Marketing Efficiency of Seaweed in Sinjai Regency, South Sulawesi, Indonesia

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Abstract
As a maritime country, Indonesia has a very diverse natural wealth consisting of biological resources, especially fisheries. Seaweed type of *Spinosum sp.* and *Gracillaria Sp* is a fishery commodity with important economic value and has global access which is exported to China, the European Union and Philippines. This study aimed to determine the form of marketing linkages and functions of seaweed marketing run by seaweed marketing institutions in Sinjai Regency, the role of farmer groups in influencing the seaweed marketing system in Sinjai Regency and the marketing efficiency of dried seaweed of *Eucheuma Spinosum Sp* and *Glacillaria Sp* in Sinjai Regency, Indonesia. This study used qualitative and linkages channels, marketing institutions and marketing functions, as well as market behavior through interviews and filling out questionnaires. The obtained presentation of the qualitative data during the implementation of the research was carried out descriptively. Quantitative data analysis was used to analyze marketing margins, and profit to cost ratio. The results of the marketing efficiency analysis showed that there were differences in costs, profits and margins obtained by each actor in seaweed marketing in Sinjai Regency. This difference was influenced by the implementation of marketing functions by each institution.

INTRODUCTION

Indonesia is the largest archipelagic country in the world with 17,504 islands and a sea area of 5.8 million km^2 (consisting of a territorial sea area of 0.3 million km^2, an area of archipelagic waters of 2.95 million km^2) (Pratama et al., 2017). Geo-politically (McNevin, 2014; Pramono et al., 2020), Indonesia has a very strategic role because it is located between the continents of Asia and Australia, as well as between the Pacific Ocean and the Indian Ocean, which places Indonesia as the world's maritime axis in the context of global trade (the global supply chain system) that connects the Asian-Pacific with Australia (Damelia & Soesilowati, 2016; FAO, 2018; Rimmer et al., 2021; Waldron et al., 2020).

As a maritime country, Indonesia has very diverse natural wealth, consisting of biological resources (especially fisheries) and non-biological resources such as mining, sea transportation, maritime industry and marine tourism (Ali & Sulistiyono, 2020; Kusuma et al., 2021; Rochwulaningsih et al., 2019). This natural wealth is one of the basic assets that must be

managed optimally to realize the welfare and prosperity of the Indonesian (Studies, 2020).

Seaweed is a fishery commodity that has important economic value and has broad global access and bright business prospects in national and international markets (Crawford, 2002; Monagail & Morrison, 2020; Teniwut et al., 2019; Yusuf et al., 2018). Seaweed is still widely exported in the form of raw materials in the form of dried seaweed. As much as 85.5% of production of dried seaweed raw materials is exported to China, European Union and Philippines (Badan Pusat Statistik (BPS), 2021).

Production of Indonesian seaweed which grows in the tropics is the largest production in the world. Indonesia's contribution in raw materials has also been recognized internationally (Bixler & Porse, 2011; Hurtado et al., 2014; Larson et al., 2021; Pambudi et al., 2010). This is because Indonesia has potential areas for the cultivation and production of *Spinosum sp.* and *Gracillaria Sp* (Yusuf et al., 2018). This type has a very important role as a stabilizer, thickener, gel former, and emulsifier. This species is widely cultivated on the coast, ponds and is the main source of agar(Bixler & Porse, 2011; Hurtado et al., 2014; Larson et al., 2021). This property is widely used in the food, pharmaceutical, cosmetic, textile, paint, toothpaste and other industries. Since 2005, Indonesia has become the largest seaweed producer with an increasing amount of wet seaweed production each year(Damelia & Soesilowati, 2016).

Indonesian seaweed is known for its good quality and is in great demand by the industry because it contains high levels of carrageenan, agar and alginate and is suitable for used as a raw material for the food industry, softener (Kothakota et al., 2022; Lange et al., 2020; Pant & Varma, 2020; Van Der Heijden et al., n.d.). Along with the increasing world demand for seaweed commodities today, this makes the Government of Indonesia always encourage the cultivation and industrialization of Indonesian seaweed and its derivative products which is very extraordinary, which has made it in demand by various countries in the world. Nearly 555 types of seaweed in Indonesia and most of the seaweed products have been exported as dried or processed seaweed (Tahang et al., 2019; van Oort et al., 2022).

The waters of South Sulawesi which are quite extensive with a beach length of approximately 2500 km can be utilized for the benefit of seaweed cultivation. To further increase this potential, the Regional Government of South Sulawesi has established seaweed development areas in seven districts based on Governor's Decree No. 904/X1/1996 regarding the development center for 5 seaweed products in South Sulawesi. The areas are Pangkep, Maros, Takalar, Jeneponto, Bulukumba, Sinjai, and Selayar Regencies.

The market holds a very important control in the business system (Achmad Zamroni, 2012; Rebours et al., 2014), and marketing issues are still adhered to the free market system. There is no protection for cultivators in terms of marketing the produce (Mathematics, 2016; Zamroni et al., 2011). The enactment of Law Number 7 of 2016 concerning the protection and empowerment of fishermen, fish cultivators and salt farmers has not yet touched on the marketing aspect. So there is no price bargaining for farmers. The length of the marketing chain has caused the price of seaweed to be depressed at an unfavorable price level (Achmad Zamroni, 2012; Jack, 2013; Rebours et al., 2014). Even the

presence of farmer groups has not supported all seaweed farmers in Sinjai Regency. Many farmers still sell their seaweed directly to collectors. This automatically creates differences in the income earned by farmers belonging to farmer groups and farmers who manage their businesses individually. For this reason, this study aimed to analyze the efficiency of marketing seaweed in Sinjai Regency. Because the success of farming activities was not only determined by the efforts and work of farmers, but also must be supported by clear marketing institutions so that farmer's knowed better what the market price was and where their agricultural products were taken to be marketed. Based on the description, it can be concluded that the main objectives of this study were to determine the shape of the marketing linkage and marketing function of seaweed run by the seaweed marketing agency in Sinjai Regency, the role of farmer groups in influencing the marketing system of seaweed in Sinjai Regency and the marketing efficiency of dried seaweed of *Eucheuma Spinosum Sp* and *Glacillaria Sp* in Sinjai Regency, Indonesia.

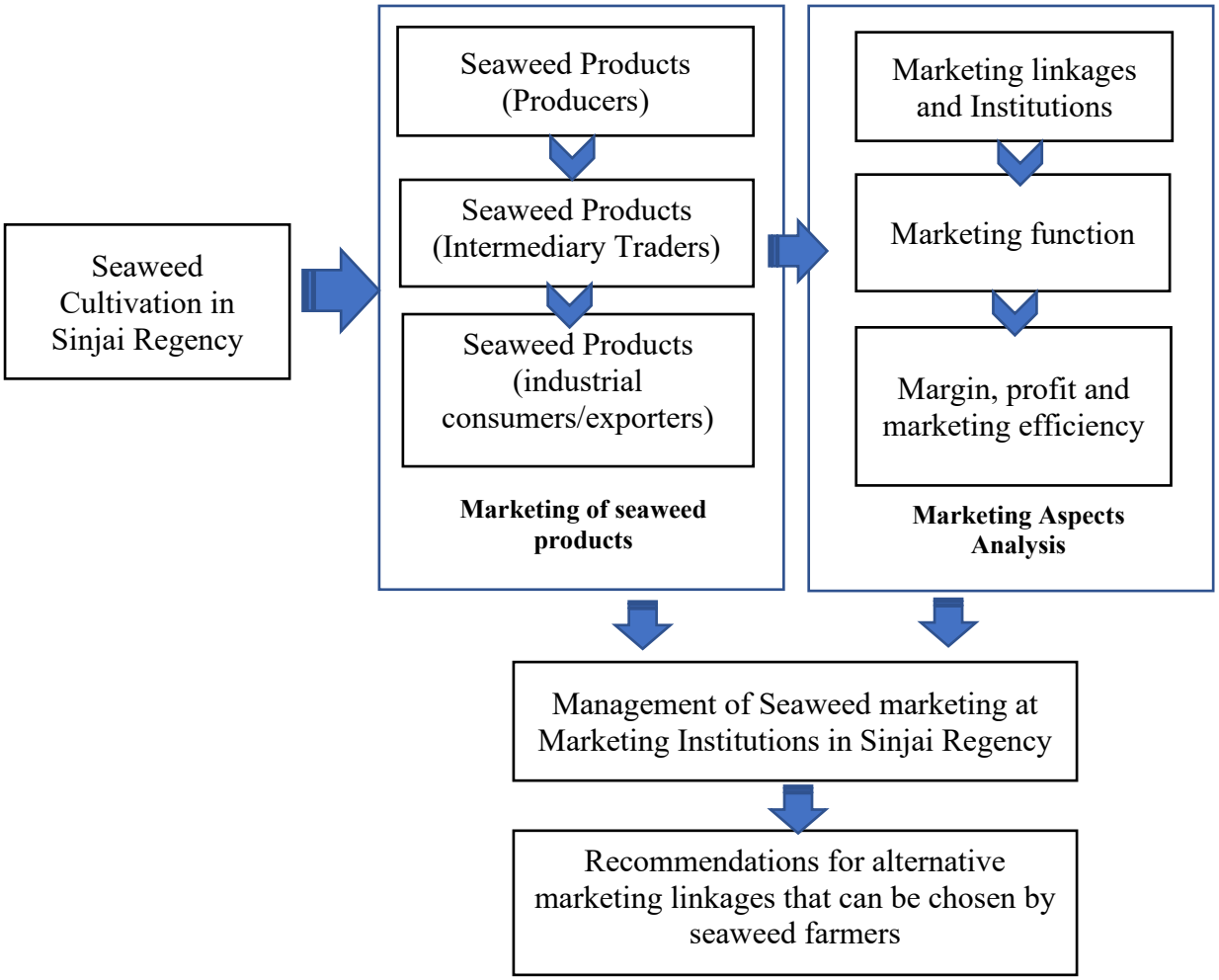


Figure1. Research Framework

METHOD

This research was conducted in Sinjai Regency, South Sulawesi Province. The research location was chosen purposively (purposive sampling) (Creswell, 1994) with the consideration that this area has great potential for the development of seaweed cultivation.

1. Determination of Sample and Respondents

Determination of the number of samples. The determination of respondent farmers was carried out by purposive sampling, namely deliberately but with consideration of certain characteristics. In this study the respondents who were taken as a population were seaweed farmers in Sinjai Regency who were members of farmer groups and seaweed farmers who did not join farmer groups and did not carry out marketing activities facilitated by groups. Some of the characteristics of seaweed farmers that were taken into consideration were seen from the average production volume at each harvest and the experience of seaweed farming. in this study it took 60 farmer respondents referring to the opinion, if the total population reaches 100 people, the minimum sample size is 10% - 15% of the total population. Then the farmer respondents who were taken consisted of 30 who sold seaweed in groups from the farmer groups as 30 farmers selling seaweed individually. Withdrawal of farmer respondents who managed marketing activities through farmer groups was carried out based on directions from the Field Extension Officers of Sinjai Regency.

Determination of Respondents. After determining the number of samples, the next step was determining the respondents to be interviewed. This determination method used accidental sampling. Thus, the respondents interviewed were farmers who were met during field research and met the established criteria to be interviewed. The marketing institutions respondents in this study were the marketing institutions that were the destination of the seaweed flow from the farmer respondents at the time the research was conducted. The marketing institutions respondents in this study consisted of two collecting traders, one intermediary agent and two exporters.

2. Data Analysis

This study used qualitative and quantitative analysis methods. The qualitative analysis was aimed to analyze marketing linkages, marketing institutions and marketing functions, as well as market behavior through interviews and filling out questionnaires. The obtained presentation of the qualitative data during the implementation of the research was carried out descriptively. Quantitative data analysis was used to analyze marketing margins, and profit to cost ratio.

A. Market Behaviour Analysis

Market behavior in seaweed marketing was analyzed by observing the activities of selling and buying practices between cultivating farmers to processing factories/exporters, the pricing system of each actor involved in marketing activities, the payment system and cooperation between marketing institutions in the marketing system of seaweed in Sinjai Regency. Analysis of market behavior was done descriptively.

B . Marketing Margins

Marketing margin analysis was carried out to determine the components of marketing costs that made product prices rise and differed from one marketing institutions to another. Marketing margin reflected the difference in income received by each marketing institutions. This was because the amount of marketing costs incurred by each marketing institutions was also different, depending on the marketing function being carried out. According to Kohl & Uhl (2002), marketing margins could be formulated mathematically as follows:

MP = Pr – Pf

Which:
MP = Marketing Margins
Pr = Price at the consumer level
Pf = Price at farmer level (producer)

C. Profit Analysis of Marketing Institutions

KP = MP-BP Which :
KP = Marketing Profit (Rp/Kg) MP = Marketing Margins (Rp/Kg)
BP = Marketing Cost (Rp/Kg)

D. Analysis of Marketing Efficiency

EP = BP/Hk
Which :

EP = Marketing Efficiency (Rp/Kg) BP = Marketing cost (Rp/Kg)
Hk = Prices at the last collector's level in Sinjai Regency (Rp/Kg)

Provided that :

- If EP > 1 means it is not efficient, and
- If EP < 1 means it is efficient

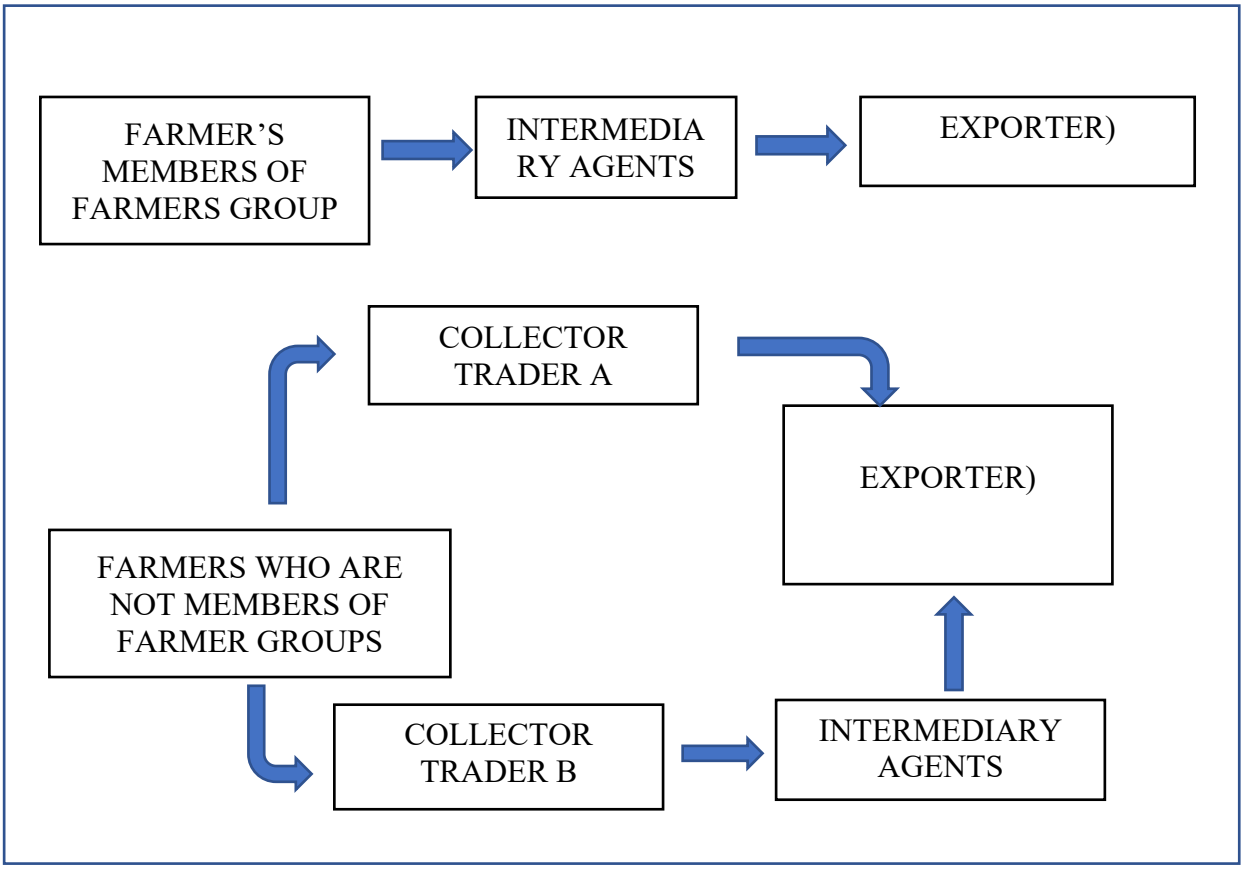
And the marketing efficiency equation put forward by Fanani (2002):

EP = (Hp/Hk) x 100% which :
MP = Marketing Margins (Rp/Kg)
Hk = Prices at the last collector's level in Sinjai Regency (Rp/Kg)
Hp = Price at producer level (Rp/Kg)

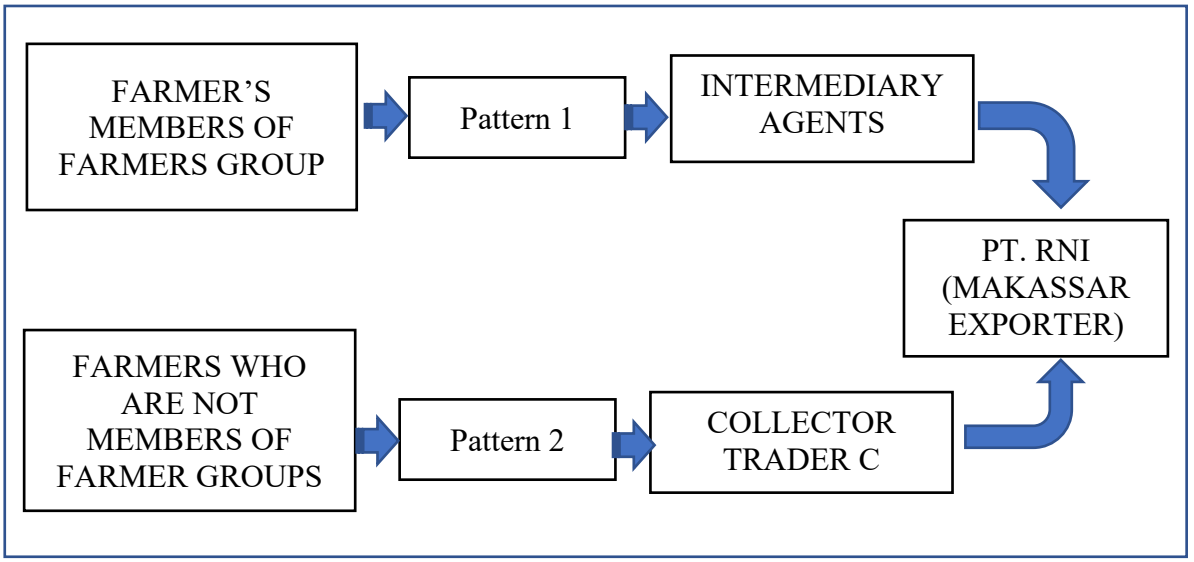
RESULT AND DISCUSSION

A. Marketing System

Marketing of seaweed in Sinjai Regency from farmers to exporters involves several marketing institutions. Marketing institutions involved in seaweed marketing activities in Sinjai Regency consist of collectors, middlemen (distributors) and exporters. In this study, the locations for seaweed cultivation which were used as research locations were the Ponds and Coastal Areas in East Sinjai Sub-district, North Sinjai Sub-district, and Pulau Sembilan Sub-district which were in the Sinjai Regency area. Seaweed produced in this area was a product intended for the export market, so that in this study it was not traced to the final consumer. The scheme of the marketing linkage for seaweed in Sinjai Regency as a whole can be seen in the following figure for each type of seaweed.



Figures 2. Seaweed Marketing Linkages of *Glacillaria sp*.



Figures3. Seaweed Marketing Linkages of *Spinosum sp*.

Seaweed marketing activities at the farm level in the study area were divided into two, seaweed marketing through farmer groups and seaweed marketing was carried out individually by farmers. Seaweed farmers in the Ponds Area of North Sinjai Sub-District, East Sinjai Sub-District, and Pulau Sembilan Sub-District managed marketing

activities as a group or individually, but marketing activities were dominated by farmers who sold seaweed through farmer groups. Meanwhile, seaweed farmers in the Sinjai Regency area sold their harvested seaweed in the form of dried seaweed.

The pattern of seaweed marketing linkages in Pulau Sembilan Sub-District tended to form a short marketing chain. This was considering that the resulting product was a raw material that was used for the processing industry, especially in the processing of carrageenan, which was imported by several countries such as Demmark, the Philippines and the United States. Meanwhile, the domestic seaweed processing industry was still rare. Unlike the case with farmers in the Ponds Area of North Sinjai and East Sinjai Sub-Districts, farmers in these areas sold seaweed individually. Each farmer sold dried seaweed to collectors. Collector traders would then sold seaweed to intermediary traders, then intermediary traders sold to exporters, but there were also individual farmers directly to exporters, of course, cheaper prices because the quality did not meet standards.

B. Market Structure Analysis

Analysis of the structure of the seaweed market in Sinjai Regency can be seen through several determining factors. The things that were used as the basis for conducting an analysis of the market structure were the number of buyers and sellers involved, the nature of the seaweed products traded, barriers to entry and exit of the market, and market information that occurs.

1. Number of Buyers and Sellers in Seaweed Marketing

In marketing seaweed in Sinjai Regency, it consisted of several institutions that form marketing linkage patterns. Seaweed cultivated in the Sinjai Regency was a product for the export market. The marketing marketing seaweed in Sinjai Regency, it consisted of several institutions that form marketing linkage formed showed the flow of seaweed marketing from the farmer level to the exporter level. The institutions involved in this marketing activity started from the farmer level which managed seaweed marketing activities in groups and individually.

Differences in the management of marketing activities at the farm level result in differences in the bargaining position of seaweed farmers. Farmers who were members of farmer groups were generally able to sell their seaweed yields to marketing institutions that have a higher level such as intermediary agents or exporters because of the quality assurance of the dried seaweed products offered. Between the farmer groups and buyers previously made a bargain in fixing the price. Buyers with the highest price bids would get dried seaweed from farmer groups in the Sinjai Regency area.

Among seaweed collectors in Sinjai Regency it can generally be said that there was no competition. Each collector trader generally had regular farmers who hand over the seaweed harvest so that the collector traders did not have to compete with each other to obtain seaweed supplies. The selling price at the farmer level was determined by the collecting traders. The determined prices by the collecting traders are generally adjusted to the prices set by the exporters. The seaweed collectors who were

the respondents in this study generally sold to the same exporter. At the exporter level, in general, the amount of demand was quite high with the requirements for quality standards of dried seaweed that would be traded.

2. Barriers to Entry and Exit of the Market

Barriers to market entry and exit were one of the things that could be used as a basis for determining the market structure that was faced by each marketing agency. The level of obstacles that would be faced depends on the strength of each institution concerned. Obstacles seen in seaweed marketing activities in Sinjai Regency included the availability of capital, network and attachments owned by the institution considering this product was an export destination product and the ability to handle it during the postharvest period so that product quality could be guaranteed.

3. Market Behavior Analysis

Market behavior in seaweed marketing activities in Sinjai Regency can be seen by observing the sales and purchasing activities was carried out by each marketing institution, the pricing system, the payment system applied in buying and selling transactions and the cooperation carried out in each marketing institution. Market behavior that was formed would reflect the strategy chosen by market participants in achieving their respective goals.

a. Sales and Purchasing Practices

The marketing linkage formed began with the farmer selling the dried seaweed harvest. Farmers who market seaweed through groups sell to intermediary agents, while farmers who market individually sold to collectors or directly to exporters. In post-harvest activities through farmer groups, member farmers incur transportation and packaging costs which were borne by the group's operational costs. Meanwhile, farmers who market seaweed individually did not incur postharvest costs because farmers did not carry out special handling of dried seaweed products and sold directly to collectors.

Seaweed collectors bought dried seaweed products from farmers who have become customers in each sales period. Collector traders would then sold the dried seaweed products to exporters in the Makassar area. Buying and selling transactions were carried out between collectors and exporters were carried out freely without any specific contract that binds both parties. Meanwhile for the intermediary agents, the goods were received from the farmer groups were ready to be sent. The farmers who were members of the farmer groups have sorted and packaged the dried seaweed produced so that the intermediary agents directly transported and brought the seaweed to the exporters in Makassar.

b. Pricing System

Farmers' income level was of course greatly influenced by the price level obtained in marketing a commodity. This can also be seen in seaweed marketing activities that were carried out by seaweed farmers in Sinjai Regency. Differences in marketing management systems at the farm level had a significant impact on the mechanism for determining the selling price of seaweed at the farm level. This provided an overview of

the differences in bargaining position faced by seaweed farmers.

In the management system of respondents selling seaweed products individually, the bargaining position of farmers was low to propose determining the selling price. Pricing at the farm level was more influenced by collecting traders. The purchase price was determined by the collecting trader that was an adjustment to the selling price offered by the exporter to the collecting trader. Information on prices at the exporter level was also sometimes obtained from competitors.

c. Payment system

The payment system implemented by the marketing agency in this study was using a cash payment system. Payment with this system was used by collectors to seaweed farmers. Direct payments were adjusted to the total volume of sales from each farmer, which was further reduced by loan payments if farmers made loans to collectors.

d. Cooperation between Marketing Institutions

Cooperation was carried out by marketing institutions in Sinjai Regency that was between collector traders and farmers who managed marketing individually. The cooperation carried out was related to capital. Collector traders provided capital loan assistance to farmers. The provided capital loans were free from loan interest, so that it was not burdensome for farmers; it's just that the collecting traders were free to buy seaweed at the price desired by the collecting traders. Thus farmers were not free to determine the price.

4. Marketing Margin Analysis

Marketing margin was the sum of all marketing costs incurred by marketing institutions and the amount of profits taken in commodity distribution activities from one marketing institutions to another marketing institutions. In this study, marketing margins can be seen in each marketing institutions as a whole and in each marketing linkage.

Margin calculations were obtained from the value of the difference between the selling price and the purchase price at each marketing institutions as well as the difference between the prices at the farm level and the prices at the final marketing agency level contained in the formed marketing channel pattern. Some of the components that were taken into account in determining marketing margins include marketing costs and profits. Marketing costs were all costs incurred by marketing institutions in distributing seaweed from Sinjai Regency to the hands of exporters. Costs incurred in the distribution of seaweed commodities include transportation costs, labor costs, packaging costs, fees and other costs. While the profit value was obtained from reducing the selling price of the purchase price which has been added to the marketing costs incurred. Details of the calculation of seaweed marketing margins in Sinjai Regency can be seen in the table.

Table 1. Calculation of Marketing Margin of Type Dried Seaweed of *Glacillaria sp* and *Spinosum sp*

Linkages / Elements	*Glacillaria sp*			*Spinosum sp*	
	I	II	III	I	II
	(Rp/Kg)	(Rp/Kg)	(Rp/Kg)	(Rp/Kg)	(Rp/Kg)
Farmers Group/Farmers					
Selling Price	3.000	2.700	2.700	5.000	4.800
Marketing cost Margins	-	-	-	-	-
Profit	-	-	-	-	-
Collector Traders					
Purchase price		2.700	2.700		4.800
Selling Price		3.500	4.000		6.000
Marketing cost Margins		150	295,4		473,3
Profit		300	200		1.200
Intermediary Agent					
Purchase price	3.000	3.500		5.000	
Selling Price	3.400	4.000		5.700	
Marketing cost Margins	250	89		250	
Profit	400	500		700	
Exporter					
Purchase price	4.000	4.000	4.000	5.700	6.000
Selling Price	8.500	8.800	9.000	9.200	10.000
Marketing cost Margins	2.112,8	2.141	2.031,25	2.317	2.522
Profit	4.500	5.000	5.000	3.500	4.000
Total of Marketing Cost	2.262,8	2.380	2.326,65	2.567	2.995,3
Total of Profit	2.537,2	4.420	3.068,75	1.683	2.204.7
Total of Margins	4.900	5.800	5.200	4.200	5.200

Source: Primary Data after processing, 2022

This improvement in the quality of dried seaweed resulted in spending on marketing costs at the farm level. Quality improvement would reduce marketing margins on marketing channels II and III. By increasing the quality through reducing the water content, it was able to reduce margins or decrease the value to be. The existence of these efforts was considered capable of increasing channel efficiency as evidenced by the decrease in margin values and an increase in the quality of the seaweed produced.

5. Farmer's Share Analysis

Farmer's share is the portion received by farmers in a marketing activity and is expressed as a percentage (Busch & Spiller, 2016; Wiseman et al., 2019). The farmer's share value was obtained through a comparison of the price received at the farm level toward the price paid at the end consumer level (Busch & Spiller, 2016). In this study, the institution that was used as the final consumer in seaweed marketing activities was the exporter by using the selling price level of dried seaweed when it was exported to the destination country.

The farmer's share value had a negative relationship with the marketing margin value formed in a marketing linkage. The higher the farmer's share obtained by farmers in a marketing linkage the linkage was considered efficient. However, it was possible that a high farmer's share did not reflect that the marketing activity was running efficiently. This depends on the efforts made by the marketing institutions dryinvolved in providing value added to the product so that the resulting product was in accordance with the wishes of consumers. Farmer's share value was received by farmers in grass marketing activities.

Based on the data presented in the table, the largest share received by farmers was in marketing linkage I with a farmer's share value of 35.29% for *Glacillaria* species and 54.34% for *Spinosum* types. In linkage I, in this study tracing marketing linkage was carried out up to the exporter level as well as linkages II and III. Based on information obtained from intermediary agents, the dried seaweed obtained was then distributed to exporters in Makassar. The exporter would then export the dried seaweed to China, Denmark and America.

Meanwhile in linkages II and III the farmer's share values generated in each linkage were 30.68% and 30% for *glacillaria* types and 48% for channel II for *spinosum* types. At the farmer level, seaweed has been dried, but this has not been done according to the specified quality standards, this has caused exporters in linkages II and III to do the drying again. The repetition of this implementation would result in multiple marketing costs which would affect the determination of the price to be paid by the final consumer so that the price received by the consumer will be higher and the percentage of the price at the farm level would be smaller. In linkages II and III, the source of price information at the exporter level was obtained directly from the exporter. Exporters in linkages II, III have export destinations to more than one country, namely the Philippines, China and the United States.

Table 2. *Farmer's Share* of Dried Seaweed

Marketing Linkages	Price Price at Farmers Level (Rp/kg)	Price at Exporters Level (Rp/kg)	*Farmer's Share* (%)
Linkage I : *Glacillaria* *Spinosum*	 3.000 5.000	 8.500 9.200	 35,29 54,34
Linkage II : *Glacillaria* *Spinosum*	 2.700 4.800	 8.800 10.000	 30,68 48
Linkage III *Glacillaria*	 2.700	 9.000	 30

Source: Primary Data after processing, 2022

6. Marketing Efficiency

In determining the efficiency of seaweed marketing in Sinjai Regency, equalize the quality standard of dried seaweed in each marketing linkages to compare the efficiency value of each linkage, the components that were calculated in determining the value of marketing efficiency, obtained from the results of calculations in conditions of dried seaweed quality with high levels of water by 35%.

Table 3. Marketing Efficiency of Dried Seaweed in Sinjai Regency

Marketing Linkages	Price at Farmers Level (Rp/Kg)	Price at Exporters Level (Rp/Kg)	Marketing Margins	*Farmer's Share* (%)
Linkage I : *Glacillaria Sp* *Spinosum Sp*	 3.000 5.000	 8.500 9.200	 5.500 4.200	 35,29 54,34
Linkage II : *Glacillaria Sp* *Spinosum Sp*	 2.700 4.800	 8.800 10.000	 6.100 5.200	 30,68 48
Linkage III : *Glacillaria Sp*	 2.700	 9.000	 6.300	 30

Source: Primary Data after processing, 2022

The table above showed data regarding the value of marketing efficiency in each marketing linkage formed with d seaweed product conditions. Based on these data it can be seen from the value of the margin and farmer's share that linkage I was relatively more efficient compared to the other two types of channels for *Glacillaria* and *Spinosum* types with a margin value of IDR 5,500.00 for *Glacillaria* types and IDR

4,200.00 for *Spinosum* types and Farmer' Share 35.29% for *Glacillaria* species and 54.34% for *Spinosum* species.

CONCLUSION

The role of farmer groups has a considerable influence on the sustainability of seaweed marketing in Sinjai Regency. Farmer groups not only have a role in seaweed cultivation activities, but also in marketing activities. The farmer groups were tasked with directly looking for potential buyers of seaweed. Farmers who carried out marketing activities through farmer groups obtain better income, because the existence of farmer groups further strengthens the bargaining position of farmers, especially in obtaining the selling price level of dried seaweed. Farmers who sold seaweed through farmer groups obtain higher selling prices, namely IDR 3,000.00 per kilogram of dried seaweed for the *Glacillaria* type and IDR 5,000 for the *Spinosum* type compared to farmers who sold individually, which is only IDR 2,700 per kilogram of dried seaweed *Glacillaria* and IDR 4,800 of *Spinosum*.

The results of the marketing efficiency analysis showed that there were differences in costs, profits and margins were obtained by each actor in seaweed marketing in Sinjai Regency. This difference was influenced by the implementation of marketing functions by each institution. Linkage I has the smallest margin gain among the three linkage patterns formed, namely IDR 4,900 for Glacillaria types and IDR. 4,200 for *Spinosum* types and the highest farmer's share were 35.29% for *glacillaria* types and 48% for *Spinosum* linkage channel I have better quality seaweed because farmer groups have standardized the quality of seaweed so that it had export standards.

REFERENCES

Achmad Zamroni. (2012). An assessment of farm-to-market link of Indonesian dried seaweeds: Contribution of middlemen toward sustainable livelihood of small-scale fishermen in Laikang Bay. *African Journal of Agricultural Reseearch*, *7*(30), 4198–4208. https://doi.org/10.5897/ajar11.1059

Ali, I., & Sulistiyono, S. T. (2020). A Reflection of "Indonesian Maritime Fulcrum" Initiative: Maritime History and Geopolitical Changes. *Journal of Maritime Studies and National Integration*, *4*(1), 12–23. https://doi.org/10.14710/jmsni.v4i1.8081

Badan Pusat Statistik (BPS). (2021). *Laporan Bulanan: Data Sosial Ekonomi*. Badan Pusat Statistik.

Bixler, H. J., & Porse, H. (2011). A decade of change in the seaweed hydrocolloids industry. *Journal of Applied Phycology*, *23*(3), 321–335. https://doi.org/10.1007/s10811-010-9529-3

Busch, G., & Spiller, A. (2016). Farmer share and fair distribution in food chains from a consumer's perspective. *Journal of Economic Psychology*, *55*, 149–158. https://doi.org/https://doi.org/10.1016/j.joep.2016.03.007

Crawford, B. (2002). Seaweed Farming : An Alternative Livelihood for Small-Scale Fishers ? By : Brian Crawford Program Manager , Asia. *World War II*, *October*, 23pp. http://imcafs.org/download/Alt_Livelihood.pdf

Creswell, J. W. (1994). *Research Design Qualitative and Quantitative Approaches*. Sage Publications.

Damelia, D., & Soesilowati, E. (2016). The Strategy to Improve the Competitiveness of

Indonesian Seaweeds in Global Market. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi Dan Pembangunan*, *17*(2), 193. https://doi.org/10.23917/jep.v17i2.2392

FAO, F. (2018). The Global Status of Seaweed Production, Trade and Utilization. Volume 124, 2018. *Http://Www.Fao.Org/in-Action/Globefish/Publications/Details-Publication/En/C/1154074/*, *124*, 2018.

Hurtado, A. Q., Gerung, G. S., Yasir, S., & Critchley, A. T. (2014). Cultivation of tropical red seaweeds in the BIMP-EAGA region. *Journal of Applied Phycology*, *26*(2), 707–718. https://doi.org/10.1007/s10811-013-0116-2

Jack, K. (2013). Constraints on the adoption of agricultural technologies in developing countries. *Journal of Agricultural Technology Adoption Initiative, J-PAL (MIT) and CEGA (UC Berkeley)*, *15*(4), 250–260.

Kothakota, A., Raghunathan, R., Nelluri, P., Rajendran, D., Pandiselvam, R., Thulasiraman, V., Sahoo, S. K., Pillai, S., & Jerome, R. E. (2022). Biodegradable Products from renewable sources: Impact on Replacing Single Use Plastic for Protecting the Environment. *ResearchSquare*. https://doi.org/10.21203/rs.3.rs-1864716

Kusuma, B. A., Karjoko, L., Jaelani, A. K., Gusti, I., Ketut, A., Handayani, R., & Hayat, M. J. (2021). Under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) Establishment of Indonesian Maritime Power: Regulation of Transnational Organized Crime on Illegal, Unreported, and Unregulated (IIU) Fishing. *International Journal of Criminal Justice Sciences. Criminal Justice Sciences (IJCJS)-Official Journal of the South Asian Society of Criminology and Victimology*, *16*(2), 251–266. https://doi.org/10.5281/zenodo.4756074

Lange, L., Bak, U. G., Hansen, S. C. B., Gregersen, O., Harmsen, P., Karlsson, E. N., Meyer, A., Mikkelsen, M. D., Van Den Broek, L., & Hreggviðsson, G. Ó. (2020). Chapter 1 - Opportunities for seaweed biorefinery. In M. D. Torres, S. Kraan, & H. B. T.-S. S. T. Dominguez (Eds.), *Advances in Green and Sustainable Chemistry* (pp. 3–31). Elsevier. https://doi.org/https://doi.org/10.1016/B978-0-12-817943-7.00001-9

Larson, S., Stoeckl, N., Fachry, M. E., Dalvi Mustafa, M., Lapong, I., Purnomo, A. H., Rimmer, M. A., & Paul, N. A. (2021). Women's well-being and household benefits from seaweed farming in Indonesia. *Aquaculture*, *530*, 735711. https://doi.org/https://doi.org/10.1016/j.aquaculture.2020.735711

Mathematics, A. (2016). *济無No Title No Title No Title*. *8*(4), 1–23.

McNevin, A. (2014). Beyond territoriality: Rethinking human mobility, border security and geopolitical space from the Indonesian island of Bintan. *Security Dialogue*, *45*(3), 295–310. https://doi.org/10.1177/0967010614530458

Monagail, M. Mac, & Morrison, L. (2020). The seaweed resources of Ireland: a twenty-first century perspective. *Journal of Applied Phycology*, *32*(2), 1287–1300. https://doi.org/10.1007/s10811-020-02067-7

Pambudi, L. T., Meinita, M. D. N., & Ariyati, R. W. (2010). Seaweed cultivation in Indonesia: recent status. *Journal of Marine Bioscience and Biotechnology*, *4*(1), 6–10.

Pant, H., & Varma, J. (2020). *Innovations in Agriculture, Environment and Health*

Research for Ecological Restoration (Issue July). https://www.researchgate.net/publication/342589030

Pramono, W. T., Darmawan, A., Deffinika, I., & Soelistijo, D. (2020). Geopolitical Implication on Contested Waters; Comparison Between Indonesia and the Philippines Strategy to Overlapping South China Sea Waters. *IOP Conference Series: Earth and Environmental Science*, *412*(1), 12034. https://doi.org/10.1088/1755-1315/412/1/012034

Pratama, Y. W., Purwanto, W. W., Tezuka, T., McLellan, B. C., Hartono, D., Hidayatno, A., & Daud, Y. (2017). Multi-objective optimization of a multiregional electricity system in an archipelagic state: The role of renewable energy in energy system sustainability. *Renewable and Sustainable Energy Reviews*, *77*, 423–439. https://doi.org/https://doi.org/10.1016/j.rser.2017.04.021

Rebours, C., Marinho-Soriano, E., Zertuche-González, J. A., Hayashi, L., Vásquez, J. A., Kradolfer, P., Soriano, G., Ugarte, R., Abreu, M. H., Bay-Larsen, I., Hovelsrud, G., Rødven, R., & Robledo, D. (2014). Seaweeds: an opportunity for wealth and sustainable livelihood for coastal communities. *Journal of Applied Phycology*, *26*(5), 1939–1951. https://doi.org/10.1007/s10811-014-0304-8

Rimmer, M. A., Larson, S., Lapong, I., Purnomo, A. H., Pong-Masak, P. R., Swanepoel, L., & Paul, N. A. (2021). Seaweed Aquaculture in Indonesia Contributes to Social and Economic Aspects of Livelihoods and Community Wellbeing. In *Sustainability* (Vol. 13, Issue 19). https://doi.org/10.3390/su131910946

Rochwulaningsih, Y., Sulistiyono, S. T., Masruroh, N. N., & Maulany, N. N. (2019). Marine policy basis of Indonesia as a maritime state: The importance of integrated economy. *Marine Policy*, *108*, 103602. https://doi.org/https://doi.org/10.1016/j.marpol.2019.103602

Studies, I. (2020). *S . Rajaratnam School of International Studies INDONESIA ' S MARITIME DOCTRINE AND SECURITY CONCERNS Author (s): Iis Gindarsah and Adhi Priamarizki S . Rajaratnam School of International Studies (2015) Stable URL : https://www.jstor.org/stable/resrep0*. *May*, 0–15.

Tahang, H., Latama, G., & Kasri. (2019). Development strategy and increased production of seaweed in Takalar District. *IOP Conference Series: Earth and Environmental Science*, *370*(1). https://doi.org/10.1088/1755-1315/370/1/012058

Teniwut, W. A., Marimin, & Djatna, T. (2019). Gis-based multi-criteria decision making model for site selection of seaweed farming information centre: A lesson from small Islands, Indonesia. *Decision Science Letters*, *8*(2), 137–150. https://doi.org/10.5267/j.dsl.2018.8.001

Van Der Heijden, P. G. M., Lansbergen, R., Axmann, H., Soethoudt, H., Tacken, G., Van Den Puttelaar, J., & Rukminasari, N. (n.d.). *Seaweed in Indonesia: farming, utilization and research*.

van Oort, P. A. J., Rukminasari, N., Latama, G., Verhagen, A., & van der Werf, A. K. (2022). The Bio Economic Seaweed Model (BESeM) for modelling tropical seaweed cultivation – experimentation and modelling. *Journal of Applied Phycology*, *34*(5), 2627–2644. https://doi.org/10.1007/s10811-022-02799-8

Waldron, S., Langford, A., & Waldron, S. (2020). *Seaweed farmers ' flexibility makes Indonesia a major player in global markets*

, but there is more work to be done Seaweed farmers ' flexibility makes Indonesia a major player in global markets , but there is more work to be done Authors Indonesia Centre. *November*.

Wiseman, L., Sanderson, J., Zhang, A., & Jakku, E. (2019). Farmers and their data: An examination of farmers' reluctance to share their data through the lens of the laws impacting smart farming. *NJAS - Wageningen Journal of Life Sciences*, *90–91*, 100301. https://doi.org/https://doi.org/10.1016/j.njas.2019.04.007

Yusuf, S., Arsyad, M., & Nuddin, A. (2018). Prospect of seaweed developement in South Sulawesi through a mapping study approach. *IOP Conference Series: Earth and Environmental Science*, *157*(1). https://doi.org/10.1088/1755-1315/157/1/012041

Zamroni, A., Laoubi, K., & Yamao, M. (2011). The development of seaweed farming as a sustainable coastal management method in Indonesia: An opportunities and constraints assessment. *WIT Transactions on Ecology and the Environment*, *150*, 505–516. https://doi.org/10.2495/SDP110421