	9.61		3,439.81
Auxiliary tax	358	sacks	5.00		1,790.00
Clearance	3	trip	20.00		60.00
Local transport permit	3	trip	100.00		300.00
Dumping/loading fee	358	sacks	5.00		1,790.00
Communication expense					300.00
TOTAL COST					**629,726.51**
NET INCOME OR VALUE ADDED					**45,273.49**
VALUE ADDED PER UNIT					**1.81**
RETURN ON INVESTMENT					**0.07**
PAYBACK PERIOD					**13.91**
BREAK EVEN VOLUME (Dried Seaweeds in Kg.)					**23,323.20**

Appendix Table 6. Cost and Return Analysis for SRC of a Carrageenan Processor, RDS at Php27/kg

Product Type/Form	Semi-Refined Carrageenan				
Player	Processor				
Activity	Processing of Semi-Refined Carrageenan				
Activity Cycle (monthly)	12				
Cost and Returns Per Activity Cycle	**Quantity**	**Unit**	**Unit Cost**	**Lifespan (in Years)**	**Total Cost**
TOTAL REVENUE					**25,000,000.00**
Total semi-refined carrageenan output	100,000	kgs.	250.00		25,000,000.00
PRODUCTION COST					
A. Fixed Cost					**304,583.33**
Depreciation of Equipment					257,916.67
Permits and Licenses	1	application	560,000.00	1	46,666.67
B. Operating Cost					**14,400,00.00**
RDS (75%)	400,000	kgs.	27.00		10,800,000.00

Chemicals (5%)			-		720,000.00
Salary & Logistics (13%)			-		1,872,000.00
Utilities & Communication (7%)			-		1,008,000.00
TOTAL COST					**14,704,583.33**
NET INCOME OR VALUE ADDED					**10,295,416.67**
VALUE ADDED PER UNIT					**102.95**
RETURN ON INVESTMENT					**0.70**
PAYBACK PERIOD					**1.43**
BREAK EVEN VOLUME (SRC in kg.)					**58,818.33**

Appendix Table 7. Cost and Return Analysis for Seaweed Producer in Sibutu, Tawi-Tawi (Dried Seaweeds)

Species	Cottonii
Farming method	Bottom Stake Method
Farm area	0.25 ha
No. of lines	280
No. of plants per line	47
Seedling / Propagule weight	25 grams
Culture period	1.5 months
Activity Cycle / No. of croppings per year	7

Cost and Returns Per Activity Cycle	**Quantity**	**Unit**	**Unit Cost**	**Lifespan (in Years)**	**Total Cost**
TOTAL REVENUE					**36,561.43**
Total yield (fresh)	3,920	kgs.			
Seedling allocation	330	kgs.	6.67		2,200.00
Total seaweed for drying	3,590	kgs.			
Dried seaweed output	513	kgs.	67.00		34,361.43
PRODUCTION COST					
A. Fixed Cost					**1,958.93**
Culture preparation					
Stainless steel knife	5	pcs	50.00	4	8.93

PE Rope #6	13	rolls	200.00	1	371.43
Soft tie	10	rolls	220.00	0.5	628.57
Mangrove stick	150	pcs	5.00	1	107.14
Styrofoam	100	pcs	20.00	1	285.71
Non-motorized banca	1	unit	15,000.00	5	428.57
Harvest and Post-Harvest					
Basket	2	pcs	200.00	1	57.14
Cover tent	5	meters	50.00	1	35.71
Screen Dryer	5	meters	50.00	1	35.71
B. Operating Cost					**16,612.71**
Culture preparation					
Seedlings	330	kgs.	6.67		2,200.00
Labor for tying of seedling	280	lines	2.00		560.00
Labor for installation/planting	1	man/day	250.00		250.00
Culture					
Labor for farm maintenance	2	months	3,000.00		6,000.00
Repair and maintenance expense	-	-	-		2,625.00
Harvesting					
Labor for harvesting	280	lines/boat	10.00		2,800.00
Labor for cleaning seaweed harvest	280	lines	5.00		1,400.00
Drying					
Labor for drying	2	man/day	250.00		500.00
Packing					
Straw	0.02	roll	220.00		3.96
Labor for packing	0.375	man/day	250.00		93.75

Transportation cost for selling of seaweeds	9	sacks	10.00		90.00
Labor for loading/unloading of seaweeds	9	sacks	10.00		90.00
TOTAL COST					**18,571.64**
NET INCOME OR VALUE ADDED					**17,989.79**
VALUE ADDED PER UNIT					**35.08**
RETURN ON INVESTMENT					**0.97**
PAYBACK PERIOD					**1.03**
BREAK EVEN VOLUME (Dried Seaweeds in Kg)					**277.19**

Appendix Table 8. Cost and Return Analysis for Barangay Trader in Sibutu, Tawi-Tawi (Dried Seaweeds)

Prouduct Type/Form	Raw Dried Seaweed				
Player	Barangay Traders				
Activity	Local trading of RDS				
Activity Cycle (thrice a month)	36				
Cost and Returns Per Activity Cycle	**Quantity**	**Unit**	**Unit Cost**	**Lifespan (in Years)**	**Total Cost**
TOTAL REVENUE					**700,000.00**
Total RDS output	10,000	kgs.	70.00		700,000.00
PRODUCTION COST					
A. Fixed Cost					**13.89**
Weighing scale	1	unit	5,000.00	10	13.89
B. Operating Cost					**697,868.92**
RDS	10,000	kgs.	67.00		670,000.00
Cleaning/Redrying	1	man/day	300.00		300.00
Sack	143	pcs	23.00		3,289.00

Straw	0.286	roll	220.00		62.92
Repacking	143	sacks	15.00		2,145.00
Auxiliary tax	143	sacks	5.00		715.00
Labor for loading/unloading	143	sacks	50.00		7,150.00
Transportation cost	143	sacks	99.00		14,157.00
Communication expense	-	-	-		50.00
TOTAL COST					**697,882.81**
NET INCOME OR VALUE ADDED					**2,117.19**
VALUE ADDED PER UNIT					**0.21**
RETURN ON INVESTMENT					**0.00**
PAYBACK PERIOD					**329.63**
BREAK EVEN VOLUME (Dried Seaweeds in Kg.)					**9,969.75**

Appendix Table 9. Cost and Return Analysis for Large Trader in Zamboanga City Supplied by Traders from Tawi-Tawi (Dried Seaweeds)

Prouduct Type/Form	Raw Dried Seaweed
Player	Large Traders
Activity	Local trading of RDS
Activity Cycle (twice a month)	24

Cost and Returns Per Activity Cycle	**Quantity**	**Unit**	**Unit Cost**	**Lifespan (in Years)**	**Total Cost**
TOTAL REVENUE					**1,402,200.00**
Total RDS output (Cottonii)	17,100	kgs.	80.00		1,368,000.00
Total RDS output (Spinosum)	900	kgs.	38.00		34,200.00
PRODUCTION COST					
A. Fixed Cost					**18,979.17**
Tucks scale	1	unit	300,000.00	20	625.00
Weighing scale (platform)	1	unit	16,000.00	2	333.33
Fork lift	1	unit	1,200,000.00	20	2,500.00
Baling machine	1	unit	250,000.00	20	520.83
Warehouse	1	unit	18,000,000.00	50	15,000.00
B. Operating Cost					**1,295,270.00**

RDS (Cottonii)	17,100	kgs.	70.00		1,197,000.00
RDS (Spinosum)	900	kgs.	30.00		27,000.00
Sacks	300	pcs	17.00		5,100.00
Straw	3	rolls	90.00		270.00
Transportation cost			-		24,000.00
Salary	10	weekly	1,800.00		18,000.00
Auxiliary tax	18000	kgs.	0.10		1,800.00
BFAR permit	1	application	100.00		100.00
Maintenance cost			-		20,000.00
Communication expense			-		2,000.00
TOTAL COST					**1,314,249.17**
NET INCOME OR VALUE ADDED					**87,950.83**
VALUE ADDED PER UNIT					**5.14**
RETURN ON INVESTMENT					**0.07**
PAYBACK PERIOD					**14.94**
BREAK EVEN VOLUME (Dried Cottonii Seaweeds in Kg.)					**16,129.46**
BREAK EVEN VOLUME (Dried Spinosum Seaweeds in Kg.)					**804.30**

Appendix Table 10. Cost and Return Analysis for RC of a Carrageenan Processor

Prouduct Type/Form	Semi-Refined Carrageenan
Player	Processor
Activity	Processing of Semi-Refined Carrageenan
Activity Cycle (monthly)	12

Cost and Returns Per Activity Cycle	**Quantity**	**Unit**	**Unit Cost**	**Lifespan (in Years)**	**Total Cost**
TOTAL REVENUE					**56,000,000.00**
Total semi-refined carrageenan output	140,000	kgs.	400.00		56,000,000.00
PRODUCTION COST					
A. Fixed Cost					**290,583.33**
Depreciation of Equipment			-		257,916.67
Permits and Licenses	1	application	560,000.00	1	32,666.67
B. Operating Cost					**46,666,700.00**

RDS (80%)	466,667	kgs.	80.00		37,333,360.00
Chemicals (5%)			-		2,333,335.00
Salary & Logistics (10%)			-		4,666,670.00
Utilities & Communication (5%)			-		2,333,335.00
TOTAL COST					**46,957,283.33**
NET INCOME OR VALUE ADDED					**9,042,716.67**
VALUE ADDED PER UNIT					**64.59**
RETURN ON INVESTMENT					**0.19**
PAYBACK PERIOD					**5.19**
BREAK EVEN VOLUME (SRC in kg.)					**117,393.21**

Appendix Table 11. Cost and Return Analysis for Gel Press RC of Carrageenan Processor

Prouduct Type/Form	Refined Carrageenan
Player	Processor
Activity	Processing of Refined Carrageenan (Gel Press)
Activity Cycle (monthly)	12

Cost and Returns Per Activity Cycle	**Quantity**	**Unit**	**Unit Cost**	**Lifespan (in Years)**	**Total Cost**
TOTAL REVENUE					**3,900,000.00**
Total semi-carrageenan output	6,000	kgs.	650.00		3,900,000.00
PRODUCTION COST					
A. Fixed Cost					**330,750.00**
Depreciation of Equipment			-		328,750.00
Permits and Licenses	1	application	24,000.00	1	2,000.00
B. Operating Cost					**3,116,883.12**
RDS (77%)	30,000	kgs.	80.00		2,400,000.00
Chemicals (8%)			-		249,350.65
Salary & Logistics (8%)			-		249,350.65
Utilities & Communication (7%)			-		218,181.82

TOTAL COST					**3,447,633.12**
NET INCOME OR VALUE ADDED					**452,366.88**
VALUE ADDED PER UNIT					**75.39**
RETURN ON INVESTMENT					**0.13**
PAYBACK PERIOD					**1.62**
BREAK EVEN VOLUME (Gel Press RC in kg.)					**5,304.05**

APPENDIX 1: (Five-Year) Implementation Plan (2022-2026)

Vision, Mission, Goals, Objectives, and Targets

VISION

A primary producer of Eucheumatoids and preferred supplier of premium quality RDS and Carrageenan in the world market

MISSION

To develop and apply innovative farming and processing technologies for improved productivity, efficiency, and profitability

In line with this vision and mission, the goal is to achieve 5 key outcomes for the seaweeds industry in the next 5 years, namely:

1. Increased Production of Quality Raw Dried Seaweeds to 2% Annually in the Next 5 Years (2022-2026)
2. Provided access to financial resources to farmers
3. Improved Marketing Linkages of Seaweed Farmers
4. Capacitated Seaweed Farmers and Farmer Organizations
5. Promoted Community-based Value-added Products and Fresh Seaweeds for Food and Nutrition Security.
6. Addressed threats affecting the integrity and superiority of the Philippine seaweed/carrageenan.

Responsibility Matrix, Budget Requirement, Activities, and Targets

Action/ Strategy/ Description (Objectives)	**Program/ Activity/ Project**	**Physical and Financial Targets**						**Responsible Entity**
		2022	**2023**	**2024**	**2025**	**2026**	**Total**	
1. Increase seaweed production by 2% growth annually for 5 consecutive years (2022-2026) *	**A.** Improvement/ maintenance of existing BFAR NSTDC and Seaweed Culture Laboratories in collaboration with the Government and private sector Provision of Moisture Content Analyzer	-Project Proposal Preparation -Drafting of FOO -Shortlisting of SCL	Improvement of 6 laboratories (Php 2M) Php 12M	Improvement of 4 laboratories (Php 2M) Php 8M	Maintenance of 10 Laboratories (Php1.5M) Php 15M	Maintenance of 10 Laboratories (Php1.5M) Php 15M	Php 50M	BFAR, NFRDI UPMSI BAR DOST, SUCs, SEAFDEC Private sector,
		Enhancement of NSTDC	Php 1M	Php 1M	Php 1M	Php 1M	Php 4M	
		Other Government Institutions	Php 1M	Php 1M	Php 1M	Php 1M	Php 4M	
		SUCs	Php 1M	Php 1M	Php 1M	Php 1M	Php 4M	
		Private Sectors	Php 1M	Php 1M	Php 1M	Php 1M	Php 4M	

	B. Establishment state of the art Seaweed Culture Laboratory Complete Facilities with Equipment, Zamboanga	-Project Proposal Preparation Feasibility Study Consultation with Experts Php1M	Continuation of 2022 Start of construction Php100M	Operational Expenses Php2M	Operational Expenses Php 2M	Operational Expenses Php 2M	Php 107M	BFAR, Private sector, SUCs, SEAFDEC, UP-MSI
	C. Establishment of Pilot satellite seaweed land based nursery/seedling bank in partnership with cooperatives (Sorsogon, Bohol, CARAGA) in collaboration with private sectors	-Project proposal preparation Fiberglass -estimates c/o Sir Pierre Maintenance	Php2.5M/ site (SEAWEED PHONICS) Php 7.5M	Php 300,000	Php 300,000	Php 300,000	Php 7.5 M Php 900,000	BFAR, Private Sector, LGU, Partner Cooperatives
	D. Establishment & Maintenance of Seaweed Nurseries in collaboration with Private Sectors BFAR Managed Coop Managed BFAR Project	Create BFAR Fisheries Office Order (FOO) to establish at least 2 nurseries for the Top 15 Major producing provinces 10 nurseries/year P300K/Nursery Maintenance 10 nurseries Roll over scheme	Php 200k/ nursery Establishment of 30 Seaweed Nurseries Php 3M 10x200K Php 2M 10 nurseries	Php 200k/ nursery Maintenance of 30 Seaweed Nurseries Php 3M 20x200k Php 4M 20 nurseries	Php 200k/ nursery Maintenance of 30 Seaweed Nurseries Php 3M 30x200K Php 6M 40 nurseries	Php 200k/ nursery Maintenance of 30 Seaweed Nurseries Php 3M 40x200k Php 8M 80 nurseries	Php 800,000 Php12 M Php20 M	BFAR, Private Sector, Partners Cooperative LGUs
	E. Provision of Solar Dryers (Hanging method)	Target Major Producing Regions 10 units/year@ Php 250,000	10units x Php250,000 = Php2.5M	10% inc. 10units x Php275,000 =Php2.750M	10% inc. 10units x Php302,500 =P3,025,000	10% inc. 10unitsxPhp332,750= Php3,327,500	Php 11,602,500 M	BFAR, LGU
	F. Provision of Boats:	Target 10 BFAR organized coops /year	10 FBx20 K = Php200K	Php200K	Php200K	Php200K	Php800k	BFAR LGUs

	1. Flat boat(FB) for planting and tending the farm 2. Motorized boat(MB), 18hp, for loading of harvest	Preparation of FOO, Project Proposals Flat Boats-20K Motorized Boat-70K	10 MB x Php70K=Ph700,000	Php700,000	Php700,000	Php700,000	Php2.3, 8M	
	G. Provision of Propagules-to class 5-6 municipalities coming from BFAR Nurseries LGU will provide (Mandanas) Class 1,2,3,4 Municipalities (Can buy from Seaweed Coops)	Produced from BFAR Seaweed Nurseries Transport of propagules Will Start 2022		Php3M			Php3M	BFAR, LGU
	I. Establish laboratories collaboration with NFLD for seaweed quality analysis	Selected Regional Lab to conduct this Maintenance		Php50M Php6M	Php6M	Php6M	Php50 M Php18 M	BFAR-NFLD NSTDC NFRDI
	J. Provision of Moisture Content Analyzer	Proposal for the acquisition of 3 Moisture Analyzer/Region	1 Moisture Analyzer@ Php 150K x 3= Php 450Kx7Reg 3,150,000	Php 450Kx3Reg= 1,350,000	Php 450Kx3Reg =1,350,000	Php 450Kx3Reg =1,350,000	Php 12,600 M	BFAR NSTDC
	K. Improve strains of *Eucheuma/Kappaphycus* and cultivation of seaweed species with demand through research and development	Project Proposal Preparation	Php 5M	Php 6M	Php 7M	Php 8	Php 26M	NFRDI, UP-MSI; SEAFDEC; SUCs; NFRDI; NSTDC
2. Provide Access to financial resources to Seaweed Farmers	A. Survey/ Review available loan programs for seaweed farmers	Project Proposal Preparation Consultation/ Workshops: 3-National level= 300K Luzon Php = 500K	Visayas Php 500K Mindanao Php 500K				Php 1.5M	BFAR ACPC LBP Micro-financing Org. (MFO) Central Bank

	B. Information Dissemination to Seaweed Farmers on available loans for seaweed farmers through seminars	Project Proposal Preparation on Information Dissemination on available loan programs through seminars 15 Regions P400K/region Top 5 Regions= Php2M	Next Top 5 Regions Php2M	Third top 5 Regions Php2M			Php 6M	BFAR/ FISSD ACPC LBP
	C. Orientation on Financial Literacy to Seaweed Farmers	Project Proposal Preparation on Orientation on Financial Literacy to 15 Regions at 400K@ Top 5 Regions= Php2M	Second Top Regions Php 2M	Third Top Regions Php 2 M			Php 6M	BFAR ACPC LBP NGOs Coops Seaweed Farmers
	D. Recommend to ACPC to request Central Bank to designate Micro-financing Organizations (MFO) to major seaweed producing regions to provide loans to seaweed farmers	2 Consultation Meetings with ACPC and MFOs 200K/Consultation = Php400K	Coordination, meeting and Monitoring of the establishment of MFOs 5 Major Seaweed Producing Regions Php500K	Coordination, meeting and Monitoring of the establishment of MFOs 5 Major Seaweed Producing Regions Php500K	Coordination, meeting and Monitoring of the establishment of MFOs 5 Major Seaweed Producing Regions Php500K	Evaluation of the of the performance and outcome of the establishment of MFO to the seaweed farmers Php 1M	Php 2.9M	BFAR/ FISSD ACPC CB LGUs PFOS Seaweed Farmers
	E. Reproduction and distribution of IEC materials	Preparation of Project Proposals Layout IEC materials in consultation w/ ACPC and MFOs Print and repro-duce and distribute IEC Materials Php 1M				1M	Php 1M	BFAR ACPC LGUs
	F. Conduct of scientific research on the	Project proposal preparation	Continue Scientific research	Continue Scientific research	Continue Scientific Research	Documentation and recommen	Php3.4 M	BFAR NFRDI DOST

	acceptable loan terms, rates and repayment schemes, and the viability of special loan programs	Consultation meetings with involved institutions and seaweed farmers Field validation Php 1M	Php600K	Php600K	Php600K	dation base on the outcome of the Scientific Research Php600K		ACPC MFOs Seaweed Farmers
3. Improve marketing linkages of seaweed farmers	A. Intensify the organization of seaweed farmers into cooperatives to comply to the requirements of the local processors in terms of volume and quality	Organize 30 Additional Seaweed Coops P150K/coop X 30= Php3.6M	Continuous Development of the 30 organized coop Through seminars 30coopsXPhp150K= Php4.5M	Strengthening of the 30 developed coops through CDA and accredited Training Provider 30X300K= Php9M	Institutionalization of the 30 strengthened coops 30XPhp150K=Php4.5M	Federation of the 30 coops Strategic Planning 500k/coop Php=15M	Short Term 2022-2026 Php36,600M	BFAR CDA LGUs Seaweed Farmers CDA accredited T. Providers
	B. Attendance/ participation to Convention, Symposium	Participation to 2 convention/symposium per year Php3M	Php3M	Php3M	Php3M	Php3M	Short Term 15M	BFAR SIAP DTI SUCs SIAP NGOs Seaweed Stakeholders Scientists, Experts
	C. Provision of warehouse to seaweed coops to store and maintain quality of RDS	-Identify viable 3 seaweed coop beneficiaries in top producing regions on the provision of warehouse -Processing of requirements and Documents for 15 warehouses	Establishment of 4 multi-purpose seaweed warehouses with solar dryer at 6M/building = Php24M	Establishment of 4 multi-purpose seaweed warehouses with solar dryer at 6M/building = Php24M	Establishment of 4 multi-purpose seaweed warehouses with solar dryer at 6M/building = Php24M	Establishment of 4 multi-purpose seaweed warehouses with solar dryer at 6M/building = Php24M	Php 96M	BFAR LGUs
	F. Conduct of annual inventors-investors forum	Conduct of Investors meet the Investors Regular Assessment of seaweed products/ applications with	Php 1M	Php 1M	Php 1M	Php 1M	Php 4M	BFAR, DTI-BOI, Scientist, Investors

		commercial value Organized, Inventors of seaweed applications						
	C. Facilitate participation in international trade fairs	Support viable seaweed products in international trade fairs	Php 2M	Php 2M	Php 2M	Php 2M	Php 8M	BFAR, DA-AMAS DTI-BOI
	D. Develop database on buyers and products and disseminate to seaweed farmer cooperative	Planning and workshop, activity proposal on the development of database	Php 2M	Php 2M	Php 2M	Php 2M	Php 8M	
	E. Set-up SMS price watch hotline FIMC	Activity Proposal	Php 2M	Php 2M	Php 2M	Php 2M	Php 8M	BFAR SIAP COOPs
	F. Link the Seaweed Farmers directly to seaweed processors/consolidators thru their cooperatives	Conduct of Consultation Meetings with the concern value chains, Market Matching	Php 2M	Php 2M	Php 2M	Php 2M	Php 8M	BFAR, Processors, SIAP, COOPs, Traders
4. Capacitate seaweed farmers and farmers' organization - Scholarship Grants to Potential and qualified children of seaweed farmers	A. Attendance to regular trainings/seminars/workshops *TR for Seaweed Production and Processing – NC II *GAqP for seaweeds *PNS for RDS	Conduct of Training on Seaweed Production/ Processing, Conduct seminar, orientation on PNS on seaweed Target 100 pax per region	Php 3M	Php 3M	Php 3M	Php 3M	Php 12M	BFAR, NSTDC, TESDA, LGU,
	B. Cross-country/area visits to successful seaweed areas/farmers and the sharing of knowledge and best practices	As incentive to Outstanding Seaweed Farmers, criteria to be established	Php 1.5M	Php 1.5M	Php 1.5M	Php 1.5M	Php 6M	BFAR LGU DTI

	C. Collaboration and networking with the national and international seaweed community and those working on the conservation of marine resources.	Attendance/Participation to Seaweed Congress, ASIC, and other relevant organizations	Php 1.5M	Php 1.5M	Php. 1.5M	Php 1.5M	Php 6M	BFAR SIAP DTI
	D.Agriculture Career System Establishment of Training & Assessment Centers for Seaweed production – NC II and Seaweed Processing – NC II in Luzon, Visayas and Mindanao *Students will be accommodated to the training and assessment through a TESDA	Consultation Meeting with TESDA and other experts Creation of TWG Site Selection for Luzon, Visayas, Mindanao Validation Project Proposal Preparation Preparation of documents, Feasibility Studies Planning activities Finalization/ Approval Php 3M	Mindanao Establishment or TESDA accreditation of BFAR Training Centers for 1. Establishment of Training and Assessment Centers for Seaweed Production NCII Php5.5M 2. Establishment of Training and Assessment Centers for Seaweed processing NCII Php10M 3.Procurement of Materials for Training and Assessment Centers for Seaweed Processing NCII PhP2,200M	Visayas Establishment or TESDA accreditation of BFAR Training Centers for 1. Establishment of Training and Assessment Centers for Seaweed Production NCII Php5.5M 2. Establishment of Training and Assessment Centers for Seaweed processing NCII Php10M 3.Procurement of Materials for Training and Assessment Centers for Seaweed Processing NCII PhP2,200M	Luzon Establishment or TESDA accreditation of BFAR Training Centers for 1. Establishment of Training and Assessment Centers for Seaweed Production NCII Php5.5M 2. Establishment of Training and Assessment Centers for Seaweed processing NCII Php10M 3.Procurement of Materials for Training and Assessment Centers for Seaweed Processing NCII	Monitoring and Evaluation of the Established Training Centers	Short Term 2022-2023 Php16.5M Php30M	TESDA BFAR SUCs

					PhP2,200M		6,600M	
	E. Develop a database of trainees and trainings completed	Establish database of seaweed farmers to level up appropriately the needs of the seaweed farmers	Php 2M	Php 1M	Php 1M	Php 1M	Php 5M	BFAR TESDA
	Strategic planning of 30 cooperatives	500k/cooperative						
5. Promote community-based value-added products and fresh seaweeds for food and nutrition security	A. Techno transfer *Identification of beneficiaries *Conduct of trainings to beneficiaries based on the TR for Seaweed Processing-NC II to include basic financial , entrepreneurship and marketing training *Provision of processing equipment/materials/tools	*3 coops *3 trainings @ Php150k/ Training = 450,000 *1 set/ coop @ Php30k each for 15 coops =450k	3 coops *3 trainings @ Php200/ Training = 600,000 *1 set/ coop @ Php35k each for 15 coops =525k	3 coops *3 trainings @ Ph 200K/training = 600,000 *1 set/ coop @ 40k each for 15 coops =600k	3 coops *3 trainings @ Php200K/ Training 600,000 *1 set/ coop @ Php40k each for 15 coops =600k	3 coops *3 trainings @ Php250K/ training 750,000 *1 set/ coop @ Php45k each for 15 coops =675k	15 Php3M 15 trainings Php 2,850,000	BFAR, LGU & Seaweed Coop & DTI & TESDA

	*Enhancement, production & commercializatio n of seaweed-based products *Packaging & labelling		*top 3 OTOP @ Php250k/ Product= 750,000		*top 3 OTOP products @ Php300k/ Product = 900,000		6 produc ts Php1,6 50,000 M	
	B. Product Promotion *Participation to trade fairs *Link to market through conduct of annual inventors-investors forum	*at least 5 trade fairs @Php300k/ Fair = 1,500,000 1 MOA @ 1 coop	*at least 5 trade fairs @Php330k/ Fair = 1,650,000 1 MOA @ 1 coop	*at least 5 trade fairs @Php350k/f air = 1,750,000 1 MOA @ 1 coop	*at least 5 trade fairs @Php400,0 00/fair = 2,000,000 1 MOA @ 1 coop	*at least 5 trade fairs @Php450,0 00/Fair = 2,250,000 1 MOA @ 1 coop	Php9,1 57,650 25 trade fairs 5 MOA for 5 coops	DTI & Seawee d Coop & BFAR & LGU
	C. Establishment & operation of VLSPF *Extraction of carrageenan, agar, alginate & other phycocolloids *Monitoring and evaluation of the status of the processing facilities		1 coop @ 3M 100k	1 coop @ 3M 110k	1 coop @ 4M 121k	1 coop @ 4M 133k	4 coops 464k	BFAR, DOST, LGU & Seawee d Coop
	D. Development of new seaweed applications (R & D) *Conduct of trial applications *Analysis of the developed products *Technology transfer		At least 3 products @ 3M = 9M		At least 3 products @ 3.6M=10.8M		6 produc ts @ 19.8M	BFAR, DOST & LGU & NFRDI & Seawee d Coop

	E. Distribution of Carts (with complete accessories including ref, freezer, oven) for seaweed products F. Formulation of policies Address to Food Safety *Drafting of policies *Consultation *Refinement *Promulgation *Publication G. Production and distribution of IEC materials on the products developed	 250,000	15 Carts @ Php100k/Cart = 1.5M 100k 250,000	 500k 250,000	15 Carts @ Php120k/Cart = 1.8M 500k 250,000	 300k 500,000	30 Carts @ Php Php3.3 M Php1.4 M Php1.5 M	BFAR, Seaweed Coop BFAR & Industry Stakeholders; Food Safety Section of DA BFAR, LGUs, DOST, Seaweed Coop
6. Addressed threats affecting the integrity and superiority of the Philippine carrageenan and other seaweed products including RDS	A. Conduct Bi-annual Stakeholders' Consultation to address issues that affect the industry's integrity, RDS, Carrageenan B. Update of scientific studies on carrageenan C. Crafting of Documents to address the decision of NOSB relative to the possible delisting of carrageenan to the USDA approved organic ingredients	-Prepare Activity Proposal for the Peer Review of latest research, and other development on carrageenan, relevant documents that have positive and negative impact on the quality of carrageenan for submission to the International Journal in preparation to the next NOSB Sunset Review on 29 May 2023 Addressing the possible delisting of carrageenan in the organic food	Php 2M	Php 2M	Php 2M	Php 2M	Php 11M	BFAR, SIAP UPMSI DTI Carrageenan Processors SUCS

	D. Update the Market Requirement compliance to export and local Market	-Participation /Collaboration in ASEAN countries with Seaweed Projects -Participate in the USDA Consultation re above Carrageenan delisting Php3M						
	TOTAL (PhP)	**18,650,000**	**210,725,000**	**171,000,000**	**134,525,000**	**128,852,000**	**663,752,500.00**	

APPENDIX 2: Outputs from the Multi-stakeholder Consultation Workshops in the Regions

Region 1

STRENGTHS, WEAKNESSES, OPPORTUNITIES, AND THREATS (SWOT) OF THE SEAWEED INDUSTRY OF REGION 1

SEGMENT	STRENGTHS
Production	Existence of BFAR-maintained seaweed laboratory in RMaTDeC-Lucap, Alaminos City, Pangasinan
	Existence of Seaweed Development Program at BFAR to shepherd the growth of the seaweed industry
	Presence of competent technology generators/developers/technical expert in state universities/colleges and research centers to conduct research and development
	Access/ availability of financial grants and credit from government financial institutions for the seaweed producers
	Access to insurance grants by the PCIC for the seaweed producers
	Availability of vast area in coastal areas of Region 1 for seaweed farm establishment and expansion
Post Harvest	Seaweed dryers provided by BFAR to project beneficiaries
	Available multi-commodity solar tunnel dryer owned by Academe (DMMMSU)
	Availability of Philippine National Standards (PNS) for Raw Dried Seaweeds (RDS)
	Presence of Academe (Don Mariano Marcos Memorial State University) conducting research and development on seaweed products
	Existing shared facility for processing of seaweed products
	Assisted associations engaged in post harvest and processing of seaweed products (food and non-food)
Marketing & Trading	Available programs for organizing of seaweed cooperatives
	Presence of local buyers for raw dried seaweeds (Accel Carrageenan Company)
	Marketing support by BFAR I and academe (market matching, trade fair, fora)
	Participation to trade fairs organized by NGAs
	Presence of Academe assisting associations in marketing and promoting seaweed products

SEGMENT	WEAKNESSES
Production	Low productivity and production of present cultivars
	Inadequate supply of good quality seedlings
	Poor info dissemination of standards in seaweeds growers
	Lack of compliance to good farming practices
	Limited technical staff to transfer the knowledge on technical and developmental aspects of seaweed farming to the fisherfolk
	Inability of the fisherfolk to access formal financing institutions due to strict documentary requirements.
	Insufficient budget for R&D activities
	Absence of storage facility for emergency use during typhoons and rainy season (natural calamities)
	Lack of land based facility for seaweed growers
	Deteriorating quality of propagules due to long hours of travel from the source
Post Harvest	Limited BFAR allocation for the provision of drying facilities
	Absence of storage and drying facilities for RDS
	Limited post harvest and processing equipment
	Limited info dissemination of standards in seaweeds processing
	Some seaweeds products unlabeled (bottled, etc.)
	Seaweeds products not approved by FDA for commercialization
Marketing & Trading	No buyer of RDS
	Limited buyer of fresh seaweed esp. Kappaphycus, Eucheuma, and Gracilaria
	Limited direct access between the processors and farmers
	Lack of infrastructure for seaweed trading (e.g. fish landing not equipped for seaweed trading)
	No registered traders in the Province of Region I
	Lack of promotional activities for seaweed products

SEGMENT	OPPORTUNITIES
Production	Increasing demand of seaweed of good quality propagules
	Potential alternative uses of seaweeds for feeds, fertilizers and other important applications (bioplastics, hand sanitizer, etc.)
	High potential for farm productivity enhancement and quality
	Investment priority project to attract private investors in seaweed farming
	Vast area (Pangasinan) for establishment and expansion areas for seaweed farming
	Available planting materials to lessen grazing problems and not easily damage during typhoons
	Identification of organic materials potential for replacement of plastic straw (possible from water hyacinth) through research and development
	Improving the technique on transporting the propagules to the farm sites
	Adoption of R & D studies of Research Institutions on improving strain of seaweeds particularly on *Kappaphycus* spp.
Post Harvest	Premium price for good quality RDS
	Availability of technologies on innovative seaweed products and packaging from academes and research institutions
	Strong working relationship and linkages among processors and traders, farmers and traders
Marketing & Trading	Good export market and potential growth for carrageenan
	Diversification of market and new product applications

SEGMENT	THREATS
Production	Vulnerability to seasonal weather disturbances and impacts of climate change
	Prevalence of seaweed pests and diseases (ice-ice)
	Indiscriminate, improper use and discharge of inorganic fertilizer in field cultivation.
	Increasing competition with other seaweed producing countries
	Presence of predators (siganids, turtles) in production areas
Post Harvest	Unpredictable weather condition during drying
	Declining pool of competent technical experts
	Rising logistic costs
Marketing & Trading	Increasing logistic cost (transport, permits, covid tests)

RECOMMENDATIONS FOR POLICIES, STRATEGIES AND PROGRAMS

Objective/Target	Strategies/Policies/Programs	Responsible Entity
Increase seaweed production by 2% growth annually for 5 consecutive years (2022-2026)	Upgrading of existing BFAR Culture Laboratory to accommodate more cultivars	BFAR
	Provision of propagules by BFAR and established municipal nurseries	BFAR, LGU, FAs
	Improve strains of Kappaphycus and Eucheuma	BFAR, Academes
	Promote new farming technologies (climate change resilient)	BFAR, Academes
	Conduct of capacity building activities for seaweed producers	BFAR, Academes, TESDA
Increase income of seaweed farmers	Invest in high yield farming techniques	FAs
	Introduce climate resilient farming techniques	BFAR, LGU, Academes
	Link producers to buyers	BFAR, DA
	Establishment of seaweed warehouse to maintain quality of RDS	BFAR, LGUs
	Distribution of post harvest materials	BFAR, Academes, DOST, DTI
Improve marketing linkages of seaweed farmers	Intensify promotion activities to existing major markets	BFAR, Academes, LGU
	Conduct of annual Seaweed Industry forum	BFAR, LGU
	Facilitate participation in regional and national trade fairs	BFAR, FAs
	Develop database on producers, products, and buyers	BFAR
	Link the Seaweed Farmers directly to seaweed processors/consolidators	BFAR, LGUs

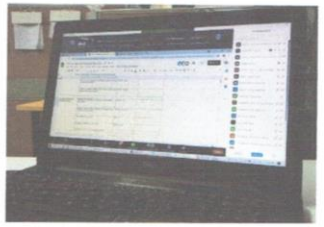
Objective/Target	Strategies/Policies/Programs	Responsible Entity
Capacitate seaweed farmers and farmers organization	Attendance to regular trainings/seminars/workshops related to production, postharvest, processing, and marketing	BFAR, LGUs, TESDA, DTI, PHILMECH
	Cross area visits to successful seaweed areas/farmers and the sharing of knowledge and best practices	BFAR, LGUs
	Collaboration and networking with the regional and national seaweed community and those working on the conservation of marine resources	BFAR, LGUs
	Develop a BFAR database of trainees and trainings of seaweed farmers beneficiaries	BFAR
Promote community-based value-added products and fresh seaweeds for food and nutrition security	Conduct of trainings to beneficiaries based on the TR for Seaweed Processing-NC II and other post-harvest and processing-related trainings	BFAR, TESDA, LGUs, Academes/Research Institutions
	Provision of processing equipment/materials/tools	BFAR, LGU
	Enhancement, production & commercialization of seaweed-based products	BFAR, LGU, DTI, Academes/Research Institutions
	Technical assistance on packaging & labeling of seaweed-based products	BFAR, LGU, DTI
	Participation to trade fairs	BFAR, LGU, DTI, NGAs
	Link to market through conduct of annual producers-processors-buyers forum	BFAR, LGU, DTI
	Development of new seaweed applications (R & D)	BFAR, DOST, Academes/Research Institutions
Address threats affecting the integrity and superiority of the Philippine Carrageenan	Conduct of regular stakeholders' consultation to address issues that affect the industry's integrity, RDS, Carrageenan	BFAR
	Update of scientific studies on carrageenan	BFAR
	Update the Market Requirement compliance to export and local Market	BFAR

PHOTO DOCUMENTATION

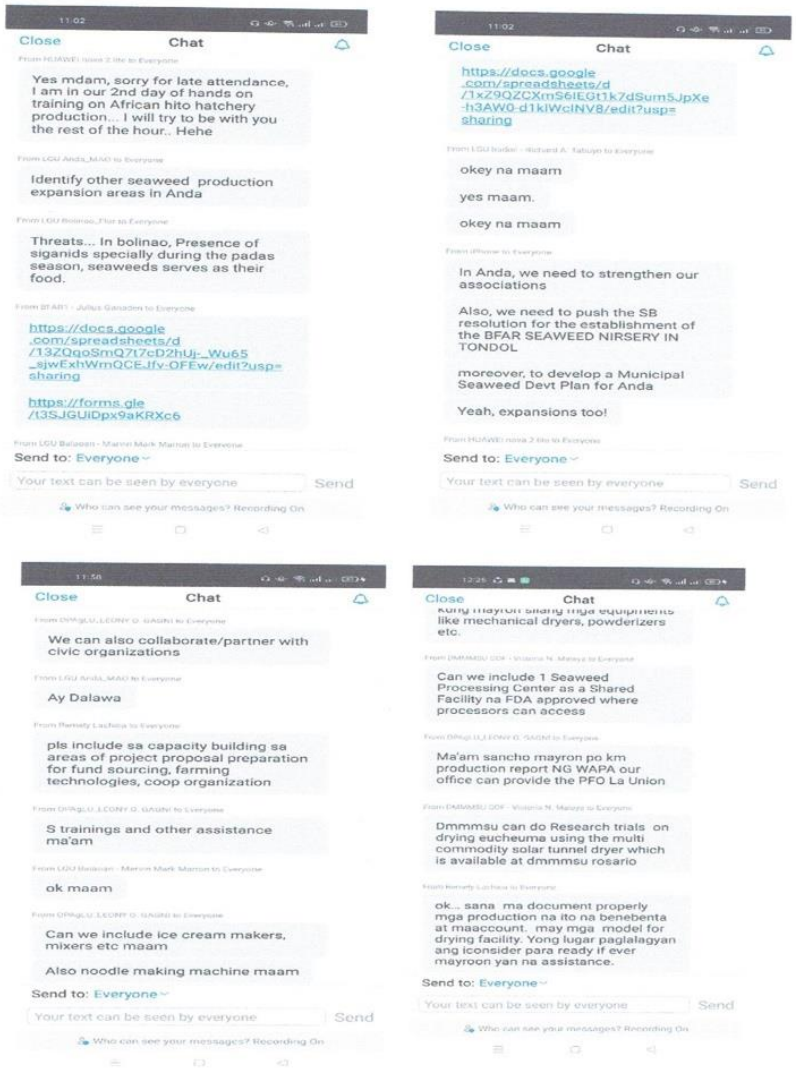
Secretariat

Mr. Henry Q. Canlas, Head of Production Unit, acknowledging the participants

Ms. Remely Lachica, Chief FPSSD, delivering her welcome remarks and discussing the presentation



Ms. Sancho Bilog facilitating the consultation workshop



Recommendations of the Industry in the Chatbox

Region 2

ACTION PLANNING ON RESPONSIBILITY MATRIX

Action/Strategy/Description	Program/Activity/Project	Physical target					Financial Targets ('000)						Responsible Entity
		2022	2023	2024	2025	2026	2,022.00	2,023.00	2,024.00	2,025.00	2,026.00	TOTAL	
1. Increase seaweed production by 2% growth annually for 5 consecutive years	1. Improvement/maitenance of Seaweed Culture Laboratory in collaboration with private sector	1	1	1	1	1	551.25	578.81	607.75	638.14	670.04	3,045.99	BFAR
	2. Maintenance of seaweed nurseries	5	5	5	5	5	154.38	162.09	170.19	178.70	187.63	852.99	BFAR
	3. Provision of elevated solar dryer		2		2			52.50		105.00		157.50	BFAR
	4. Distribution of seaweed propagules (kgs)	30,000	35,000	35,000	40,000	40,000						0.00	
2. Increase income of seaweed farmers	1.Expansion of seaweed farming in traditionaland non traditional areas	5	5	5	5	5	250.00	262.50	275.63	289.41	303.88	1,381.42	LGUs, BFAR
	2. Provision of livelihood alternative assistance	5	5	5	5	5	300.00	315.00	330.75	347.29	364.65	1,675.69	LGUs, BFAR
	4. Provision of seaweed warehouse				1					1,500.00		1,500.00	LGUs, BFAR
3. Improve marketing linkages of seaweed farmers	1. Intensify promotional activities on the importance of seaweed	10	10	10	10	10	180.00	189.00	198.45	208.37	218.79	994.61	BFAR
	2. Conduct market matching	2	2	2	2	2	60.00	63.00	66.15	69.46	72.93	331.54	BFAR
	3. Attendance to exhibits and trade fairs for product promotion	4	4	4	4	4	200.00	210.00	220.50	231.53	243.11	1,105.14	BF, LGUs
	4. Conduct of seaweed festival and summit	1	1	1	1	1	150.00	180.00	180.00	180.00	180.00	870.00	BFAR
	5. Develop database of seaweed farmers, buyers and processors and seaweed products	1	[1]	[1]	[1]	[1]	15.00	15.00	15.00	15.00	15.00	75.00	BFAR
4. Capacitate seaweed farmers and farmers organization	1. Attendance to trainings, seminars and workshop	2	2	2	2	2	67.20	70.56	74.09	77.79	81.68	371.32	BFAR, LGUs
	2. Facilitation on the statutory and regulatory market requirements	3	3	3	3	3	135.00	141.75	148.84	156.28	164.09	745.96	DTI, LGUs
	3. Conduct organizational meeting/strengthening of seaweed growers organization	4	4	4	4	4	100.00	105.00	110.25	115.76	121.55	552.56	BFAR, LGUs
	4. Conduct quarterly consultation meeting to seaweed farmers and organization	4	4	4	4	4	100.00	105.00	110.25	115.76	121.55	552.56	BFAR, LGUs
	5. Conduct capability building seminar/skills on entrepreneuship to seaweed grower association	2	2	2	2	2	150.00	157.50	165.38	173.65	182.33	828.86	BFAR, LGUs
5. Promote community based value added products and fresh seaweed for food and nutrition	1. Conduct technology transfer												
	- identification of benificiaries												
	- conduct training based on TR of Seawed Processing NC II including basic financial, entrepreneurial and marketing	5	5	5	5	5	190.00	199.50	209.48	219.95	230.95	1,049.88	BFAR, LGUs
	- provision of processing equipment, materials and tools	5	5	5	5	5	750.00	787.50	826.86	868.20	911.61	4,144.17	BFAR, DOST, LGUs
	- enhance production and commercialization of seaweed based products	3	[3]	[3]	[3]	[3]						0.00	
	- conduct training on packaging and labelling	5	5	5	5	5	190.00	199.50	209.48	219.95	230.95	1,049.88	BFAR, DTI, DOST, LGUs
	2. Product Promotion											0.00	BFAR, LGUs
	- conduct seaweed promotion to landlocked areas	5	5	5	5	5	190.00	199.50	209.48	219.95	230.95	1,049.88	
	3. Establishment and operation of Village Level Seaweed Processing Facilities (VLSPF)	3	[3]	[3]	[3]	[3]	12,000.00	120.00	120.00	120.00	120.00	12,480.00	BFAR, LGUs
	4. Production and distribution of IEC materials on the developed products	500	1,000	1,000	1,500	1,500	50.00	100.00	100.00	150.00	150.00	550.00	BFAR
6. Address threats affecting the integrity and superiority of Gracilaria	1. Addressing the threats to the culture area due to desalination												
	-increase flow of seawater from the mouth of the Buguey lagoon thru dredging or whatever possible physical action		1					1,000.00				1,000.00	LGUs
	TOTAL											**36,364.95**	

CALABARZON

SWOT Analysis	
Marketing and Trading Segment	
STRENGTH	• Availability of local traders in some area
	• Accessibility to land and water transportation
WEAKNESS	• Limited number of traders in remote areas
	• Low quality of raw dried seaweeds (RDS)
	• Identified buyer needs the bulk of stocks/RDS before buying
	• Limited buying station
	• Fluctuation of RDS selling price
OPPORTUNITY	• More accessible for local RDS processor
	• Provision of Seaweed Farming and Postharvest Training
	• Availability of traders to buy seaweeds produced by our small seaweed farmers
	• Good price of seaweeds in some area
THREAT	• Competitors from other regions
	• Unstable seaweed price
Processing Segment	
STRENGTH	• Continuous supply of RDS
	• Established seaweed processing industry within village level (Calatagan)
WEAKNESS	• Limited supply of RDS during the lean season
	• Presence of foreign materials (tie-ties, candy wrapper, sand, etc.)
	• Insufficient seaweed processing materials to process seaweeds into high-value products
	• Low carrageenan yield due to immature harvesting
	• Lack of Labeling and Packaging innovation of seaweed products
OPPORTUNITY	• Open to Global Market
	• Availability of funds for Seaweed Society Organization
	• DTI and DOST have programs for labeling, packaging, and product development
THREAT	• Contaminated/Adulterated RDS
	• Competitors from other countries
	• Not yet competitive for local and export market

Recommendation for Policies

Objectives/Targets	Strategies/ Policies/Programs	Issues/ Constraints being addressed (Ref: SWOT)	Key Result Areas	Key Performance Indicators	Time Frame	Responsibility Entity	
						Lead	Support
1.) Increase seaweed production by 2% growth annually for 5 consecutive years (2022-2026)	Establishment of Seaweed Laboratory	Insufficient supply of good quality seaweed propagules	Established a state-of-the-art Seaweed Laboratory	Produced enough supply of good quality propagules	Short term (2023)	BFAR	LGU
	Seed capital for buying/trading to increase seaweed production	Loss of interest in seaweed farming due to financial constraints or lack of capital	To have a revolving fund for our seaweed farmer association	Number of seaweed farmers associations benefitted thru the revolving fund	Short term (2026)	Loan institution (ACEF)	BFAR
	Establishment of the seaweed seed bank in selected farm site for CALABARZON for quality seaweed propagules to increase the seaweed production	Unavailability of good quality seaweed propagules	Established a seaweed seed bank	Enough supply of good quality cultivars	Short term (2023)	BFAR	LGU
	Additional potential areas for seaweed farming in adjacent barangays	The limited supply of raw fresh seaweed especially only during the lean season, conflicts use of resources for tourism	Expansion of potential areas for seaweed farming	Seaweeds production increased	Short term (2023)	BFAR	LGU
	Upgrading of Seaweed Laboratory in Pagbilao, Quezon for tissue culture	Unavailability of good quality seaweed propagules	Upgraded seaweed laboratory in Pagbilao, Quezon with tissue culture facility, Sustainability of seaweed propagules	Increase/improve the quality of seedlings, Increase the no. of produced seaweed cultivars, suitable, adaptable, and potential seedlings are identify	Short term (2023)	BFAR	LGU
2.) Increase income of seaweed farmers (25-50%)	Provision of seaweed farm implements and seaweed seedlings	Insufficient fund of seaweeds farmer	Provide seaweed farm implements and seaweed seedlings	The seaweed farmers benefitted	Short term (2026)	BFAR	LGU
	Provision of Solar Dryer	Low quality of raw dried seaweeds (RDS)	Provide Solar Dryer (fixed/floating dryer)	The seaweed farmer organizations benefitted, increased production and selling price of RDS due to improved quality, lesser operating cost for seaweed farmers using a floating solar dryer	Short term (2026)	BFAR	LGU
	Provision of RDS storage/warehouse	Limited warehouses to store the raw dried seaweed	Established RDS storage/warehouse	Improve and maintain the quality of RDS, easy access for traders having RDS in one area	Short term (2026)	BFAR	LGU
3.) Improve marketing linkages of seaweeds farmers	Establish Price Bulletin for RDS	Unstable price of raw dried seaweed	Market Matching	Visible RDS price	Short term (2026)	BFAR	LGU
	Yearly convention of seaweed industry stakeholders (farmer leaders, traders, consolidators, processors, LGU's and Academe)	Inactive participation of some seaweed farmers association	Conduct of yearly convention with the seaweed industry stakeholders (Farmers, Processors, Traders, Consolidators and Investors)	Develop partnership and convergence (Production and Marketing)	Short term (2026)	BFAR	LGU
4.) Capacitate seaweed farmers and farmers organization	Formation of Seaweed Farmer Association into Cooperative	No existing seaweed farmers cooperative in the CALABARZON area	Formation of seaweed farmers cooperative	Seaweed farmers Cooperative create and exist in Region 4A	Short term (2026)	BFAR , CDA	LGU
	Creation of Federation of Seaweed Farmer Association in CALABARZON	Loss of interest in Seaweed Farming due to different perspectives.	Strengthen Federation of Seaweed Farmer Association in CALABARZON	Federated seaweed farmers association	Short term (2023)	BFAR	LGU
	Provision of Training (Seaweed farming and Organic fertilizer)	Limited knowledge on how to produce organic fertilizer using seaweeds	Alternative livelihood during lean season,	Training conducted for Seaweed Farming and Organic Fertilizer using seaweeds	Short term (2026)	BFAR	LGU
	Orientation on Solid waste management Act	Dumping of waste to seawater resulting in water pollution	Conduct of Orientation/Implementation on Solid Waste Management Act, IEC, the adaption of Good Aquaculture Practices	Strict implementation of Municipal Ordinance on Solid Waste Management Act	Short term (2026)	LGU, DENR	BFAR
5.) Promote community- based value-added products and fresh seaweeds for food and nutrition security	Provision of seaweed processing materials/utensils/equipment in village level	Insufficient seaweed processing materials to process seaweeds into high-value products	Provide seaweed processing materials/utensils/equipment, Promotion of seaweed products	Seaweed farmer association benefited in Village Level	Short term (2026)	BFAR, DTI, DOST	LGU
6.) Addressed threats affecting the integrity and superiority of the Philippine Carrageenan	Assessment of Seaweeds Production and Diseases in CALABARZON area	Low production of seaweed, Seaweed Diseases	Research conducted	Improved quality disease-resistant propagules	Short term (2023-2024)	NFRDI, DOST, PRDP, ACADEME	BFAR, LGU
	Assessment and monitoring of fishpond effluent affecting the growth of seaweeds						
	Development of Commercially Viable Seaweed Based (*Sargassum spp*) Bio-Fertilizers for Crop Management	Lack of alternative livelihood during the lean season	Developed Viable Seaweed Based Bio-Fertilizers for Crop Management	Accessible to market	Short term (2023)	NFRDI, DOST, PRDP, ACADEME	BFAR, LGU

Responsibility Matrix

Action/Strategy/Description	Program/Activity/Project	Physical and Financial Targets					Total (Php)	RESPONSIBILITY
		2022	2023	2024	2025	2026		
1.) Increase seaweed production by 2% growth annually for 5 consecutive years (2022-2026)	Establishment of Seaweed Laboratory in Batangas Province	Draft of Proposal and other pertaining documents	Establish Seaweeds Laboratory 1.5M	Maintenance of Seaweeds Laboratory 1M	Maintenance of Seaweeds Laboratory 1M	Maintenance of Seaweeds Laboratory 1M	4.5M (Estimate)	BFAR and LGU
	Establishment of land and sea based seaweed seedbank in CALABARZON for quality propagules to increase the seaweed production	Draft of Proposal and other pertaining documents	Establish (1) Seaweed seedbank for Batangas and (2) in Quezon 4.5M	Maintenance of (3) Seaweeds Seedbank 3M	Maintenance of (3) Seaweeds Seedbank 3M	Maintenance of (3) Seaweeds Seedbank 3M	13.5M (Estimate)	BFAR and LGU
	Improvement of Seaweed Laboratory in Pagbilao, Quezon for tissue culture	Upgrading of Seaweed Laboratory in Pagbilao, Quezon for tissue culture 1M	Maintenance of upgraded Seaweed Laboratory in Pagbilao, Quezon for tissue culture 1M	Maintenance of upgraded Seaweed Laboratory in Pagbilao, Quezon for tissue culture 1M	Maintenance of upgraded Seaweed Laboratory in Pagbilao, Quezon for tissue culture 1M	Maintenance of upgraded Seaweed Laboratory in Pagbilao, Quezon for tissue culture 1M	5M (Estimate)	BFAR and LGU
2.) Increase income of seaweed farmers (25-50%)	Provision of seaweed farm implements and seaweed seedlings	105 SFI 1.57M	105 SFI 1.73M	105 SFI 1.90M	105 SFI 2.09M	105 SFI 2.30M	9.6M (10% increased/year)	BFAR and LGU
	Provision of Fixed and Floating Solar Dryer	3 Units Fixed or Floating Solar Dryer 1.5M	3 Units Fixed or Floating Solar Dryer 1.65M	3 Units Fixed or Floating Solar Dryer 1.815M	3 Units Fixed or Floating Solar Dryer 1.996M	3 Units Fixed or Floating Solar Dryer 2.196M	9.157M (10% increased/year)	BFAR and LGU
	Provision of RDS storage/warehouse	2 Units RDS Warehouse 3M	2 Units RDS Warehouse 3.3M	2 Units RDS Warehouse 3.63M	2 Units RDS Warehouse 3.99M	2 Units RDS Warehouse 4.39M	18.31M (10% increased/year)	BFAR and LGU
3.) Improve marketing linkages of seaweeds farmers	Yearly convention of seaweed stakeholders (farmer leaders, traders, consolidators, processors, LGU's and Academe)	1	1	1	1	1	2.5M	BFAR and LGU
4.) Capacitate seaweed farmers and farmers organization	Formation of Seaweed Farmer Association into Cooperative	3 Seawed Farmer Association formed into Cooperative 0.1M	3 Seawed Farmer Association formed into Cooperative 0.11M	3 Seawed Farmer Association formed into Cooperative 0.12M	3 Seawed Farmer Association formed into Cooperative 0.13M	3 Seawed Farmer Association formed into Cooperative 0.15M	0.61M (10% increased/year)	BFAR and LGU
	Creation of Federation of Seaweed Farmers Association in CALABARZON	1	Assembly	Assembly	Assembly	Assembly	.75M	BFAR and LGU
	Provision of Trainings (Seaweed farming and Organic fertilizer)	4	4	4	4	4	0.5M	BFAR and LGU
	Strengthening Federation of Seaweed Farmers Association in Quezon	1	Assembly	Assembly	Assembly	Assembly	0.5M	BFAR and LGU
	Creation of Federation of Seaweed Farmers Association in Batangas	1	Assembly	Assembly	Assembly	Assembly	0.5M	BFAR and LGU
5.) Promote community- based value-added products and fresh seaweeds for food and nutrition security	Provision of seaweed processing materials/utensils and equipment in village level	4 0.6M	4 0.66M	4 0.726M	4 0.79M	4 0.86M	3.63M (10% increased/year)	BFAR and LGU
6.) Addressed threats affecting the integrity and superiority of the Philippine Carrageenan	Assessment of Seaweed Production and Diseases in CALABARZON area	Draft of Proposal and other pertaining documents	1				1.5M	NFRDI, ACADEME, DOST,PRPDP
	Assessment and monitoring of fishpond effluent affecting the growth of seaweed	Draft of Proposal and other pertaining documents		1			1M	NFRDI, ACADEME, DOST,PRPDP
	Development of Commercially Viable Seaweed Based (*Sargassum spp*) Bio-Fertilizers for Crop Management	Draft of Proposal and other pertaining documents			1		1M	NFRDI, ACADEME, DOST,PRPDP

MIMAROPA

Seaweed Roadmap Template
2022 – 2026

Region: MIMAROPA

ACTION/STRATEGY/DESCRIPTION (OBJECTIVE)	PROGRAM/ACTIVITY/PROJECT	UNITS/Seaweed nursery					YEAR (Pesos)					TOTAL (P)	RESPONSIBILITY AGENCY
		2022	2023	2024	2025	2026	2022	2023	2024	2025	2026		
Increase seaweed production by 2% growth annually for 5 consecutive years.	--Provision of F1 generation seedling from seaweed nurseries (establishment of 2 nurseries).						400,000.00	400,000.00	400,000.00	400,000.00	400,000.00	2,000,000.00	Provincial Govt and BFAR MIMAROPA
	----Operationalization of Seaweed culture Laboratory or indoor nursery						2,000,000.00	2,000,000.00	2,000,000.00	2,000,000.00	2,000,000.00	10,000,000.00	BFAR MIMAROPA
	--Establishment of Nursery for continuous production											15,000,000.00	MLGU, PLGU & BFAR
	Occidental Mindoro	5	5	5	5	5	500,000.00	500,000.00	500,000.00	500,000.00	500,000.00	2,500,000.00	
	Oriental Mindoro	5	5	5	5	5	500,000.00	500,000.00	500,000.00	500,000.00	500,000.00	2,500,000.00	
	Marinduque	5	5	5	5	5	500,000.00	500,000.00	500,000.00	500,000.00	500,000.00	2,500,000.00	
	Romblon	5	5	5	5	5	500,000.00	500,000.00	500,000.00	500,000.00	500,000.00	2,500,000.00	
	Palawan	10	10	10	10	10	1,000,000.00	1,000,000.00	1,000,000.00	1,000,000.00	1,000,000.00	5,000,000.00	
	Provision of Seaweeds Solar Dryer	50 units (10 units/year/5provinces)					1,000,000.00	1,000,000.00	1,000,000.00	1,000,000.00	1,000,000.00	5,000,000.00 5,000,000.00	Provincial Govt and BFAR MIMAROPA
Increase income of seaweed farmers.	Provision of seaweed farming materials and propagules (500 beneficiaries/year). --Area expansion --Regulation of seaweed prices --Financial assistance to seaweed farmers or organizations through grants or loans						2,825,000.00	2,825,000.00	2,825,000.00	2,825,000.00	2,825,000.00	14,375,000.00	Provincial Govt and BFAR MIMAROPA

Increase marketing linkages of seaweed farmers.	Partnership and associations as leverage in sharing of good practices (establishment of seaweed network in MIMAROPA). --Promotion of seaweed products Use of ICT to link seaweed producers to markets	250,000.00 100,000.00	250,000.00 110,000.00	250,000.00 120,000.00	250,000.00 130,000.00	250,000.00 140,000.00	1,250,000.00 600,000.00	Provincial Govt and BFAR MIMAROPA MLGU, PLGU, SUC & BFAR
Capacitate seaweed farmers and seaweed organization.	Capacity-building training on seaweed nursery operations *Training on Business Plan development *Training on basic financial management	500,000.00	500,000.00	500,000.00	500,000.00	500,000.00	2,500,000.00	Provincial Govt, SUC and BFAR MIMAROPA
Promote commodity based value-added products and fresh seaweed for food and nutrition security.	Introduction of Seaweeds products to the locality, traders, cooperatives, etc. -Provision of Processing equipment to the organizations -Training on GMP and HACCP for seaweed farmers and organizations	500,000.00 400,000,.00	600,000.00 500,000.00	700,000.00 600,000.00	800,000.00 700,000.00	900,000.00 800,000.00	3,500,000.00 3,000,000.00	Provincial Govt and BFAR MIMAROPA
Addressed threats affecting the integrity and superiority of the Philippine carrageenan.	Research on new strains of climate-resistant seaweed variety. Intensify IEC and training on seaweed production focus on sustainable farming and environmental management (3 trainings per year).	2,000,000.00	2,500,000.00	3,000,000.00	3,500,000.00	4,000,000.00	15,000,000.00	Provincial Gov't and BFAR MIMAROPA
	Policy on the prohibition of the used of fertilizer in seaweed farming. Conduct of R&D to enhance locally produced carageenan	300,000.00 1,000,000.00	400,000.00 1,000,000.00	500,000.00 1,000,000.00	600,000.00 1,000,000.00	700,000.00 1,000,000.00	2,500,000.00 5,000,000.00	
TOTAL							**PhP79,725,000.00**	

Region 5

PFO CAMARINES SUR

Action/ Strategy/ Description (objectives)	Program/ Activity/ Project
1. Increase seaweed production by 2% growth annually for 5 consecutive years (2022-2026)	Add 10% increase in current areas Add 10% increase in seaweed farmers Add 10% budget of assistance
2. Increase income of seaweed farmers	Intensive Village Seaweeds Processed products Expand market linkage and outlets Post-Harvest Facilities
3. Improve marketing linkages of seaweed farmers.	Create network of various seaweed producers, traders and processors for better process of trading at less cost product delivery and better profit
4. Capacitate seaweed farmers and farmers association	Introduce new technical training on seaweed farming system Training on price-market monitoring and networking Site visit on seaweed processing plants Seminar of fishery law most especially on seaweeds Training for People's Organization on Proper Management and Values Formation For fisheries technician- training on Seaweed Culture and Management
5. Promote community-based value-added products and fresh seaweeds for food and nutrition security	Research Projects on Seaweeds Products for Industrial use by DOST/ Academe/BFAR for coastal community and industrial benefit Training on various seaweed processing for value-added products
6. Addressed threats affecting the integrity and superiority of the Philippine carrageenan	Intensify various product research for food and industrial product at better quality and various application for food, medicine, cars, electronics, product packaging and others by and among BFAR, DOST, Academe, TESDA, DA-Bureau of Animal and Food to compete other western seaweed product Training on Climate Resilient Seaweed Farming

PROVINCE OF SORSOGON

Action/ Strategy/ Description (objectives)	Program/ Activity/ Project
1. Increase seaweed production by 2% growth annually for 5 consecutive years (2022-2026)	Suportahan ang mga Provincial Seaweed Nursery para sa patuloy at maayos na distribution ng seaweeds sa bawat probinsya kung maaari alisin na lang ang Liquidation Damage sa supplier ng seaweed dahil sa isa ito sa mga dahilan kung bakit naididiliver ang seaweeds ng wala sa panahon. Sa ganitong paraan maiiwasan ang mortality at magiging kapakipakinabang ito para maipataas ang production sa seaweeds.
2. Increase income of seaweed farmers	Ibigay ang proyejto ng napapanahon sa tulog ng ahensya at pagmamalsakit ng farmers.
3. Improve marketing linkages of seaweed farmers.	Gumawa ng sites ang BFAR Regional o Provincial na maaaring sumagot sa tanong ng farmers halimbawa isang group chat ng mga farmers. Tanong ng farmers , presyo, buyers at saan. dahilan sa pandemya ito ang mas madali at epektibong pamamaraan.
4. Capacitate seaweed farmers and farmers association	Hikayatin ang mga farmers na mabuo bilang crop.
5. Promote community-based value-added products and fresh seaweeds for food and nutrition security	Gumawa ng mga produkto at gumamit ng social media para sa pagpapakilala nito at pagbibinta sa facebook at iba pa.
6. Addressed threats affecting the integrity and superiority of the Philippine carrageenan	

PROVINCE OF CATANDUANES

Action strategy Description (Objectives)	Program/ Activity/ Project
1. Increase seaweed production by 2% growth annually for 5 consecutive years (2022-2026)	1. BFAR to subsidize initial input for seaweed farmers 2. Intensive site re-assessment 3. Conduct refresher training course for seaweed 4. Infuse seaweed cooperative
2. Increase income of seaweed farmers	1. Strengthen market linkages 2. Introduce seaweed species suited in the area
3. Improve marketing linkages of seaweed farmers	1. Intervention on market matching 2. Improve post-harvest technologies
4. Capacitate seaweed farmers and farmers association	1. Provide regular extension service activities 2. Record keeping 3. Capacitate seaweed farmers on financial literacy
5. Promote community-based value-added products and fresh seaweeds for food and nutrition security	1. Adopt seaweed nursery operation 2. Introduce village-level processing facilities 3. Introduce solar drying facility
6. Addressed affecting the integrity and superiority of the Philippine Carrageenan	1. Adhere government restriction (zoning, area, capacity, etc.) 2. Update processing technologies

BFAR 7

Production Segment	
Strengths	• ***Existence of the Seaweed Tissue Laboratory in Sinandigan, Ubay, Bohol.*** • ***Presence of competent scientists in state universities/colleges and research centers to conduct research and development.*** • ***Natural and organic plant based products.*** • ***Known technology for mass production of good quality seedlings.*** • ***Presence of technology brochures (IEC Materials).*** • ***Willingness the of seaweed farmers to sustain seaweed production in the region.*** • ***Existence of registered seaweed associations and cooperatives in the region.*** • ***Availability of potential area for seaweed farm expansion.*** • ***Presence of some of the biggest processors in the world.*** • ***Pioneered in seaweed farm development in all seaweed producing areas in the world.*** • ***Strong partnership and collaboration with seaweed farmers, traders, processors, BFAR, academe and stakeholders in the region.*** • ***Good quality of seaweeds from the Philippines.*** • ***Existence of the Seaweed Industry Association of the Philippines (SIAP) that will monitor and provide updates on the Seaweed Industry trends.*** • ***Strong government support especially in BFAR region 7.***
Weaknesses	• ***Inadequate supply of good quality seedlings.*** • Lack of compliance to good farming practices and biosecurity measures. • Limited technical staff to transfer to the fisherfolk the knowledge on technical and developmental aspects of seaweed farming especially on innovations. • Inability of the fisherfolk to access formal financing institutions due to strict documentary requirements. • Insufficient and / or no ordinance to address zoning problem at LGU level and weak implementation of existing ordinances. • Insufficient budget for R&D activities. • Inherent vulnerability to weather disturbances (e.g. monsoons and typhoons). • ***Limited financial investment and support in seaweed farming.*** • ***Vast areas that is not feasibility and seasonality for seaweed farming.*** • ***Delay of releasing the insurance claims from PCIC.*** • ***Unwillingness for the fisherfolk to adopt new technologies and innovation.*** • ***Aging seaweed farmers.*** • ***Inconsistent awareness and lack of coordination among LGU's and other Agencies.*** • ***Insufficient numbers of seaweed nurseries in the region.*** • ***Decreasing seaweed production.*** • ***Price fluctuations scaring buyers, producers and users.*** • ***Misbalanced of production for cottonii and spinosum in the region.***
Opportunities	• ***Increasing demand on seaweed and seaweed products.*** • ***Increasing populations meaning increasing the demand on food.*** • Increasing demand of seaweed of good quality propagules. • Potential alternative uses of seaweeds for feeds, fertilizers and other important applications (bioplastics, hand sanitizer, etc.) • ***Market potential for other seaweed species (e.g. ulva, sargassum, halymenia, etc.)*** • High potential for farm productivity enhancement and quality. • Investment priority project to attract private investors in seaweed farming. • ***Bohol Province to establish mini-processing plant for echeumatoids species.*** • ***Fund allocation coming from DA as requested by the congressional district of Bohol for the provision seaweed project that includes fiber glass harvesting boat for seaweed, seaweed grow-out farming with propagules and farm implements, fiber glass boats with complete accessories, and multi-cab amount to about P 12,000,000.00.***
Threats	• ***Decreasing seaweed production.*** • Vulnerability to seasonal weather disturbances and impacts of climate change. • Prevalence of seaweed pests and diseases (ice-ice). • Indiscriminate, improper use and discharge of artificial fertilizer in field cultivation. • Increasing competition with other seaweed producing countries. • ***Increasing competition of other food hydrocolloids products.***

	• ***Pressure on international food regulations.*** • ***Increasing number of seaweed producers in other countries.*** • ***Global warming.***
Post-Harvest Segment	
Strengths	• Long daylight period of the country being a tropical. • Strong, committed and dedicated working relationship among family members as part of the Filipino Culture. • Availability of PNS for RDS. • Favorable weather condition for solar drying. • Availability of drying technologies depending on the season. • Provision of seaweed dryers and storage facilities by BFAR and other institutions (e.g. PRDP, DOST, DOLE, and DTI). • ***Available innovative technical manpower for product development in processing.*** • ***Available technology development for seaweed value-added products (e.g. chips, salads, salvaro, noodles, puto, etc.).***
Weaknesses	• Limited budget for the provision of drying and storage facilities and other post-harvest equipment. • Poor and inconsistent quality of dried seaweed that effects on carrageenan recovery (Immature harvested seaweeds, Adulterated RDS, High percentage of impurities). • Lack of compliance to Philippine National Standard on RDS. • ***Limited financial investment and support in R&D in seaweed value adding and processing.***
Opportunities	• Premium price for good quality RDS. • Huge market for good quality RDS both in the local and export levels. • Strong working relationship and linkages among processors and traders, farmers and traders and farmers and processors. • Availability of technologies on innovative seaweed products and packaging.
Threats	• Unpredictable weather condition in some areas during drying. • Competition with other countries in terms of market opportunities for carrageenan seaweed. • Declining pool of competent technical experts. • Rising logistic costs.
Marketing/Trading	
Strengths	• Good demand at local and export markets. • ***Carrageenan being food ingredients.*** • ***Natural and organic plant-based product.*** • ***Cost-effective food hydrocolloids.*** • ***Versatile and diversified uses or functions.*** • Proven marketing and distribution system

	• Existence of Philippine Seaweed Industry Association which serves as a source of information on the trends and current Seaweed Industry situation both in the international and local levels. • Available programs for organizing of seaweed cooperatives.
Weaknesses	• Lack of equipment for testing moisture content of the seaweed in the farmer and trader sectors. • Poor RDS quality due to high presence of contaminants. • Fluctuating RDS production volume. • Presence of excessive layers of middlemen in the trading chain. • Presence of 'fly-by-night' traders. • Limited direct access between the processors and farmers. • Inability to adapt to RDS price fluctuation. • Low credit worthiness attitude of farmers. • Seaweed farmers access to financing facility of Government. Controlled Corporation (GCC) and private institutions. • Lack of infrastructure for seaweed trading (e.g. fish landing not equipped for seaweed trading). • ***Unhealthy seaweed pricing competition within industry players.*** • ***Industry over-capacity.*** • ***High tariff and trade barriers.***
Opportunities	• Good export market and potential growth for carrageenan. • Increasing demand of US and EU Consumers. • Diversification of market and new product applications. • ***Consumer prefers natural ingredients.*** • ***Increasing demand of raw dried seaweed and carrageenan worldwide.*** • ***New applications for carrageenan.*** • ***Worldwide GDP / high purchasing power of some emerging economies.*** • ***New applications for health & personal care products.*** • ***Buyer industry growth rates (food & pharma/nutraceutical applications)*** • ***Trade liberalization & globalization***
Threats	• Existence of cheaper carrageenan substitutes. • Delisting of carrageenan as acceptable ingredients for organic product in US. • Increasing logistic cost (transport, arrastre, stevedoring & other fees • ***Increasing numbers of processors in other countries particularly China.*** • ***Brain drain of technical people going to competitor countries.*** • ***Presence of cheaper substitute products for carrageenan.*** • ***New market entry requirements of major importing countries like EU/US.*** • ***Global financial crisis / low demand.*** • ***Growth of Chinese carrageenan industry.***

	• ***Pressures on international food regulations.***
Processing (Industry Level / Carrageenan)	
Strengths	• Presence of 4 RC and 11 SRC processors in the country with enough capacity to meet demand increase. • Highly competitive carrageenan export price. • No. 1 in quality of RDS in terms of carrageenan yield and the overall quality parameters – BMP, BAP, GAP. • Manufacturing, process technology - capability to extract carrageenan and tailored-fit to specific applications. • Advance processing technology and facilities. • Availability of Seaweed Carrageenan Processing Experts. • Fiscal and non-fiscal incentives to new and/or expansion of carrageenan production processing under the government investment priority program. • ***Bohol Province to establish mini-processing plant for eheumatoids species.*** • ***Center of the seaweed trading all over the country.*** • ***Presence of big seaweed processors and exporters all over the country.***
Weaknesses	• Usage of seaweed biomass to limited product such as RC, SRC and ATC. Potential product application includes use of biomass as fertilizer, bioplastic and animal feeds. • Lack of awareness of consuming seaweed among non-coastal communities. • Limited seaweed cooperatives with direct linkage to processors. • ***Seaweed farmers have limited access to processors.*** • ***Poor quality of RDS due to contaminants.***
Opportunities	• Projected growth of Asian and Middle-east markets. • Diversification of seaweed biomass use for food, feed, fertilizer, personal care, and cosmetic products, nutraceutical, fuel and bioplastics applications. • Joint-venture or partnership with off-shore companies. • Potential of seaweed as fresh seafood to contribute to Philippine food security program. • ***SRC and RC coming from the Philippines is presentable and acceptable than other producing countries.***
Threats	• Delisting of carrageenan as an organic food ingredient USDA in 2023. • Strong competition with Indonesian carrageenan price.

	• Re-evaluation of carrageenan and seaweed products as acceptable food ingredients as required by European Food Safety Authority (EFSA). • Costly implication of ASC-MSC seaweed standards. • Trade barrier through strong government support and subsidy (technical and financial) in seaweed production and processing in other competing countries i.e. Indonesia. • ***Strong competition from other food hydrocolloids products.***
Processing (Village Level / Value-Added Products)	
Strengths	• Varied applications of RDS as food ingredient. • Availability of seaweed products for commercialization. • Crafted the training regulation for seaweed processing (NC II) to be promulgated by TESDA. • Availability of technologies for seaweed-based products being promoted and transferred by the government institutions as an alternative source of livelihood. • Great potential to develop seaweeds as a fresh seafood for 110 M Filipinos. • Existence of viable seaweed farmer coops that can be tap as vehicle for village level processing and promotion of its processed products. • Nutritional value of seaweed at minimal cost.
Weaknesses	• Limited type/species of RDS being commercially produce. • Inadequate support (government and financing institutions) for the provision of equipment for value-adding of seaweed and seaweed products. • Limited access of micro small and medium seaweed processors to the government and financing institutions to make the locally available seaweed products to be competitive (enhancement/packaging/FDA requirements, commercialization) in the market. • Economy of scale relative to local market demand. • Lack of awareness on Intellectual Property licensing.
Opportunities	• Favorable prospect of local and export market. • Untapped local market for seaweed as fresh food. • Supplemental income to seaweed farmers. • Promotion/popularization of seaweed based food convenient item. • Commercialization of production of seaweed based fertilizer.
Threats	• Low/non-acceptance of locally processed seaweed products so products produced cannot be marketed on a grand scale. • Low compliance to the market requirements/specifications.

RESPONSILBILITY MATRIX

Action/ Strategy/ Description (Objectives	Program/ Activity/ Project	Physical and Financial Targets						Responsibility Entity
		2022	2023	2024	2025	2026	Total	
1.Increase of Seaweed production by 2% annually	1.Provision of Fiber glass harvesting flatboat (medium size) 1,000 units @ 50k per unit	Preparation of proposal for funding and distribution of 250 units	250 units = 12.5 M	250 units = 12.5M	250 units = 12.5 M	-	50 M	BFAR, Cooperatives & LGU's
	2. Continue the provision of seaweed propagules and farm implements	Preparation of project proposal	5 M	6 M	7 M	8 M	26 M	BFAR, Cooperatives & LGU's
	3. Provision of wing van for fresh and RDS transportation		10 M	-	10 M	-	20 M	BFAR, Processors, Traders, LGU's, Cooperative
	4. Support for the establishment and development of more and new farms	Preparation of project proposal	1 M	1 M	1 M	1 M		BFAR, Cooperatives, LGU's
2.Increase Income of Seaweed farmers	1. Capability Building Training (HACCP) and other related training	Preparation of project proposal	1 M	-	1 M		2 M	BFAR, Cooperatives, LGU's, Academe, Processors
	2. Construction of seaweed trading center	Preparation of project proposal	20 M	-	-		20 M	BFAR, Cooperatives, LGU's, Processors, Traders
3.Improve marketing linkages of seaweed farmers	1. Attendance to International Forums related to seaweed industry	Preparation of project proposal	0.1 M	0.1 M	0.1 M	0.1 M	0.4 M	BFAR, Processors, Traders, Stakeholders, Academe
	2 Technical assistance on investors who are interested on seaweed business	-	-	-	-			BFAR, LGU's Cooperatives
4. Capacitate seaweed farmers and farmers organization	1. Attendance to Trade Fair related to seaweeds	Preparation of project proposal	0.1 M	0.1 M	0.1 M	0.1 M	0.4 M	BFAR, Cooperatives, LGU's
5.Promote community-based value-added products and fresh seaweeds for food and nutrition	1. Development of new products for seaweedds in value-adding and processing	Preparation of project proposal	2 M	2 M	2 M	2 M	8 M	BFAR, DOST, BAR, NFRDI, Academe

Region 8

Action/Strategy/Description (Objectives)	Program/Activity/Project	Physical and Financial Targets										Total (Php)	Responsibility
		2022		2023		2024		2025		2026			
		Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial	Physical	Financial		
1. Increase seaweed production by 2% growth annually for 5 consecutive years (2022-2026)	Identify and develop additional areas with potential for seaweed culture	Biri (40 modules @Php14,000/module) Capul (20 modules @Php14,000/module)	700,000.00	San Jose (20 modules @ Php14,000/module)	140,000.00	Lavesarez (20 modules @ Php14,000/module)	140,000.00	Gamay (20 modules @ Php14,000/module)	140,000.00	Lapinig (20 modules @ Php14,000/module)	140,000.00	**1,260,000.00**	BFAR, PFO-N.Samar, Fisherfolk Association, and concerned LGU
	Establishment of seaweed nursery	10 seaweed nurseries	295,000.00	10 seaweed nurseries	354,000.00	10 seaweed nurseries	365,800.00	10 seaweed nurseries	368,160.00	10 seaweed nurseries	368,632.00	**1,751,592.00**	BFAR8 Regional Office, PFO-N.Samar and S.Leyte, Seaweed farmers
	Distribution of additional seaweed implements	785 units	11,675,000.00	995 units	14,925,000.00	1,225 units	18,575,000.00	1,455 units	22,225,000.00	1,685 units	25,875,000.00	**93,275,000.00**	BFAR8 Regional Office, PFO's, and LGU
	Distribute motorized banca to aid in the day-to-day operation and maintenance of the farm	100 bex (1 unit of 20 footer boat with honda engine or its equivalent = 60,000)	6,000,000.00	100 bex (20 footer with honda engine or its equivalent)	6,000,000.00	100 bex (20 footer with honda engine or its equivalent)	6,000,000.00	100 bex (20 footer with honda engine or its equivalent)	6,000,000.00	100 bex (20 footer with honda engine or its equivalent)	6,000,000.00	**30,000,000.00**	BFAR8 Regional Office, PFO-N.Samar, and LGU
	Provision of seaweed seedlings	500 kg per farmer, 150 farmers = 75000 kg	900,000	90000	1,080,000	108000	1,296,000	129600	1,555,200	155520	1,866,240	**6,697,440.00**	Dawahon Island, Bato, PFO, BFAR8 Regional
		500 kg * 50 farmers =25,000kg	300,000	30000	360,000	36000	432,000	43200	518,400	51840	622,080	**2,232,480.00**	Other areas in Leyte: Tabango, Palompon, Villaba, Tolosa
2. Increase Income of seaweed farmers	Establishment of Seaweed dryers (with storage) to meet the moisture content requirements of buyers	17 units	42,500,000.00	7 units	20,000,000.00	14 units	35,200,000.00	7 units	17,500,000.00	4 units	10,000,000.00	**125,200,000.00**	BFAR8 Regional Office, PFO's, and LGU
	Increase 5 lines / year	500	7,500,000	500	7,500,000	500	7,500,000	500	7,500,000	500	7,500,000	**37,500,000.00**	BFAR8, PFO-E.Samar and Seaweed Farmers
	Assist in the facilitation of the insurance for the seaweed culture of farmers	100 seaweed farmers	60,000.00	100 seaweed farmers	60,000.00	100 seaweed farmers	60,000.00	100 seaweed farmers	60,000.00	100 seaweed farmers	60,000.00	**300,000.00**	BFAR 8, Fisherfolk Association and PFO-N.Samar
	Value adding of Seaweed: Crackers, Nooodles, pickles	14,400 packs	504000	14,200	504000	14200	504000	14200	504000	14200	504000	**2,520,000.00**	BFAR8, PFO-E. Samar and Seaweed Farmers
	1. Training on seaweed value added products 2. Distribution of post harvest & processing implements	20 pax	30,000	25	37,500	30	45,000	35	52,500	40	60,000	**225,000.00**	BFAR 8 Region, PFO-Biliran, Training division and Seaweed farmers
3. Improve marketing linkages of seaweed farmers	Proper consolidation of seaweeds from farmers to gather significant volume in order to attract more investors and buyers	14 consolidators		10 consolidators		10 consolidators		10 consolidators		10 consolidators			BFAR8 Regional Office, PFO-N. Samar and S.Leyte, and Fisherfolk Association
	Participation in aqua-fairs and other exhibits	3 aqua fairs	130,000.00	2 aqua fairs	135,000.00	2 aqua fairs	140,000.00	2 aqua fairs	145,000.00	2 aqua fairs	150,000.00	**700,000.00**	BFAR8 Regional Office, PFO-N. Samar, Biliran and Samar, Seaweed farmer and LGU
	Provision of vehicle to transport produced seaweeds to TBK or to buyers offering fair price	1 unit	1,500,000.00		100,000		100,000		100,000		100,000	**1,900,000.00**	BFAR8 Regional Office, PFO-S.Leyte and Seaweed farmer
	Provision of 40 Gross tonnage Fiberglass Motorized boat for rds delivery and marketing to Cebu City.	1 unit	34,000,000									**34,000,000.00**	Dawahon Island seaweed farmers, PFO-Leyte and BFAR8 Regional

	Organize as a Cooperative - establishment of processing plant	1 unit	3,000,000.00									**3,000,000.00**	BFAR8 Regional Office, PFO-Leyte, Seaweed farmer and LGU
	Identify other buyer of RDS	1	100,000.00	1	100,000.00	1	100,000.00	1	100,000.00	1	100,000.00	**500,000.00**	BFAR8,PFO-E.Samar and Seaweed Farmers
	Identify other buyer of seaweed value added products	5	1,000,000.00	5	1,000,000.00	5	1,000,000.00	5	1,000,000.00	5	1,000,000.00	**5,000,000.00**	BFAR8,PFO-E.Samar and Seaweed Farmers
	Negotiate with DSWD, LGUs for seaweed noodles as relief goods	3	1,000,000.00	5	1,000,000.00	5	1,000,000.00	5	1,000,000.00	5	1,000,000.00	**5,000,000.00**	BFAR8,PFO-E.Samar and Seaweed Farmers
4. Capacitate seaweed farmers and farmers organization	- Capacitate seaweed farmers, conduct technical trainings and information dissemination campaigns regarding the latest technologies and know-hows in the culture of seaweeds	1 Training (3 Days)/year with 50 bex	180,000.00	1 Training (3 Days)/year with 50 bex	180,000.00	1 Training (3 Days)/year with 50 bex	180,000.00	1 Training (3 Days)/year with 50 bex	180,000.00	1 Training (3 Days)/year with 50 bex	180,000.00	**900,000.00**	BFAR8 Regional Office, PFO, and Fisherfolk Association
	Level-up Fisherfolk associations to a cooperative	2	1,000,000.00	2	1,000,000.00	2	1,000,000.00	2	1,000,000.00	2	1,000,000.00	**5,000,000.00**	BFAR8,PFO-E.Samar and Seaweed Farmers
	Conduct capability training on cooperativism and related training on business management	2 trainings	30,000.00	2 trainings	35,000.00	2 trainings	40,000.00	2 trainings	40,000.00	2 trainings	45,000.00	**190,000.00**	BFAR8, PFO-Biliran & Seaweed Growers
	1. Conduct capability trainings; 2. Close monitoring and provide technical assistance; and 3. Educational Tour to areas with successful seaweeds farming (in order to collect ideas and best practices)	4 LGU's	200,000.00	4 LGU's	200,000.00	4 LGU's	200,000.00	4 LGU's	200,000.00	4 LGU's	200,000.00	**1,000,000.00**	BFAR8, PFO-Samar & Seaweed Farmers
	Conduct seminars and trainings for seaweed farming using latest technology	30 pax	48,000.00	30 pax	57,600.00	30 pax	58,176.00	30 pax	58,181.76	30 pax	58,181.82	**280,139.58**	BFAR8, PFO-Leyte & Seaweed Farmers
	Provision of technical assistance and conduct of trainings on seaweed farming for new seaweeds farmers	1	60,000.00	1	72,000.00	1	86,400.00	1	103,680.00	1	124,416.00	**446,496.00**	BFAR8, PFO-S. Leyte & Seaweed Farmers
5. Promote community-based value-added products and fresh seaweeds for food and nutrition security	- Enroll in Aqua-Based Business School (Seaweed Pickle, Seaweed Crackers, and Seaweed Gelatin) to produce aquapreneurs out of seaweed farmers	90	540,000.00	90	540,000.00	90	540,000.00	90	540,000.00	90	540,000.00	**2,700,000.00**	BFAR8, PFO-S. Leyte & N. Samar & Seaweed Farmers
	Conduct of trainings on value-added fishery products such as seaweed pickles, noodles, cracker and etc.	1 training	60,000.00	1 training	60,000.00	1 training	60,000.00	1 training	60,000.00	1 training	60,000.00	**300,000.00**	BFAR8 Regional Office, PFO-S. Leyte, and Seaweed farmers
	Participate in activities of DTI, Tourism & DOST in promotion of the region's products	3 trainings/participations	125,000.00	3 trainings/participations	125,000.00	3 trainings/participations	130,000.00	3 trainings/participations	130,000.00	3 trainings/participations	135,000.00	**645,000.00**	BFAR8 Regional Office, PFO-Samar and Biliran, and Seaweed farmers
	Establishment of product display center in strategic areas to further promote the product and enterprise	1 unit	3,000,000.00									**3,000,000.00**	BFAR8 Regional Office, PFO-Leyte, and Seaweed association
	Use social media in marketing seaweed products: pickles, noodles, ctackers	2	10,000.00	2	10,000.00	2	10,000.00	2	10,000.00	2	10,000.00	**50,000.00**	PFO-E. Samar, and Seaweed association
6. Addressed threats affecting the integrity and superiority of the Philippine Carrageenan	Techno-demo on new technologies for seaweed culture	1 techno-demo (1 module)	15,000.00	1 techno-demo (1 module)	15,000.00	1 techno-demo (1 module)	15,000.00	1 techno-demo (1 module)	15,000.00	1 techno-demo (1 module)	15,000.00	**75,000.00**	BFAR, PFO-N. Samar, and concerned LGU
	Seaweed Processing Plant							1 Processing Plant	50,000,000.00			**50,000,000.00**	BFAR 8, PFO-N. Samar, concerned LGU and seaweed farmers

	1. Good aquaculture practices and post harvest standards. 2. Establishment of seaweed dryers and storage facilities 3. Provision of moisture meter	1 unit moisture analysis meter	100,000.00	1 unit moisture analysis meter	100,000.00	1 seaweed dryer with storage facility	125,000.00	1 seaweed dryer with storage facility	150,000.00	**600,000.00**	BFAR 8, PFO-Biliran, concerned LGU and seaweed farmers
	1. Advise/encourage farmers to thouroughly clean their seaweeds before drying and sacking 2. Advise farmers to practice proper storing of dried seaweeds 3. Monitor farmers	300 seaweed farmers	50,000.00	600 seaweed farmers	50,000.00	900 seaweed farmers	50,000.00	1500 seaweed farmers	50,000.00	**250,000.00**	BFAR8,PFO- E. Samar and Seaweed Farmers
	1. Provide alternate farming technology that can adopt the growing threat of Philippine Carrageenan. 2. Conduct trainings on good aquaculture practices and post-harvest handling.	6 trainings on GAPs	260,000.00	6 trainings on GAPs	260,000.00	6 trainings on GAPs	260,000.00	6 trainings on GAPs	260,000.00	**1,300,000.00**	BFAR8,PFO-S. Leyte & Samar and Seaweed Farmers
	1. Procurement of reusable tie (PE rope no. 8) - practiced already in Bato 2. Monitor farm areas										BFAR8,PFO-Leyte and Seaweed Farmers
	TOTAL:		**116,872,000.00**		**56,000,100.00**		**75,212,376.00**		**58,173,549.82**	**417,798,147.58**	

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Table X. SWOT Analysis at Industry Level

	Segment Level	Industry Level
Strengths	· Low start-up cost of seaweed farming	Better seaweed quality that attracts preference from international clients Harmonization/Cooperation of industry players
	· Availability of experienced seaweed farmers	
	· High quality of Philippine seaweeds	
	· Active farmer associations / cooperatives	
	· Availability of skilled workers for carrageenan production	
	· Availability of carrageenan extraction facilities and customization capability	
	· Advanced processing facilities for carrageenan	
	· High quality of Philippine carrageenan (Suggestion: To make it as one....like, High quality of Phil seaweed especially carrageenan)	
	· Presence of SIAP, affiliation to international industry associations and access to market information	
	· Availability of existing facilities using advance technology in seaweed tissue culture laboratory and indoor and outdoor nurseries	
	· Continuous provision of trainings	
	· Availability of technical experts and scientists	
	· Availability of market-matching initiatives of the government	
Weaknesses	· Inadequate supply of good quality seedlings	Poor practices in production and post-harvest High cost of production
	· Lack of capital and access to financial resources	
	· Poor farming practices	
	· Poor knowledge on technical and developmental aspects of seaweed farming	
	· Unwillingness to adopt new technologies	
	· Limited reach and quality of technical training and assistance	
	· Lack of motorized boats	
	· Lack of climate resiliency measures and tools	
	· Lack of moisture content analyzer	
	· Limited drying and storage facilities	
	· Contaminated dried seaweeds	
	· Inconsistent RDS quality	
	· Limited promotion of value-added products	
	· Weak implementation of municipal ordinances / Lack of zoning ordinances	
	· Use of inorganic fertilizer and other substances	
	· Premature harvesting of some farmers resulting to poor quality carrageenan	
	· Non-compliance to HACCP requirements	
	· Poor packaging and labeling	
	· Short storage/shelf life of some products	
	· Unstable market price	
	· Farmers are price-driven	
	· Weak linkage to exporters	
	· Lack of on-site market for small quantity	
	· Inorganized seaweed farmers	
	· Unutilized other high value seaweed species	
	· Poor socio-economic condition of farmers	
Opportunities	· Re-utilization of idle seaweeds and large potential areas for expansion	Increasing demand for carrageenan and other potential uses of seaweeds Unutilized farm areas and processing plant capacities
	· Unmet local RDS demand	
	· High demand for RDS by local carrageenan processors	
	· Price incentives for quality RDS from processors	
	· Increasing demand for seaweeds for new applications	
	· Availability of other high value seaweed species	
	· High local and global demand for carrageenan	
	· Availability of still untapped wide expansion areas for seaweed farming	
	· Many uses and applications in the manufacture of pharmaceuticals, industrial and food products	
	· Available packaging innovation	
	· Availability of crop loans and financing support	
	· Presence of big processors and exporters	
Threats	· Presence of pests and diseases	USDA delisting in 2023 and compliance to EU requirements Weather variability and climate change
	· Unpredictable weather conditions	
	· Other natural disasters	
	· Possible delisting of carrageenan in US DA list	
	· Illegal fishing activities	
	· Incidence of poaching	
	· Volatility of seaweed prices	
	· Unstable peace and order situation	
	· High transportation costs	
	· Deteriorating quality of seedlings	
	· Availability of other carrageenan substitute	
	· Tight export market competition	
	· Interfering middlemen issue	
	· Global warming affecting erratic water temperature condition	

Please expand the initial list of industry-level SWOT based on the outputs from the stakeholder consultation workshop. The details can be discussed below in relation to the issues and constraints.

Region 10

ACTION / STRATEGY / DESCRIPTION (OBJECTIVES)	PROGRAM / ACTIVITY / PROJECT	PHYSICAL AND FINANCIAL TARGETS					TOTAL (Php)	RESPONSIBILITY
		2022	2023	2024	2025	2026		
1. Increase seaweed production by 2% growth annually for 5 consecutive years (2022-2026)* Baseline data: PSA 2020 = 32,188.39 MT	• Establishment of BFAR-managed sea-based seaweed nursery (i.e. eco-friendly farm implements, good quality seaweed propagules, FRP service boat, concrete caretakers hut with concrete working area, HDPE buoys, concrete anchorage, refractometer, etc.)	2 unit (new) Php 3 M	2 unit (maintenance) Php 1 M	2 unit (maintenance) + 1 unit (new) Php 2.5 M	3 unit (maintenance) Php 1.5 M	3 unit (maintenance) Php 1.5 M	13 unit Php 9.5 M	BFAR, LGU
	• Establishment of BFAR-managed land-based seaweed nursery with seaweed laboratory facility (to include transport vehicle, refractometer, lab equipment, reagents, etc.)			1 unit (new) Php 10 M	1 unit (maintenance) Php 1.5 M	1 unit (maintenance) Php 1.5 M	3 unit Php 13 M	BFAR, LGU
	• Provision of eco-friendly farm implements and good quality seaweed propagules for farm expansion and/or rehabilitation of existing farms (@500 kg propagules / beneficiary) Species: MOC – *K. alvarezii*	200 set Php 10 M	253 set Php 12.65 M	253 set Php 12.65 M	253 set Php 12.65 M	253 set Php 12.65 M	1,212 set Php 60.6 M	BFAR, LGU, Seaweed farmers

ACTION / STRATEGY / DESCRIPTION (OBJECTIVES)	PROGRAM / ACTIVITY / PROJECT	PHYSICAL AND FINANCIAL TARGETS					TOTAL (Php)	RESPONSIBILITY
		2022	2023	2024	2025	2026		
	CAM – *K. alvarezii, E. spinosum* LDN – *K. alvarezii, E. spinosum* MOR – *Gracilaria sp., K. alvarezii, E. spinosum*							
2. Increase income of seaweed farmers	<u>Pre-production activities</u> • Rehabilitation / Upgrading of existing sea-based seaweed nursery to be climate resilient (i.e. eco-friendly farm implements, good quality seaweed propagules, FRP service boat, concrete caretakers hut with concrete working area, HDPE buoys, concrete anchorage) for livelihood, preferably cooperative-managed	-	3 unit Php 3 M	-	-	-	3 unit Php 3 M	BFAR, LGU, Seaweed farmers' cooperative / association
	• Provision of eco-friendly farm implements and good quality seaweed propagules for farm expansion and/or rehab of existing farms (@500 kg propagules / beneficiary)	-do-	-do-	-do-	-do-	-do-	-	BFAR, LGU, Seaweed farmers
3. Improve marketing linkages of seaweed farmers	• Provision of logistic support for transport of good quality dried seaweeds to buyers / processing plants			1 unit Php 1 M	1 unit Php 1M		2 Php 2 M	BFAR, LGU, DTI, Seaweed farmers
	• Conduct of Regional Market matching activities	1 Php 85.5 k	1 Php 85.5 k	1 Php 85.5 k	1 Php 85.5 k	1 Php 85.5 k	5 Php 427.5 k	BFAR, LGU, DTI, Seaweed farmers
4. Capacitate seaweed farmers and farmers organization	• Reorientation / Updating / Training on seaweed culture technology	255 pax Php 145.35 k	255 pax Php 145.35 k	255 pax Php 145.35 k	255 pax Php 145.35 k	255 pax Php 145.35 k	1,275 pax Php 726.75 k	BFAR, LGU, Seaweed farmers
	• Training on GAqP, GMP / SSOP for seaweeds	255 pax Php 471.75 k	255 pax Php 471.75 k	255 pax Php 471.75 k	255 pax Php 471.75 k	255 pax Php 471.75 k	1,275 pax Php 2.4 M	BFAR, LGU, Seaweed farmers
	• Training on seaweed post harvest and processing technology	85 pax Php 157.25 k	85 pax Php 157.25 k	85 pax Php 157.25 k	85 pax Php 157.25 k	85 pax Php 157.25 k	425 pax Php 786.25 k	BFAR, LGU, DTI, Seaweed farmers

	• Strengthening of existing seaweed farmers association (values formation, organizational structure re-orientation, rules and responsibilities, financial literacy, introduction to cooperativism)	195 pax Php 111.15 k	195 pax Php 111.15 k	195 pax Php 111.15 k	195 pax Php 111.15 k	195 pax Php 111.15 k	975 pax Php 555.75 k	BFAR, LGU, Seaweed farmers
5. Promote community-based value-added products and fresh seaweeds for food and nutrition security	• Training on cooperativism for seaweed associations (values formation, financial literacy, etc.)	75 pax Php 138.75 k	90 pax Php 165.5 k	90 pax Php 165.5 k	60 pax Php 111 k	60 pax Php 111 k	375 pax Php 693.75 k	BFAR, LGU, CDA, Seaweed farmers
	• Establishment / Rehabilitation / Upgrading of village type Post harvest facility (processing utensils and equipment e.g. ice making machine, freezer, etc.,) for o Seaweed ice cream o Seaweed noodles o Seaweed sticks / crackers o Seaweed pickles	1 unit (new) + 4 unit (rehab / upgrading) Php 5.6 M	3 unit (new) + 1 unit (rehab / upgrading) Php 6.9 M		2 unit (rehab / upgrading) Php 1.8 M		11 unit Php 14.3 M	BFAR, LGU, DTI, BFAD, Seaweed farmers
	• Establishment / Rehabilitation / Upgrading of seaweed solar dryers (concrete flooring, warehouse / storage, moisture content analyzer, baling machine)	14 unit (rehab / upgrading) Php 8.4 M	1 unit (new) Php 1.6 M	1 unit (new) Php 1.6 M			16 unit Php 11.6 M	BFAR, LGU, Seaweed farmers
6. Address threats affecting the integrity and superiority of the Philippine Carrageenan	• Establishment / Rehabilitation / Upgrading of seaweed solar dryers (concrete flooring, warehouse / storage, moisture content analyzer, baling machine)	-do-	-do-	-do-	-do-	-do-	-	BFAR, LGU, Seaweed farmers
	• Strict implementation of GAqP, GMP / SSOP on seaweeds	Concerned municipalities	Concerned municipalities	Concerned municipalities	Concerned municipalities	Concerned municipalities	-	BFAR, LGU, Seaweed farmers
	• Strict implementation of Municipal Fisheries	Concerned municipalities	Concerned municipalities	Concerned municipalities	Concerned municipalities	Concerned municipalities	-	BFAR, LGU, Seaweed farmers

ACTION / STRATEGY / DESCRIPTION (OBJECTIVES)	PROGRAM / ACTIVITY / PROJECT	PHYSICAL AND FINANCIAL TARGETS					TOTAL (Php)	RESPONSIBILITY
		2022	2023	2024	2025	2026		
	Ordinances (MFOs) and other relevant laws, rules and regulations on seaweed farming							
	• Conduct of Information, Education and Communication (IEC) Campaign on the use of eco-friendly farm implement in seaweed farming to maintain good quality of seaweeds	4,650 pc (IEC materials) Php 765 k	4,650 pc (IEC materials) Php 765 k	4,650 pc (IEC materials) Php 765 k	4,650 pc (IEC materials) Php 765 k	4,650 pc (IEC materials) Php 765 k	23,250 pc Php 3.825 M	BFAR, LGU, Seaweed farmers

Region 11

	Key Challenges	Recommendations	Strategies								
			Short term			Medium term			Long Term		
			Action Plan	Outputs and Outcomes	Key Stakeholders (Implementers, Enablers etc)	Action Plan	Outputs and Outcomes	Key Stakeholders (Implementers, Enablers etc)	Action Plan	Outputs and Outcomes	Key Stakeholders (Implementers, Enablers etc)
1	Price monopoly by traders/consolidators	Establish more market; market matching	Conduct weekly price monitoring on the prevailing price of raw dried and fresh seaweeds	Weekly price bulletin Monitor price	BFAR DTI LGU	Draft, submit resolution and conduct public consultation for the establishment of SRP for RDS and fresh seaweeds	Number of public consultations conducted; Number of resolutions, minutes and synthesis passed during consultation; Finalized and submitted pertinent documents to be approved for the development and establishment of SRP for RDS and fresh seaweeds	BFAR DTI LGU PO Private Stakeholders Other concerned agencies	Develop national policy on the establishment of SRP for RDS and fresh seaweeds	Approved and implemented national policy on SRP for RDS and fresh seaweeds	BFAR DTI LGU PO Private Stakeholders Other concerned agencies
2	Low quality of seaweed propagules	Introduce propagules from other source (e.g Barobo); Community-based researches such as diversification of varieties	Conduct profiling of the potential areas; Establish new seaweed technology demonstration farm	Generate profile from inputs to market; Established demo farm; higher growth rate and survival; good quality of carrageenan	BFAR LGU Academe Seaweed Farmers/Growers	Technology - transfer and dispersal of the new seaweed propagules to farmers, association/cooperatives	Adaption of technology; Number of beneficiaries; produced good quality seaweed and carrageenan with high ROI	BFAR LGU Academe Seaweed Farmers/Growers	Mass production of seaweeds	Produced large volume and high quality seaweeds and carrageenan	BFAR LGU Seaweed Farmers/Growers
3	Chemical run-off/ discharges from industrial plant	File complaint; Intensive environmental monitoring	File complaint to concerned agencies	Filed complaint to concerned agencies; Action conducted by concerned agencies regarding on the filed complaint	BFARMC/BLGU LGU DENR BFAR	Conduct regular sampling and monitoring activities; Implementation of the Clean Water Act.	Monitoring of laboratory results and reports; observance and copmpliance of establishments/industrial plants on the Celan Water Act	BFARMC/BLGU LGU DENR BFAR			
4	Lack of instruments or apparatuses used for water sampling	Establish local laboratories for efficient environmental monitoring	Establishment of local laboratories (LGU managed)	Number of local laboratories established; procurement of basic instruments and apparatuses used for water sampling	LGU	Conduct trainings for laboratory personnel	Number of personnel trained	BFAR LGU	Maintenance of local laboratories; Capacity building and strengthening of laboratory personnel	number of laboratories maintained; personnel strengthened and capacitated	BFAR LGU
5	Davao del Sur: Expansion of seaweed areas to fish cage areas	Stop conversion of seaweed areas to fish cages area thru an ordinance	Request to LGU on the status of the zoning ordinance	Activity/Dialogue reports; Updated zoning ordinance (CLUP)	Seaweed Farmers/Growers LGU	Draft and submit resolutions/ordinances for the delineation of aquaculture areas	Resolutions/Ordinance crafted and submitted	LGU BLGU BFARMC	Implement approved Resolutions/Ordinance	Monitoring Reports; Observance on the compliance of the implemented ordinance	LGU BLGU BFARMC

6	Davao City: Industrialization - port development and other structures	Conduct dialogue with the concerned persons; review and revisitation of the CLUP (whether industrial or aquaculture zone)	Request to LGU on the status of the zoning ordinance	Activity/Dialogue reports; Updated zoning ordinance (CLUP)	Seaweeds Farmers/Growes LGU	Draft and submit resolutions/ ordinances for the establishment of aquaculture zone	Resolutions/Ordinance crafted	LGU BLGU BFARMC	Implement approved Resolutions/Ordinance	Monitoring Reports; Observance on the compliance of the implemented ordinance	LGU BLGU BFARMC
7	Infestation of epiphytes (Local: Siring - sisi-like)	Conduct of research regarding the infestation of the "siring";	Draft and submit proposals for research for the prevention of emerging diseases	Proposals drafted and submitted; Proposal approved and for funding	BFAR LGU Seaweed Farmers Academe	Conduct of research in the prevention of emerging epiphytes/diseases	Researches conducted; Reliable data for the prevention and eradication of emerging epiphytes/diseases	BFAR LGU Seaweed Farmers Academe	Technology-transfer	Adoption of technology by seaweed farmers/growers	BFAR LGU Seaweed Farmers Academe
8	Environmental factors - seasonal (September - March - nindot ang tubo)	Expansion areas; Need other livelihood interventions during off-season;	Transfer to other potential areas (undisturbed by seasonal patterns); provision of fishing gears and paraphernalias;	Good quality of seaweed produced in potential areas; fishing gears or paraphernalias distributed	LGU Seaweed Farmers/Growers	Observe and repeat necessary action plan in every change of season (e.g. from Habagat to Amihan or Amihan to Habagat); As			Observe and repeat necessary action plan in every change of season (e.g. from Habagat to Amihan or Amihan to Habagat); As need arises		
9	No available facilities and machineries for seaweed processing	Establish processing facilities and machineries	Assessment and validation for the types and number of facilities and machineries needed	List of facilities and machineries needed	BFAR PLGU/LGU Seaweed Farmers/Growers	Draft and submit proposals for the establishment and provision of facilities and machineries	Proposals drafted and submitted; Proposal approved and for funding	BFAR LGU DTI DOST Seaweed Farmers/Growers Other concerned agencies and Pos	Establishment of processing facilities and distribution of machineries Monitoring and evaluation	Number of facilities established and machineries distributed Number of monitoring conducted	BFAR LGU DTI DOST Seaweed Farmers/Growers Other concerned agencies and Pos
10	Lack of trainings to improve existing technologies	Train the seaweed farmers/growers for new seaweed culture/farming technologies	Conduct trainings;	trainings conducted; Technology-transfer;	BFAR Academe LGU Seaweed Farmers/Growers	Implementation and adoption of new technologies in seaweed culture/farming	Successful adoption of new technologies in seaweed culture/farming; Mass production of seaweeds using the new technology	LGU Seaweed Farmers/Growers	Establish learning/training sites for seaweeds farming	Training/learning sites established; Stakeholders benefited on the learning/training sites established	BFAR LGU Seaweeds Farmers and Growers NGOs ATI Private
11	High cost of Production Inputs	Access to loan credits; provision/subsidized materials for seaweeds farming	Submit project proposals and requirements to lending institutions; Request letter with attached list of beneficiaries to PLGU/LGU	Number of loans granted; Provision of materials for seaweed farming	BFAR PLGU/LGU Seaweed Farmers/Growers	Encourage associations to form cooperatives	Number of associations turned to cooperatives	CDA LGU BFAR People's organization	Established cooperatives	Number of cooperatives established	CDA LGU BFAR

1	Explore more fertilizer such as nanosilver or organic fertilizer for a better production	Conduct of research studies	Draft and submit proposals for research	proposals drafted and submitted;	BFAR Academe LGU Seaweed Farmers/Growers	Encourage key stakeholders in the conduct of research	Researches conducted/output	BFAR Academe LGU Seaweed Farmers/Growers	Technology-transfer	Number of farmers adapted of the new technology	BFAR Academe LGU Seaweed Farmers/Growers
	Develop another product from seaweeds	Establish processing facilities and machineries	Assessment of needed facilities and machineries	Type of facilities and machineries needed	Seaweeds Farmers/Growers LGU BFAR DTI DOST and other concerned agencies	Draft and submit proposals for the establishment of facilities/machineries	Proposals drafted and submitted; Proposal approved and for funding	Seaweeds Farmers/Growers LGU BFAR DTI DOST and other concerned agencies	Establishment of processing facilities and distribution of machineries Monitoring and evaluation	Number of facilities established and machineries distributed; Monitoring of facilities and machineries established and distributed; Mass production of produced products	Seaweeds Farmers/Growers LGU BFAR DTI DOST and other concerned agencies

CARAGA

Action/Strategy/Description (Objectives)	Program/Activity/Project	Physical & Financial Targets					Total (Php)	Responsibility
		2022	2023	2024	2025	2026		
1. Increased seaweed production by 2% growth annually for 5 consecutive years (2022-2026)	Establishment of land-based and sea-based nurseries as source of quality seedlings for whole-year around	One (1) land-based nursery established & one (1) sea-based nursery established (Barobo, Surigao del Sur) = Php 3,500,000.00	One (1) land-based nursery established & one (1) sea-based nursery established (Hinatuan, Surigao del Sur) = Php 3,500,000.00	One (1) land-based nursery established & one (1) sea-based nursery established (Lianga, Surigao del Sur) = Php 3,500,000.00	One (1) land-based nursery established & one (1) sea-based nursery established (Cagdianao, Province of Dinagat Islands = Php 3,500,000.00	One (1) land-based nursery established & one (1) sea-based nursery established = Php 3,500,000.00	Php 17,500,000.00	BFAR, LGU
	Established of localized seaweed nurseries	Three (3) local seaweed nurseries establised (Php 200,000 per nursery)= Php 600,000.00	Three (3) local seaweed nurseries establised (Php 200,000 per nursery)= Php 600,000.00	Three (3) local seaweed nurseries establised (Php 200,000 per nursery)= Php 600,000.00	Three (3) local seaweed nurseries establised (Php 200,000 per nursery)= Php 600,000.00	Three (3) local seaweed nurseries establised (Php 200,000 per nursery)= Php 600,000.00	Php 3,000,000.00	BFAR, LGU
2. Increase income of seaweed farmers	Farm management training	Two (2) farm management trainings conducted (100,000 per training)= Php 200,000.00	Two (2) farm management trainings conducted (100,000 per training)= Php 200,000.00	Two (2) farm management trainings conducted (100,000 per training)= Php 200,000.00	Two (2) farm management trainings conducted (100,000 per training)= Php 200,000.00	Two (2) farm management trainings conducted (100,000 per training)= Php 200,000.00	Php 1,000,000.00	BFAR,LGU

	Financial literacy & management training	Two (2) financial literacy and management trainings conducted (100,000 per training)= Php 200,000.00	Two (2) financial literacy and management trainings conducted (100,000 per training)= Php 200,000.00	Two (2) financial literacy and management trainings conducted (100,000 per training)= Php 200,000.00	Two (2) financial literacy and management trainings conducted (100,000 per training)= Php 200,000.00	Two (2) financial literacy and management trainings conducted (100,000 per training)= Php 200,000.00	Php 1,000,000.00	BFAR,LGU
3. Improve marketing linkages of seaweed farmers	Promotion of seaweed products (fresh, dried & food based) thru local trade fair/fishery products exhibit	4 trade fair conducted (100,000 per trade)= Php 400,000.00	4 trade fair conducted (100,000 per trade)= Php 400,000.00	4 trade fair conducted (100,000 per trade)= Php 400,000.00	4 trade fair conducted (100,000 per trade)= Php 400,000.00	4 trade fair conducted (100,000 per trade)= Php 400,000.00	Php 2,000,000.00	BFAR,DTI
4. Capacitate seaweed farmers & farmers organization	Cooperative organizing	2 cooperatives organized (Php 500,000 per coop)= 1,000,000.00	2 cooperatives organized (Php 500,000 per coop)= 1,000,000.00	2 cooperatives organized (Php 500,000 per coop)= 1,000,000.00	2 cooperatives organized (Php 500,000 per coop)= 1,000,000.00	2 coops organized (Php 500,000 per coop)= 1,000,000.00	Php 5,000,000.00	BFAR,CDA,LGU
	Post-harvest trainings	Two (2) post-harvest trainings conducted (100,000 per training)= Php 200,000.00	Two (2) post-harvest trainings conducted (100,000 per training)= Php 200,000.00	Two (2) post-harvest trainings conducted (100,000 per training)= Php 200,000.00	Two (2) post-harvest trainings conducted (100,000 per training)= Php 200,000.00	Two (2) post-harvest trainings conducted (100,000 per training)= Php 200,000.00	Php 1,000,000.00	BFAR,LGU
5. Promote community-based value added products & fresh seaweeds for food and nutrition security	Provision of post-harvest equipment	seaweed associations/cooperatives received materials & equipment for seaweed value-added products (350,000 per coop/association)= Php 700,000.00	Two (2) seaweed associations/cooperatives received materials & equipment for seaweed value-added products (368,000 per coop/association)= Php 736,000.00	seaweed associations/cooperatives received materials & equipment for seaweed value-added products (387,000 per coop/association)= Php 774,000.00	seaweed associations/cooperatives received materials & equipment for seaweed value-added products (407,000 per coop/association)= Php 814,000.00	seaweed associations/cooperatives received materials & equipment for seaweed value-added products (423,000 per coop/association)= Php 846,000.00	Php 3,870,000.00	BFAR, LGU
6. Addressed threats affecting the integrity and superiority of the Philippine carrageenan	Modernization of drying facility	Provision of floating-type seaweed dryer; 3 units (Php 450,000 each)= 1,350,000.00	Provision of floating-type seaweed dryer; 3 units (Php 450,000 each)= 1,350,000.00	Provision of floating-type seaweed dryer; 3 units (Php 450,000 each)= 1,350,000.00	Provision of floating-type seaweed dryer; 3 units (Php 450,000 each)= 1,350,000.00	Provision of floating-type seaweed dryer; 3 units (Php 450,000 each)= 1,350,000.00	Php 6,750,000	BFAR, LGU, UPLB

APPENDIX 3: Directory of Stakeholders

THE PHILIPPINE SEAWEED INDUSTRY ROADMAP
1st Consultation Meeting
Via Zoom

DIRECTORY

NAME	AFFILIATION
1. Mr. Demosthenes F. Togonon	BFAR
2. Ms. Irma Ortiz	BFAR
3. Mr. Wilfredo Fajardo	BFAR
4. Ms. Ida Capacio	BFAR
5. Ms. Maricel Pino	BFAR
6. Fernando B. Fernandez, Jr.	BFAR
7. Mr. Ryan Idica	BFAR
8. Ms. Flor Raya	BFAR
9. Dr. Danilo Lagro	University of San Carlos
10. Dr. Michael Roleda	UPMSI
11. Mr. Marcial Solante	SIAP
12. Mr. Alfredo Pedrosa	SIAP
13. Mr. Ronald Simbajon	SIAP
14. Mr. Lauro Zulueta	SIAP
15. Mr. Maximo Ricohermoso	SIAP
16. Ms. Meme Dakay	SIAP
17. Mr. Antonio Yuri Yap	SIAP
18. Mr. Carl Rendon Tuñacao	SIAP
19. Mr. Conan Edugawa	SIAP
20. Ms. Jona Chiu	SIAP

THE PHILIPPINE SEAWEED INDUSTRY ROADMAP

2nd Consultation Meeting

March 25, 2021

Via Zoom

DIRECTORY

NAME	AFFILIATION
1. Mr. Demosthenes F. Togonon	BFAR
2. Ms. Irma Ortiz	BFAR
3. Mr. Wilfredo Fajardo	BFAR
4. Ms. Ida Capacio	BFAR
5. Mr. Fernando B Fernandez Jr.	BFAR
6. Ms. Vicenta Projima	BFAR
7. Mr. Rhemar Bayato	BFAR
8. Ms. Lydia noblefranca	BFAR
9. Mr.Mark Alphonse	BFAR
10. Ms. Sancho Bilog	BFAR
11. Ms. Maricel Pino	BFAR
12. Mr. Rolando Andres	BFAR
13. Ms. Sheena Asas	BFAR
14. Ma. Salvacio Ferrer	NFRDI
15. Mr. Paul Ramirez	University of the Philippines

THE PHILIPPINE SEAWEED INDUSTRY ROADMAP

3rd Consultation Meeting

July 1, 2021

Via Zoom

DIRECTORY

NAME	AFFILIATION
1. Mr. Demosthenes Togonon	BFAR
2. Ms. Irma Ortiz	BFAR
3. Mr. Wilfredo Fajardo	BFAR
4. Mr. Isidro Velayo	BFAR
5. Roberto Abrera	BFAR
6. Mr. Fernando B. Fernandez, Jr.	BFAR
7. Mr. Rolando Andres	BFAR
8. Ms. Ida Capacio	BFAR
9. Ms. Vicenta Projimo	BFAR
10. Rhemar Bayato	BFAR
11. Lydia Noblefranca	BFAR
12. Ms. Maricel Pino	BFAR
13. Mr. Rene Regaspi	BFAR
14. Mr. Marlon Alejandro	BFAR
15. Ms. Sancho Bilog	BFAR
16. Ms. Baby K. Dindo	BFAR
17. Mr. Mark Buniel	BFAR
18. Mr. Timhar Hussin	BFAR
19. Dr. Anicia Hurtado	Integrated Services for the Development of Aquaculture and Fisheries, Inc.
20. Dr. Michael Roleda	UP MSI
21. Mr. Alfredo Pedrosa	SIAP
22. Mr. Paul Ramirez	University of the Philippines

THE PHILIPPINE SEAWEED INDUSTRY ROADMAP

4th Consultation Meeting

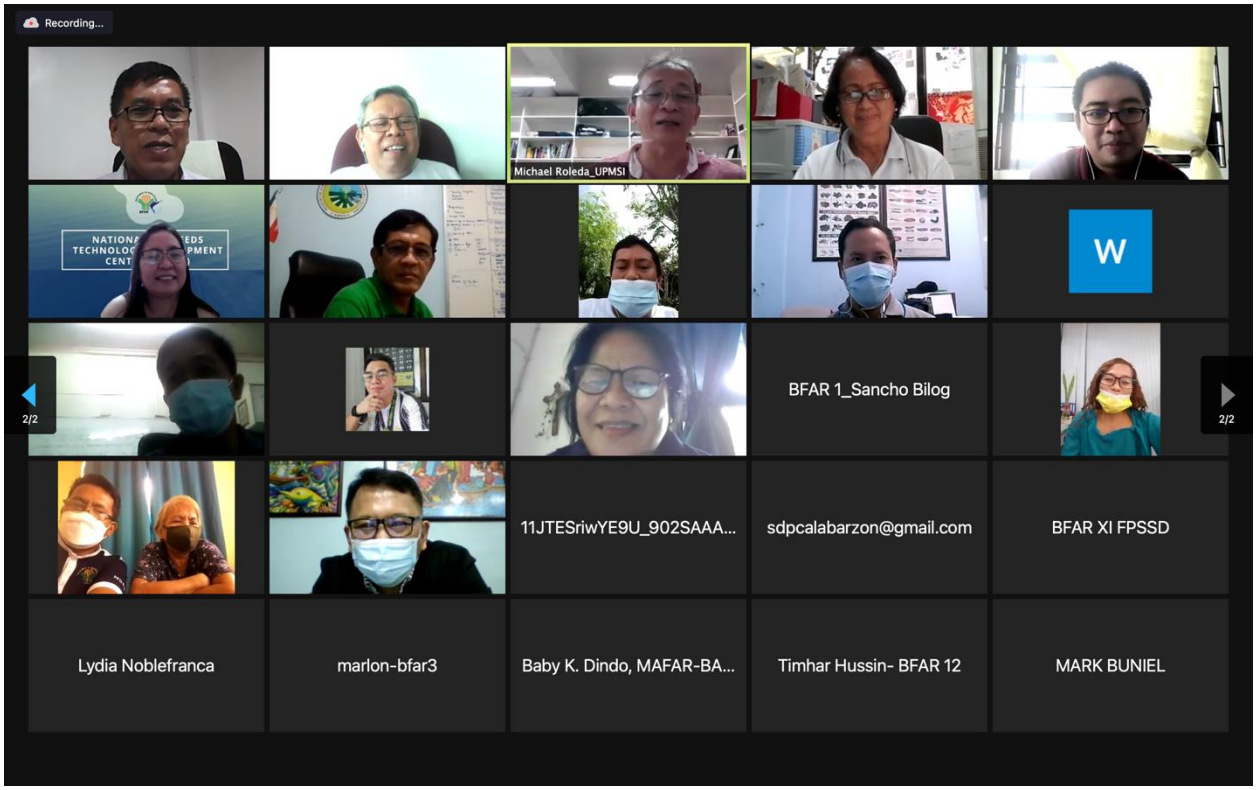
July 29, 2021

Via Zoom

DIRECTORY

NAME	AFFILIATION
1. Mr. Demosthenes Togonon	BFAR
2. Ms. Irma Ortiz	BFAR
3. Mr. Wilfredo Fajardo	BFAR
4. Mr. Domingo Torres	BFAR
5. Ms. Ida Capacio	BFAR
6. Joel Clapano	BFAR
7. Ms. Maricel Pino	BFAR
8. Mr. Rolando Andres	BFAR
9. Ms. Ma. Salvacion Ferrer	NFRDI
10. Dr. Floredel Galon	Palawan State University
11. Dr. Anicia Hurtado	Integrated Services for the Development of Aquaculture and Fisheries, Inc.
12. Dr. Marco Nemensio Montaño	UP MSI
13. Mr. Marcial Solante	SIAP
14. Francis Peñaflor	DTI BOI
15. Paul Ramirez	University of the Philippines

APPENDIX 4: Photo Documentation of Virtual Meetings




Recording Paused
View
Lydia Noblefranca
SDP - Jhun Fernandez
SDP - irma ortiz
BFAR 10, FPSSD
Joel Clapano BFAR 7
Maricel pino bfar 7
wilfredo fajardo
SDP Flor Raya
Neil P. Harder
National Seaweed Develop...
BFAR XI - Jester Namuag
SDP-denz togonon
BFAR IX Muhaimin S. Maharail
BFAR4A-Domingo L. Torres
BFAR -VIII Vicenta Projimo
BFAR6 - FPSSD - Rodante Dana
BFAR IFAD Gelli Naig
BFAR NSTDC_Nia Franche
BFAR12-RSCU
jhunfernandez
Rolando Andres
BFAR9-FPSSD
BFAR 10, Ronald Escobido
FPED Franc Jacob Sabacan
Mute
Stop Video
Security
Participants
24
Chat
Share Screen
Resume/Stop Recordir
Stop Recording (⇧⌘C)
End

Department of Agriculture
BUREAU OF FISHERIES AND AQUATIC RESOURCES

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