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Supply Chain of Seaweeds in Surigao Del Sur, Philippines

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ABSTRACT

The Province of Surigao del Sur, Philippines, is blessed with abundant marine resources that offer tourism and food industries. One of the resources that provide food and livelihood to the coastal stakeholders is the seaweed farming industry in the selected municipalities where seaweeds farming is viable. This study aimed to trace the supply chain of seaweeds in the Province

of Surigao del Sur. It includes the socio-economic and demographic profile of the seaweed farmers and the seaweed production capacity of the volume harvested per cycle; it identified problems encountered by farmer/grower, producer, and processor. The study employed qualitative and quantitative methods in generating data. The study revealed that the seaweed farmers/growers in the Province have direct intervention in selling their product to the trader and local processor while the exporter is not directly related to the farmers/grower. The trader also sells their product to the exporter, retailer, and wholesaler. Likewise, the retailer, local processor, and wholesaler also sell their product on their own and vice-versa. The retailer also sells its product to direct consumers. Growers also engaged in seaweed drying. Seaweed products are traded within barangays, municipalities, provinces, and the region. Responses on environmental management on farming and harvesting, marketing are all favorable; however, some responded that marine pollution increased due to farmers failed to follow good aquaculture practices. The LGU's and BFAR should work hand in hand to support the seaweed farmers in terms of capital, trainings, technical assistance, and provision of inputs and post-harvest facilities so that seaweed farmers/growers could continue to produce more good quality seaweeds, dried seaweeds, and minimize post-harvest losses, and expand seaweed farm to increase the volume of seaweed production.

KEYWORDS

Seaweed, coastal stakeholders, seaweed farming, mixed-method research design, Philippines

INTRODUCTION

Over the past decades, the integration of developing countries in global markets has accelerated with increased participation in international trade and growing inflows of foreign direct investment. As a result, there have been swift changes in the Agri-food systems of developing countries and a rapid expansion of the so-called modern supply chain. These modern food supply chains comprise the production and trade of high-value produce, usually destined for export to high-income markets or supermarket retail in high-income urban market segments. They are also characterized by high standards to govern quality and food safety throughout the chains, high

levels of vertical coordination – including contract-farming- in the chains, and a high degree of consolidation of the supply base and agro-industrial processing. This is in contrast to more traditional food supply chains that are governed through spot market transactions involving a large number of small traders (Maertens, et al., 2012).

A supply chain is a network of retailers, distributors, transporters, storage facilities, and suppliers that participate in the production, delivery, and sale of a product to the consumer (Harland, 1996 as cited by De Silva, 2011). According to De Silva (2011), the supply chain is typically made up of multiple companies who coordinate activities to set themselves apart from the competition. A supply chain has three key parts. These are the supply which focuses on providing the raw materials to marketing units, including how, when, and from what location, manufacturing which focuses on converting these raw materials into semi-finished or finished products and Distribution focuses on ensuring these products reach the consumers to an organized network of distributors, warehouses and retailers. Supply chains are concerned with what it costs and how long it takes to present the product for sale. The main objectives of supply chain management are to reduce the number of links and friction, such as bottlenecks, costs incurred, time to market etc. A good supply chain is essential to developing a value chain.

One of the resources that provided food and livelihood to the coastal stakeholders is the seaweed through seaweed farming in the selected municipalities that seaweeds' farming is very viable. Many of the coastal residents opted for seaweed farming for they believed that after several months of culture, if not hindered by bad weather, seaweed income is definitely feasible. The most common and popular species of seaweeds used in farming are the *Kappaphycus alvarezii and Eucheuma cottonii* because of their good growth and easy-to-culture species. It provides many benefits, such as being environmentally friendly and contributing to revenues (The Philippine Seaweed Industry, 2011).

Caraga Region has a total area of 531.80 hectares for seaweed production. The provinces of Surigao del Sur and Surigao del Norte are the major seaweed-producing provinces, with existing production areas of 350.8 hectares and 58.7 hectares, respectively. In 2003, the region ranked third in Mindanao in seaweed Production with 16,701.50 metric tons. The officers and representatives of the different associations of seaweed producers and the local buyers and traders make up the seaweed cluster. There are 495

seaweed growers region-wide, which are concentrated in the province of Surigao del Sur and Surigao del Norte (BFAR Caraga, 2018). Through this, the present study aims to assess the supply chain of seaweed in the Province of Surigao del Sur as the benchmark in the successful production of seaweed and to meet customer demand. In addition, the supply chain will also help optimize the activities of each chain that lead to competition in the global market.

OBJECTIVES OF THE STUDY

The main objective of the study is to trace the supply chain of the seaweed industry in Surigao del Sur, Philippines. Specifically, the study aims to determine the socio-economic and demographic profile of the actors of seaweed (farmer/grower, traders, and processor). The seaweed production capacity in terms of the volume harvested per cycle and the problems encountered by the actors of seaweeds (farmer/grower, producer, and processor) are identified and mapped the seaweed supply chain in the Province.

METHODOLOGY

The Locale of the Study

The study was conducted in the Province of Surigao del Sur, specifically in the Cities of Bislig and Tandag and Municipalities of Barobo, Lianga, Cagwait, and San Agustin. The Province of Surigao del Sur is the 56th Philippine province and is located in the Northeastern coast of Mindanao facing the Pacific Ocean between 125°40′ to 126°20′ East Longitudes and 7°55′ and 9°20′ North latitude.

Data collection

The data consisted of interviews of the key informants and a structured questionnaire. The structured questionnaires were administered to respondents like growers, traders, and processors. A survey tool was used in this study and was prepared in the English language; however, responses in Visayan dialect were considered for a better understanding of the issue.

BISLIG CITY	TANDAG CITY	SAN AGUSTIN	CAGWAIT	BAROBO	LIANGA
Seaweed Farmers Association	Mabua Fisherfolk Association	BMPC - Britania Multipurpose Cooperative	Aras-asan Fisherfolk Association	**Kamayo Bul-anon, Marine Association**	NONE
Womens Organization	CFARMC	Single Proprietor		Talisay small fishers Organization	
Caguyao Seaweed Farmers Association	NETOSFO				

Figure 1. Map of the study area showing the six (6) municipalities in Surigao del Sur

RESULTS AND DISCUSSION

SOCIO-ECONOMIC AND DEMOGRAPHIC PROFILE OF SEAWEEDS FARMERS

The respondents were randomly interviewed from the communities of the four (4) municipalities of Lianga, Barobo, Cagwait, San Agustin, and two (2) cities in Tandag and Bislig in the Province of Surigao del Sur wherein seaweeds farming has existed in the area. Their socio-economic and demographic profiles were determined (Table 1).

Table 1. Socio-Economic and Demographic Profile of Seaweed Farmers in Surigao del Sur

Profile		Percentage
Sex	Male	87.7
	Female	12.3
Educational Attainment	Elementary Level	12.3
	Elem. Graduate	25.3
	High School Level	17.5
	High School Graduate	33.8
	College Level	11.2
Years in Business	2-5 Years	41.7
	6-10 Years	33.8
	11-15 Years	15.1
	20 Years & Above	18.6
Main Source of Capital	Own Savings	36.3
	Partnership	4.7
	Family	11.4
	NGO/LGU	35.0
	Others (BFAR Dispersal)	13.9
Technical Assistance Received	Yes	71.7
	No	24.9
Species Preference	Eucheuma cottonii	70.1
	Eucheuma alvarezii	29.9
No. of Monolines Employed by the Seaweed Farmer	1-5 Monolines	29.9
	6-10 Monolines	19.6
	11-15 Monolines	17.8
	16-25 Monolines and above	36.3
No.of Days Farmers Harvested Seaweeds	Every Week	6.0
	Every Month	35.3
	3 Months	6.2
	2 Months	16.2
	45 Days	35.4

For farmers' active participation in the industry, the majority responded their engagement already lasted for more than five (5) years. Their roles in the seaweeds industry helped and made the Province of Surigao del Sur one of the major seaweeds producers in the Caraga Region. In terms of their monetary start-up investment, seaweeds farmers got their source of capital through their initiatives and efforts, from their own pocket and from their family supports. While others like seaweeds, farmers from Bislig City and Tandag City, were lucky because they got financial support from Non-Government Organizations and Local Government Units through PDAP/ CODESPA and from the Bureau of Fisheries and Aquatic Resources (BFAR) for seedlings dispersals. With the concerted efforts of the NGO, LGU, and other partner agencies, seaweed farming has become more sustainable, provided livelihood to the families, and made Surigao del Sur one of the major producers of seaweeds.

Most of the respondents received technical assistance because most of them are recipients of the seaweed development program implemented by the BFAR in coordination with the Local Government Unit-Municipal Agriculture Office of each municipality. Technical assistance was given through seedling dispersal and validation of the area. If it is possible, seaweed farming and the management of culturing seaweed will be recommended. With the two (2) identified seaweeds *Eucheuma cottonii* was mentioned to be the most common species used in planting may be due to its excellent growth and yield seaweeds' characteristics. Seaweed farmers cultured *Eucheuma cottonii* and *Kappaphycus alvarezii* because these species are highly valued in market price and easy to culture and in-demand in the global market.

For monolines used, responses vary, perhaps due to limitations given to each grower and the area of the seaweed farming allocated to every operator by each municipality. Monolines technique is used in the cultivation of seaweed growing by the seaweed farmers in the Province of Surigao del Sur. Per observation and encounters with seaweeds growers, harvesting of seaweed is very 45 days. Fully matured seaweeds are usually 45 days old but used for drying. Some seaweed farmers waited for 2-3 months before harvesting their seaweeds to get a higher volume of harvest. Excellent quality of seaweeds is obtained in this period. This implies that seaweed farmers harvested their seaweed depending upon the number of days and weather conditions. On the other hand, in Tandag City, some of the farmers

were not satisfied and discouraged by the prevalence of ice-ice disease and the lack of capital. Some of them, while farming seaweed ventures, also go fishing for additional income.

Table 2. Farmers' Income and Harvest flow of Seaweeds

Farmers' Income and Harvest flow		Percentage
Income Per Harvest	5,000-10,000	81.2
	11,000-15,000	9.7
	16,000-20,000	3.8
	21,000 and above	5.3
No. of Seaweed Market/ Outlet of Selling The Seaweed	Within the Barangay	35.8
	Within the Municipality	11.7
	Within Province	42.5
	Within the Region	10.0
Buyer of Seaweed	Wholesaler	51.0
	Retailer	28.2
	Importer	0.0
	Exporter	20.8

The income of most seaweeds farmers ranges from 5,000-10,000 per cropping. According to the seaweed farmers, the income generated from farming can already support the families. However, when challenged on the occurrence of the ice-ice disease and typhoon, these can be their rival in the means of living. With regards to their markets and outlets of the seaweeds, farmers traded their yields to the local traders, retailers, wholesalers, and to exporters in the province and in the region. In the case of Bislig growers, their seaweeds are immediately brought to the local buyer, their organization, the Seaweeds Farmers Association, and become a wholesaler. Buyers also differ from each municipality, maybe due to the numbers of entrepreneurs, accessibility, and the bulk of supply. Forming and engaging in an organization is also advantageous in a business like this. If the organization is sustained, funding from an outside source is possible. Support from private and public partnerships is accessible. So that seaweed farmers formed their association to acquire support from each other and from an outside source. Financial, materials, and technical supports are possible when the association is sustained.

Lianga is the only municipality in the province that processed seaweeds to "Seaweed Pickles" INDOG Lianga delights. The product was already distributed/ marketed within the province, in the region, and outside the country. The industry is managed by the INDOG Lianga, supported by the Bureau of Fisheries and Aquatic Resources (BFAR) and the Surigao del Sur State University- Lianga Campus for technical support.

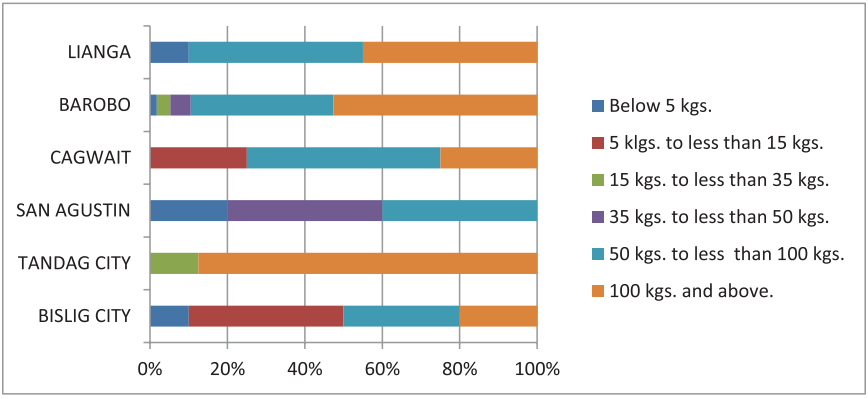

Figure 2. Total kilograms harvested by seaweed farmer per Cycle.

Figure 2 presents the kilograms harvested by seaweed farmers per cycle. This figure shows that Tandag City (87.5%) has the highest average volume of seaweed harvested per cycle and sold the product of about 100 kgs above, followed by Barobo (50.80%) and Lianga (45%). This is because most of the seaweed farmers employed a greater number of monolines from 16-25 monolines and 26 monolines and above that helped greater harvest volume.

Table 3. Perceptions of Seaweeds Farmers in Marketing

The dried seaweed is kept at home before being sold	
Agree	47.7
Disagree	16.7
Neutral	2.3
The price of dried seaweed conforms with the expectations of farmers	
Agree	23.4
Disagree	39.9
Neutral	3.4
The marketing system for dried seaweed is still useful	
Agree	58.1
Disagree	8.3
Neutral	0.3
The price of dried seaweed is always fluctuating	
Agree	50.2
Disagree	12.8
Neutral	1.4

Table 3 shows the perceptions of seaweed farmer respondents in marketing. The result shows that most respondents agreed that the dried seaweed is kept at home before being sold, especially if there were no available buyers and they can be sold into a greater volume, that the price of dried seaweed conformed with the expectations of farmers, that the marketing system for dried is still useful since there were direct traders that buy their products, and that the price of dried seaweed is always fluctuating because just like any other world commodity, the prices are dictated by the world market.

Table 4. Challenges on Seaweed Farming

Challenges	Mean	Adjectival Rating
Changes in two monsoon Seasons	4.2	Extreme challenge
Seed availability at the farm level	1.2	No challenge
The quality of seaweed seeds	3.4	Moderate challenge
Occupation by seaweed farms by farmers	3.4	Significant challenge
Predators and/or diseases	4.7	Extreme challenge

Challenges	Mean	Adjectival Rating
Financial Capital	4.7	Extreme challenge
Farming Method	1.2	No challenge
Post-Harvest Processing	2.3	Slight challenge
The Price of Dried Seaweed	2.3	Slight challenge
Marketing Channel for Dried Seaweed	2.6	Slight challenge
Fishermen's Training	2.2	Slight challenge

Table 4 shows the challenges in developing seaweed farming. Results revealed that the changes in two monsoon seasons is one of the rivals of seaweeds farmers since this will occur the ice-ice disease of the seaweed. Other challenges also differ from municipality to municipality for some reasons. One is the geographic location of the farm area, where the area may be characterized by less freshwater tributaries, and the area is secured to heavy waves that damage the plantation.

The seed availability at the farm level was not a major challenge during the harvest. They left seaweed seedlings for them to use in the second cycle, and there were also seaweed farmers in their area to buy the seaweed seedling. The quality of the seaweeds seeds majority is not a problem for them since BFAR/NGO (PDAP/CODESPA) and DTI give them quality seeds, and some are a moderate challenge for them because they are not following good aquaculture practices. The occupation of seaweed farms, for farmers, the majority are not a test to them since they were benefited already of the farming activity. The willingness of the growers to develop their coastal area was is not a challenge, for they also wanted to improve and increase their production.

The predators and diseases were extremely challenged to them because some predators like Siganid and barnacles ate the seaweeds and the barnacles attached to the seaweeds. Ice-ice disease and epiphytes will affect the growth of seaweed. The additional bigger financial capital of the seaweed farmers is another challenge to them because usually, they are dependent on their own savings, and some seaweed farmers were given by the BFAR through seaweed seedlings dispersal. The farming method was not an obstacle for them since the method used was the monoline which was easy for them to operate, and the materials were already available in the area.

The postharvest processing was a slight challenge for them, especially in Barobo and Lianga since their products were bought by the INDOG Lianga seaweed pickles delights. The price of dried seaweed and marketing channel for the dried seaweeds are not such a challenge to them since there were traders who buy the products, and fishermen's training was not a problem as well because the BFAR has conducted trainings to the seaweed beneficiaries prior to the seaweed farming and the fluctuating price was a slight problem.

Among the challenges encountered in the processing of seaweeds are the changes in monsoon seasons, supply availability, duration in processing, machines/ equipment, financial capital, manpower, storage facilities, pricing system, marketing system but still the processing is continued, which helped the seaweed farmer in Lianga and neighbouring municipalities in the Province of Surigao del Sur. The BFAR also helped them in the procurement of machines and equipment used in the processing and the BFAR in the purchase and display during the agri-aqua fair and exhibits for product promotion and marketing. Only Lianga engaged in seaweed processing because they were strongly supported by the SDSSU, LGU, and BFAR Caraga Region.

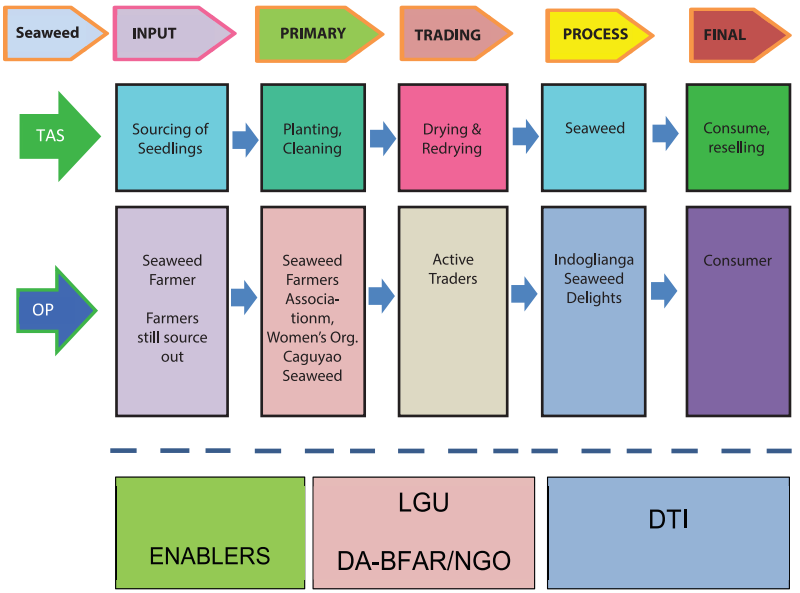

Figure 4. Supply Chain of Seaweed in the Province of Surigao del Sur

Figure 4 shows the supply chain of seaweeds in the Province of Surigao del Sur. This indicates that there were several stages in the supply chain like the input supply, primary production, trading, processing, and final sale. Each range has its own functions and with the assistance of the operators and enablers. The input provision includes the sourcing of seedling/ cultivars, monolines, posts, and floaters in which seaweed farmers sourced out their seaweed seedlings, ropes/styro/tie-wires, and floaters and it was still procured by farmers from junk yards. These input provisions were useful in preparation for seaweed farming. Then primary production was done, and this includes planting, cleaning/disease control, harvesting, drying, and transporting. The production was operated by different cooperatives and associations. In trading, it includes drying and re-drying, storage, and delivery and these were done by the active traders. In the processing, seaweed pickles were done by INDOG Lianga and they have directly collected, and procured the seaweeds from the seaweed farmers.

The final sale includes re-selling, retailing, and others were consumed by families as salad and other homemade food preparations. For the input provision and primary production, the LGU, DA-BFAR, and NGO are the concerned agencies and organizations that helped and supported the primary needs such as ropes, soft-ties, seaweed seedlings, posts and floaters. Likewise, the DTI is the concerned agency in support of trading, processing and final sale of the product. The DTI helps in marketing and market promotion.

CONCLUSIONS

The seaweed farmers/growers in the Province of Surigao del Sur, Philippines has direct intervention in selling their product to the trader and local processor while the exporter is not directly related to the farmers/ grower. The trader also sells their product to the exporter, retailer and wholesaler. Likewise, the retailer, local processor and wholesaler also sell their product on their own and vice-versa. The retailer also sells its product to direct consumers.

RECOMMENDATIONS

Based on the result of the study, the following recommendations are made. A disease-resistant seedling must be developed in the Province. The

LGU's and BFAR should work hand in hand to support the seaweed farmers in terms of capital, trainings, technical assistance, and provision of inputs and post-harvest facilities so that seaweed farmers/growers could continue to produce more good quality seaweeds, dried seaweed and minimize post-harvest losses, and expand seaweed farm to increase the volume of seaweeds production. Encourage the Cooperatives and Association to be a consolidator so that seaweed farmers/growers could have a direct buyer of their product and controller of the price of seaweed aquaculture practices in seaweed farming and follow the desired method to be able to harvest good quality seaweeds. Aside, enablers in the supply chain of seaweed in order to have strong coordination with other partner agencies to be committed to the success of the seaweeds industry in the Province.

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