

Full Length Research Paper

An assessment of farm-to-market link of Indonesian dried seaweeds: Contribution of middlemen toward sustainable livelihood of small-scale fishermen in Laikang Bay

Achmad Zamroni^{1,2*} and Masahiro Yamao¹

¹Graduate School of Biosphere Science, Hiroshima University, Hiroshima, Japan.

²Research Center for Marine and Fisheries Socio Economics, Ministry for Marine Affairs and Fisheries (MMAF), Jakarta, Indonesia.

Accepted 3 July, 2012

For many years, sustainable seaweed farming has been practiced for the revitalization of village-level economy of small-scale fishermen in Laikang Bay. This study sought to identify the characteristics of small-scale seaweed farming in South Sulawesi Province in Indonesia, to assess the roles of middlemen in supporting seaweed production and marketing, and to investigate the marketing channels of dried seaweed products in there. This study adopted structured and semi-structured questionnaires as qualitative approach, and interviews were conducted with 220 seaweed farmers in Takalar and Jeneponto Districts. Interviewing with trader and middleman was also conducted. The data obtained were evaluated using descriptive statistics to summarize and compare the data set. Findings showed that most of the respondents (seaweed farmers) had two main livelihood activities, namely seaweed farming mainly *Eucheuma cottonii* and sustenance fishing activity with seaweed farming giving bigger contributions to household income. They were usually supported by particular middlemen to meet the capital and marketing requirements of their production of dried seaweed. Fishermen could usually get capital investment and daily operational funds through a quick process from the middlemen, without any interest payment. Thus, the middlemen occupy a crucial position in the production and marketing dynamics of the seaweed trade in the study area.

Key words: Sustainable livelihood, marketing channel, patron-client, middlemen, fishery.

INTRODUCTION

In Indonesia, the land area with aquaculture potential is estimated to be around 11.81 million ha, of which 8.36 million ha have marine culture potential (Ministry for Marine Affairs and Fisheries of Indonesia (MMAF) and Japan International Cooperation Agency (JICA), 2009). Aquaculture production showed a growth rate of 20.14% within 5 years from 2001 to 2005¹ (Nurdjana, 2006). The production of farmed seaweed in Indonesia gradually increased every year reaching 1,728,475 tonnes in 2007 (Dahuri, 2004; MMAF and JICA, 2009). According to Mira

et al. (2006), there are many benefits realizable from seaweed farming such as: 1) being an environmentally friendly activity, 2) opening job opportunities, 3) improvement of fishermen's income and 4) contributing to foreign exchange revenue.

The Indonesian manufacturing industry can benefit enormously from the industrialization of carrageenan which is the principal chemical extract obtained from the farmed seaweed, *Eucheuma cottonii* (Tjahjana, 2010). The development of a viable seaweed industry can support the national program for job creation, reducing unemployment and contributing to national economic growth. Development can focus on the various types of seaweed available locally which in turn can support the

*Corresponding author. E-mail: roni_socio@yahoo.com.

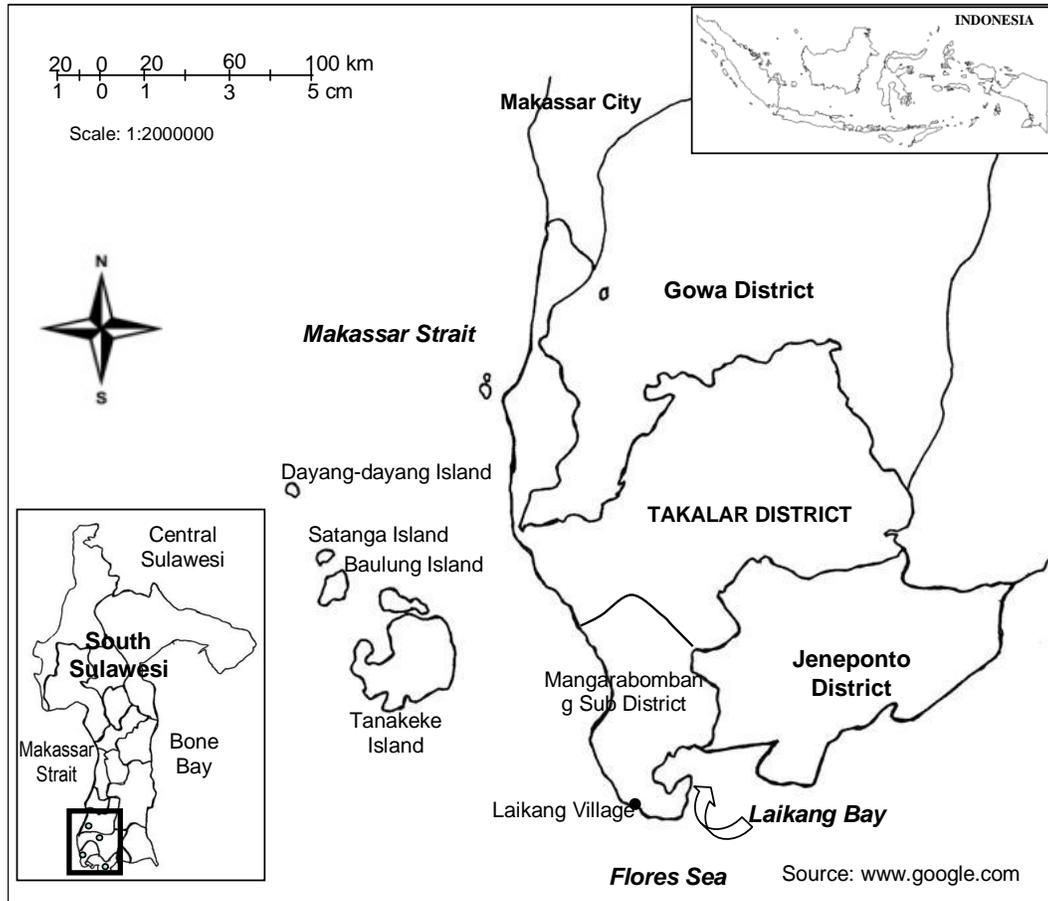


Figure 1. Map of Laikang Bay in Laikang village, Takalar District, South Sulawesi Province.

production of carrageenan, agar and alginate. The local carrageenan industry producing semi-refined carrageenan products grew rapidly after 1990. However, it declined due to lack of raw materials. This can be attributed to the fact that the manufacturing industry cannot compete with exporters of dried unprocessed seaweed in the purchase of raw materials. On the other hand, the agar or gelatin industry has been around since the 1940s, but its industrialization started only in the 1990s, when the alginate industry also began at the same time. Both agar and alginate industries, however, are too small compared to the size of the carrageenan industry.

In the cultivation of seaweed, fishermen have used various ways to address the problem of financial capital. Besides formal financial institutions that are rarely tapped, fishermen usually borrow money from the family, relatives, friends and even brokers (middlemen) in the village. This frequently happens because small-scale fishers still have problems in accessing capital from formal financial institutions such as commercial banks. The patron-client relationship within seaweed farming scheme is often referred to as *punggawa* (middlemen) – *sawi* (farmer)

system. In this study, the patron called middleman, can be defined as the person who provides the capital and lending to fishermen/seaweed farmers to plant seaweed. Meanwhile, client is a person/fisher planting the seaweed, and called seaweed farmer.

This paper seeks to identify the socio-economic characteristics of seaweed farmers in Laikang Bay; to assess the role of middlemen in sustaining local seaweed cultivation activities and to describe the pattern of the local seaweed procurement chain.

MATERIALS AND METHODS

Study area

The study sites were located around Laikang Bay, specifically within Laikang village, Takalar District, South Sulawesi Province, Indonesia (Figure 1).

Takalar District

South Sulawesi Province is located in the southernmost part of Sulawesi Island (formerly Celebes) between 0°12' to 8' S and from

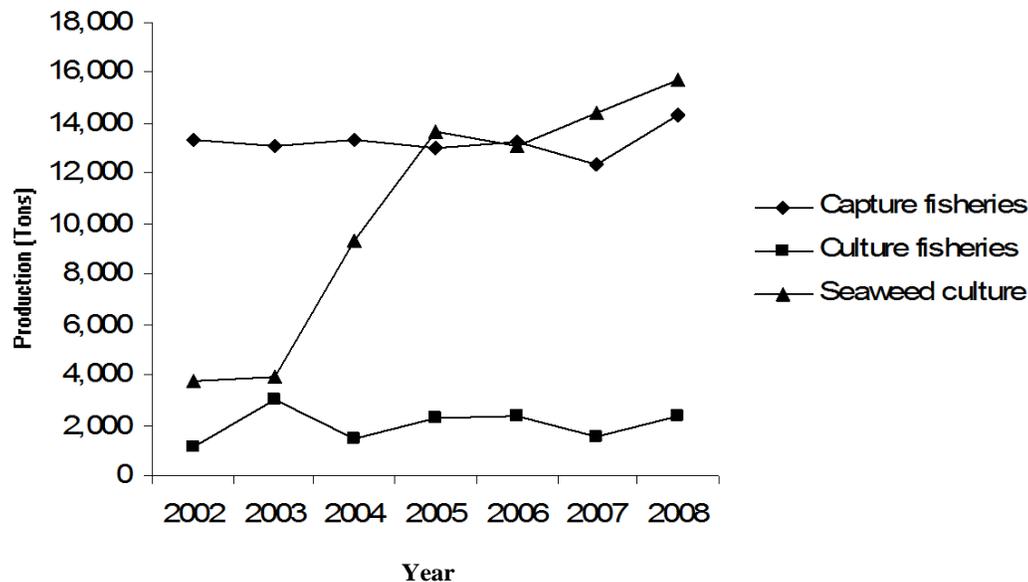


Figure 2. Production growth of three fishery activities in Jeneponto District. Source: Statistics of Jeneponto Fisheries office, 2008.

116°48' E up to 122°36' E. Makassar City, the provincial capital is located between from 5° 30' 18" S to 5° 14' 49" S and from 119° 18' 97" E to 119° 32' 3" E. The average temperature in Makassar is between 22 and 33°C (South Sulawesi Province, 2010).

Takalar District is located on the south side of South Sulawesi Province. It has a land area of 566.51 km² and is located between 5° 3' S and 5° 38' S and from 119° 22' E to 119° 39' E. It is bounded by Gowa District on the north, Gowa District and Jeneponto District on the east, Flores Sea to the south and Makassar Strait to the west (*Dinas Kelautan dan Perikanan Takalar* -Takalar Marine and Fisheries Service Office (DKP) and Narayana Adicipta Persero, 2007). It is about 42 km south of Makassar city. Interviews and data collection were conducted in Laikang village, in Managarabombang sub-district in Takalar District, 16 km from the central district and 63 km from Makassar City.

Laikang village is one of the 12 villages of Mangarabombang sub-district. It has an area of 19.6 km², comprising about 19.57% of Mangarabombang sub-district (±100.14 km²). The population is approximately 4,139 or 12% of the total population of the sub-district (35,526 people) with a population density of about 211 people/km².

Most of the people work in fisheries, and some work in the agricultural sector. Laikang village is rich in natural resources like fisheries, agriculture and tourism sectors which largely contribute to the economic development of the village. However, poorly developed fisheries infrastructure, telecommunication and public transportation, further hamper the economic development of the village.

Jeneponto District

Jeneponto District is located in the western part of South Sulawesi Province, and it has a coastal area that stretches for about 95 km in the southern part, covering an area of 74,979 ha or 749.79 km². It is bounded by Gowa District on the north, the Flores Sea on the south, Takalar district on the west and Bantaeng on the east. Jeneponto District consists of 9 sub-districts and 105 villages, and the population in 2004 was 324,927, consisting of 158,043 men and

166,884 women. There were 18,943 fishermen, fish farmers and seaweed farmers. Similar to other coastal areas, it has two dominant fishing activities namely capture fisheries and aquaculture including seaweed farming (Figure 2).

Figure 2 shows that during 2003 to 2005, production of seaweed increased sharply compared to the other fishery sectors. It clearly indicates the potential of seaweeds to contribute to the fishery sector in Jeneponto District.

Data collection and analysis

The current investigation involved surveys, direct observations and interviews. Total number of respondents was 220 seaweed farmers selected by the appropriate sampling method with data obtained through direct interview and focus group discussion. A structured questionnaire was prepared and used for direct interview, while semi structured questionnaires were used as guides in the focus group discussion. The structured questionnaire covered socio-economic information of seaweed farmers.

Key informants were selected purposively including middlemen, staff or researchers from government offices, research centers, universities, local government officers, community leaders (*Tokoh masyarakat*), heads of the villages (*Kepala desa*), religious leaders, who understand well the social and economic conditions of the village. Secondary data were obtained mainly from statistical data and scientific journals. Descriptive analysis focused on socio economic conditions of respondents and the study areas.

RESULTS

Fishermen activity in seaweed farming

The survey shows that most seaweed farmers in Laikang village are 26 to 40 years old. They have households composed of 2 to 5 persons in each family. Most of them

Table 1. Demographic characteristics of respondents.

Variable (N=220 respondents)	Frequency	Percentage	Mean	S.D
Age (years)			36.92	9.39
≤ 25	16	7.27		
26 - 40	132	60		
41 - 60	72	32.72		
Gender (Male/Female)			1	0
Male	220	100		
Female	0	0		
Education			2.23	1.97
Elementary school	136	61.8		
Junior High School	33	15		
Senior High School	6	2.7		
None	45	20.5		
Main income generating activity			3.29	2.87
Seaweed culture	132	60		
Capture fisheries	0	0		
Seaweed culture + capture fisheries	54	24.5		
Seaweed culture + public officer	4	1.8		
Seaweed culture + non fisheries	30	13.6		
Number of family member (persons)			1.9	0.29
≤ 2	7	17.5		
3 – 5	31	77.5		
≥ 6	2	5		
Income value per month			1.35	0.46
≤ 1000,000	155	70.5		
>1000,000	65	29.5		
Number of seaweed plots (1 plot=100 m × 30 m)			1.35	0.48
≤2	142	64.5		
≥3	78	35.5		

are of poor level of education having graduated only from elementary school. The income of respondents was from 2 main activities, capture artisanal fisheries and seaweed farming. Both activities were conducted by people in Laikang, Garassikang, Lurah Pantai Bahari (LPB) and Ujunga villages. The fishers who derive more income from seaweed farming than compared with other forms of culture fisheries obviously preferred to give higher priority to seaweed culture as their main income source. Most of respondents (70.5%) have income of less than 1 million Indonesian rupiah (IDR) per month (Table 1). This amount is still below the Regional Minimum Wage (*UMR*) 2010 in South Sulawesi Province (IDR 1,049, 321)² (BPS, 2010).

The main activities in Laikang Bay are seaweed

farming and capture fisheries. Approximately 10 years ago, people were mainly engaged in fishing by using simple technologies, such as nets and fishing rods. Their boats were very simple, either with 5 to 15 Horse Power (HP) engine or without an engine. Thus, the areas of their operations were limited to 1 to 3 nautical miles from the shore with operation time limited to only one day fishing. Fishermen usually went to the sea in the afternoon at about 4 to 5 PM to set up their fishing nets in the fishing ground. In the morning between the hours of 4 and 5 AM, they returned to sea to retrieve the nets. Depending on the volume of catch, they are sold to markets or consumed at home. Certain valuable species of fish would be sold either to a local trader or collector or in a traditional market, while others would be retained for

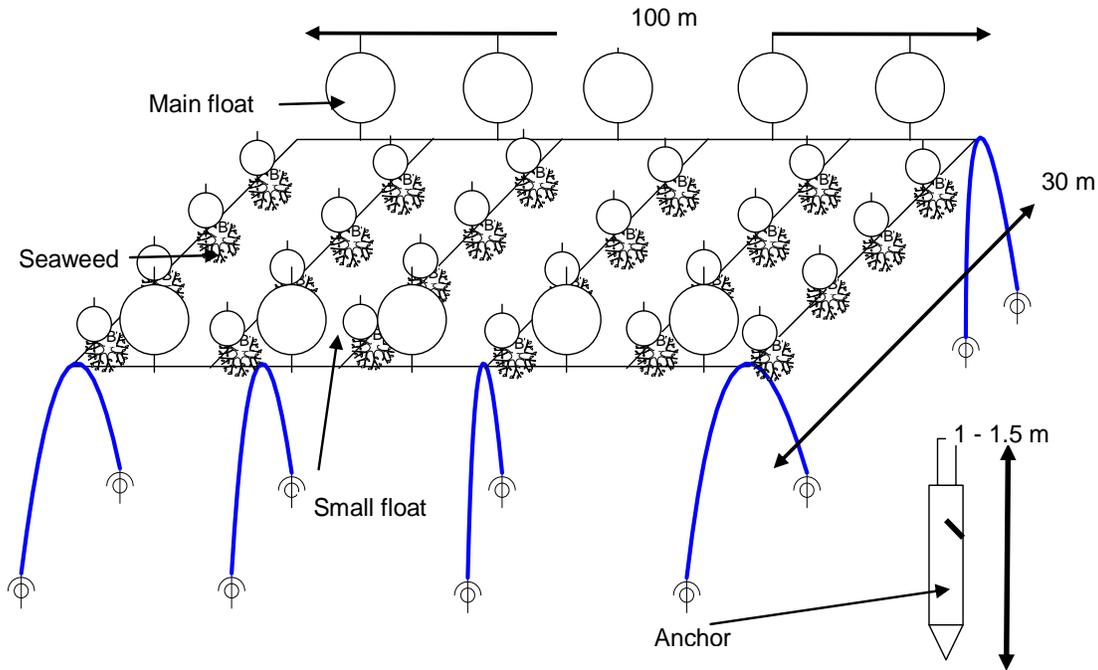


Figure 3. The construction of seaweed farm (floating method). Source: Field observation, 2009 and 2010.

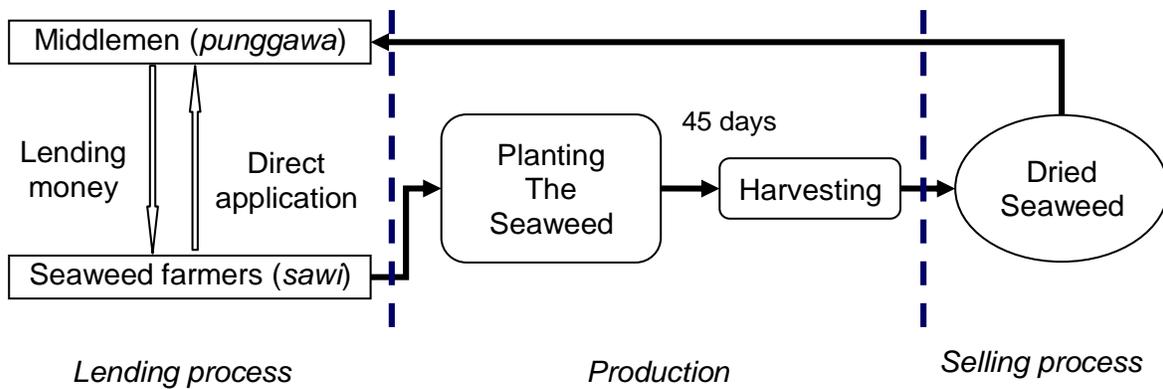


Figure 4. Relationship of seaweed trader and seaweed farmers. Source: Field observation, 2009 and 2010.

domestic consumption.

Figure 3 shows the size of one unit of seaweed farm as 100 m long and 30 m wide developed at water depths of less than 10 m. Styrofoam material are used for large buoys, while 500 and 1000 ml empty bottles of mineral water are also used. Seaweed farmers assisted by their wives and other family members prepare the seedlings to be attached on the stretch of rope. The average length of seaweed growth is 45 days, but could be shorter in case disease affects the seaweed that can result to damage or death of these plants. In this case, the seaweed can still be sold but at a price lower than usual.

Roles of middlemen in sustaining seaweed farming

Over the years, farmers have sold dried seaweeds to middlemen. The findings of this study showed that some seaweed farmers are closely affiliated with the traders/middleman in many ways particularly related with financial capital and product sales. As a consequence, they sold their product exclusively to a particular middleman (Figure 4).

Figure 4 describes the mutual relationships between farmers and middlemen. Farmers came to the middleman directly to borrow money. This money was used for

Table 2. The two patron-client systems in capture fisheries and seaweed farming activities.

Instrument	Fishing activity		Seaweed farming	
	<i>Punggawa</i> -middlemen (patron)	<i>Sawi</i> -fishermen (client)	Middlemen (patron)	Seaweed Farmer (client)
Role	Owner of fishing equipment	Worker	-Moneylender -Buyer	-Farmer -Borrower
Products or service provided	Fuel, boat, fishing gears	Manpower	-Funds/money	-Dried seaweed
Benefits	Profit from business/activity	Receives a salary	-Easy to get dried seaweed products	-Get capital money -Easy to sell dried seaweed
Organizational form	Group	Group	-Individual	-Individual

Source: Field observation 2010 supported by Arif (2007) (Unpublished).

restarting the planting cycle and allocated for purchasing of seaweed seed stock and/or repairing equipments in seaweed farm. The loan is done without any collateral and usually with minimal or no documentation. In return, farmers pledge to sell their products exclusively to the middleman. Middlemen do not fix the duration of repaying debt and even the amount of loan repayment. However, dried seaweed that is bought from farmers is treated as cash paid immediately back to the middleman, not as delayed payment as experienced by other seaweed farmers (Namudu and Pickering, 2006). The presence of middlemen in Laikang Village has been documented since the start of seaweed farming there. At present, middlemen mainly function as providers of capital lent out to particular seaweed farmers and as a buyer of raw dried seaweed from them. The middlemen's financial sources are independently different from regular institutional sources. The same *punggawa-sawi* relationship exists in the traditional fishery system but it is different from that in the seaweed farming system. Table 2 compares the two different patron-client systems in capture fisheries and seaweed farming activities.

According to the survey, a business relationship between the middleman and seaweed farmer is based solely on the viability and continuity of supply and demand trends. Middleman will get the assurance of steady availability of dried seaweed from farmers who borrowed capital from them. Thus, the business relationship between them both have each other implicitly "tied" to one another for mutual benefit. Day (2000) emphasized the value of relationship building when there are a few valuable customers or suppliers transacting lucrative business. However, the relationship between the middleman and fishermen in the long term tends to evolve into a monopolistic trade at the local level. Ogawa et al. (2006) argued that middlemen as the monopolist can act as intermediaries and have better control in adjusting the prices to obtain maximum profits for themselves and at times for the suppliers as well because

farmers are often heavily dependent on the middleman. Middlemen often refuse seaweed farmers from paying off their debts. They preferred the debt to accumulate, unpaid, in order to maintain exclusive business link with the farmers. This is somewhat restrictive to seaweed farmers because they have little freedom to sell their products to other traders who may offer better prices than the middlemen who lent them money. Nevertheless, the price of seaweed offered by middlemen is usually in accordance with prevailing market prices which the respondents perceive as reasonable.

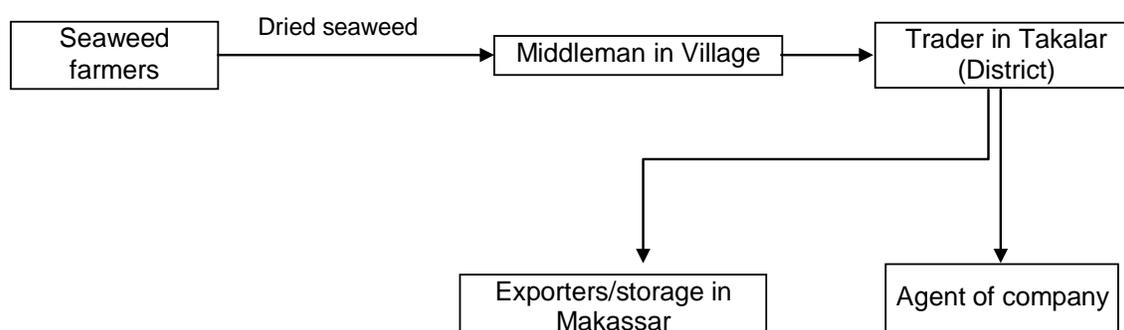
Seaweed farmers actually have another alternative for obtaining needed capital. Government projects related to community empowerment and economic development in coastal areas have provided various credit schemes in the form of revolving loan funds. However, the lack of sustainability of these programs has led seaweed farmers back to the middlemen. The failure of such income-generating projects could be related to the lack of financial capital, technical training and market access (Marais and Botes, 2006). This study found that although there is minimal interest on government loans, there are also inefficient repayment and capital recycling which weaken the programs, limiting availability of revolving funds to future borrowers. Hence, government credit program contributes very little towards supporting community-level seaweed farming (Table 3).

Marketing channel of seaweed: some preliminary investigation

The seaweed farmers in Takalar sold the seaweed in dried form to traders/middlemen coming to the village, who then sell to the trader at the district level and finally to wholesalers who have warehouses in Makassar/Ujung Pandang or to processing companies there. The typical marketing channels of seaweeds in Takalar can be seen in Figure 5.

Table 3. Comparative roles of two financial sources supporting the activities of seaweed farmers.

Instrument	Lender	
	Middleman	Financial institution
Application for credit or loan	- Non-formal - Based on trust	- By document - By contract
Collateral	- No collateral	- Mostly collateral required
Considerations	- Trust - Relationships	- Requirements - Track record - Trust
Durations	- Flexible time limit	- Fixed time limit
Interest	- No interest	- With interest
Role	- Creditors - Agent/marketing/buyer	- Creditors

**Figure 5.** Marketing channel of seaweed in Laikang village. Source: Field observation 2010 and supported by Zamroni et al. (2006).

Fishers culturing seaweeds at the village level can also serve as a middlemen, while some the company's agent referred to in the marketing chain is a person who is a paid employee of processing companies and who is tasked by the company in purchasing raw materials. Other types of middlemen are free-lance buyers and money lenders who sell dried seaweeds mainly to exporters. Some exporters are also engaged in seaweed processing aside from being exporters of dried seaweed. There are particular exporters such as Semi Refined Carrageenan (SRC) and Alkali Treatment Cottonii (ATC) producing value-added products.

Bulk shipment of seaweed out of the villages is done about once a month, or when the accumulated seaweed volume attains 15 to 20 tons in order to maximize the benefits from transportation costs. Wholesalers receive seaweed from the same traders who have become frequent and reliable suppliers over time thus reinforcing the strong ties between wholesalers and traders. Personal trust plays an important role in the success of

their business. According to the survey, wholesalers require technical specifications of dried seaweed such as water content of seaweed is less than 37% and pH less than 12. These requirements are often demanded from farmers and middlemen but sometimes not followed.

Recently, the most critical problem of Indonesian seaweed industry development in is related to marketing and breeding. Seaweed farmers have not received much economic benefit from the current marketing set up than they had expected. In general, these marketing problems are regarded as institutional aspects, complicated marketing network, and communication gap between producers and consumers or production output is often not in accordance with standards established by the processing industry or the export market of seaweed. This becomes a compelling reason for industry to buy raw seaweeds at lower prices from production sites, and then to process by themselves.

Farmers also encounter problems associated with declining seaweed quality. Seaweed are often affected by

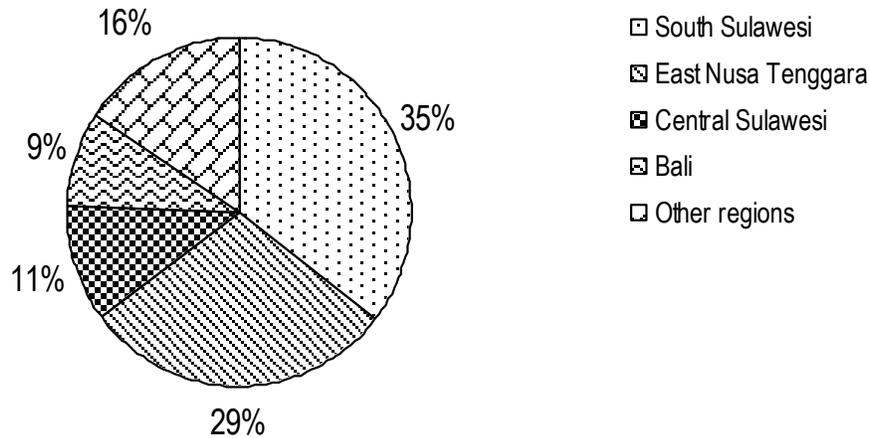


Figure 6. Indonesian wet seaweed production by Province in 2008. Source: DGCF, 2008.

Production series of Indonesian Seaweed 1975 - 2005

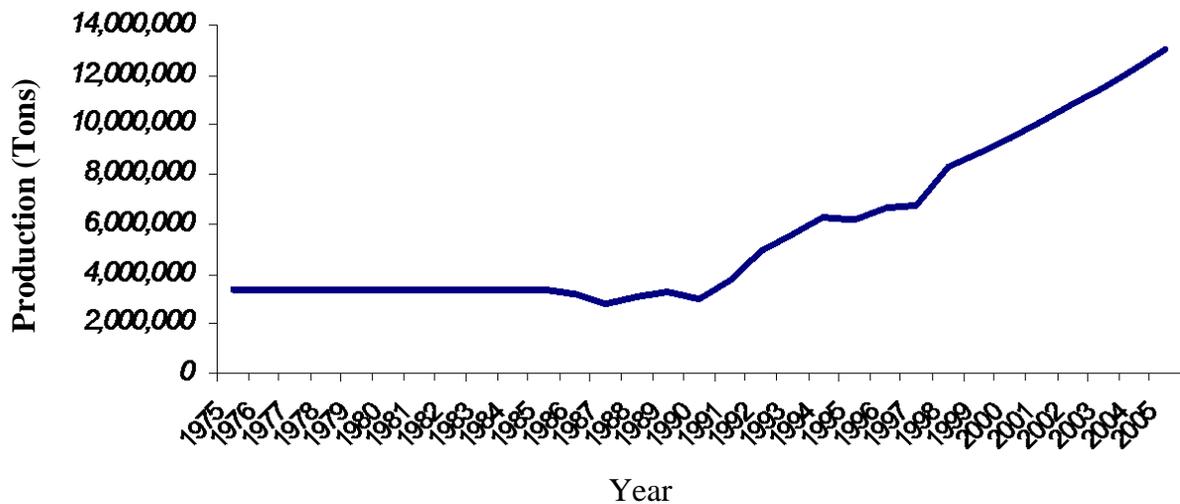


Figure 7. Trend production of seaweed in Indonesia (CBS Central Bureau statistic) (BPS, 1985, 1995, 2005).

seasonal disease outbreaks which result to premature harvesting. Some farmers observed slower growth of seaweeds which can be attributed to inferior genetic quality. This can partly be addressed by identifying new seaweed varieties or strains which can grow faster or are more disease resistant. Clearly, more research and development addressing declining seaweed seed stocks are needed.

DISCUSSION

The Government of Indonesia (GOI) has defined three

main policies, three core programs and six support programs to achieve and realize aquaculture development³ (Nurdjana, 2006). Until 2008, South Sulawesi has been the highest producer of seaweed (690,385 tons) followed by East Nusa Tenggara (566,495 tons), Central Sulawesi (208,040 tons), and Bali (170,860 tons) and other regions (304,220 tons) (Figure 6) (Sudartanto, 2010). The overall national seaweed production still shows a positive trend, likewise in the local level (Figure 7).

Coastal fisheries in Asia need relevant strategies to ensure future fish production and to improve the livelihoods or standard of living of coastal communities

(Stobutzki et al., 2006; Hurtado and Agbayani, 2002; Munoz et al., 2004). Recently, seaweeds appear to play important roles to achieve these strategies. Seaweed farming has also reduced some forms of local fishing effort and environmental pressure (Sievanen et al., 2005). Since there were several projects related to coastal community development and poverty reduction, people had begun to develop seaweed farming since 1982 by culturing the economic seaweed *E. cottonii* using the long line method. This technology uses rope of various sizes, which are arranged transversely forming a rectangle and allowed to float away from the bottom but anchored to the problem by ropes. Seaweed cultivation is maintained individually by fishermen with 50 to 100 long lines per respondent (Figure 3). This method is strongly recommended for cultivating *E. cottonii* in Tanzania compared to the off-bottom method (Msuya et al., 2007). However, Thirumaran and Anantharaman (2009) mentioned that seedling density, monsoon season, water temperature, nutrients, and water movement strongly influenced the growth rate of seaweeds. Any big changes in any or all of these parameters would affect seaweed growth and overall farm output.

Cooke (2004) and Crawford (2006) emphasized that the success of seaweed farming would depend on the extent of the roles of farmer's wives and family members who help in the drying and the preparation of seaweed plantations. They also help in the maintenance and weeding of any stretch of culture lines (line) from dirt and debris as well as tying of seedlings unto the ropes and sorting of harvested seaweeds. The supplemental labor provided by family members can contribute towards cutting down farming expense.

The present study has found that the observed positive impact on the relationship between seaweed farmers and middlemen can be explained in several points; 1) seaweed farmers could get loans through quicker process, 2) there was no interest collected on loans, 3) the farmers were assured of selling their harvest and 4) the farmers got cash payment for their produce which actually represents additional debt. Middlemen may not be the best buyers, but they can provide some social benefits in the long run (Masters, 2008) by seeking the best market prices whose profits can sometimes be passed on to the farmers (Ju et al., 2010; Rust and Hall, 2003; Shevchenko, 2004; Li, 1998). Indeed, middlemen have two essential roles as direct links to the external market and as provider of credit to fishermen (Crona et al., 2010). Characteristics of seaweed marketing in Takalar seem typical of the trends seen in this part of Indonesia. In Gorontalo Norththeast Sulawesi, dried seaweeds were sold to a local trader, then purchased by wholesalers/processing company (Neish, 2007).

According to Ju et al. (2010), intermediaries begin by making capacity choice then buy goods from producers and sell them to consumers effectively bridging the production-consumption gap (Gadde and Snehota, 2001).

Johri and Leach (2002) and Vesala (2008) argued that the adverse selection problems in the trade of goods of different quality may be alleviated through a middleman. Middlemen can act as an alternative and advantageous way to reduce market frictions (Masters, 2007). Meanwhile, wholesalers made the products available, bringing an assortment of conveniences essential for bulk-breaking, providing credit and finance, performing customer service functions, as well as providing advice and technical support (Samali and El-Ansary, 2007). Wholesalers exist because they are able to provide the most effective and efficient distribution process than all other channel participants (Rosenbloom, 2007; Torii and Nariu, 2004). In the Japanese system, for example, to improve wholesaler's performance involves: promoting strong collaboration, offering trustworthy information, accommodating a variety of needs, supporting the mission, and determining the price (Rawwas et al., 2008). Thus, accessibility and risks of the product-market chain depended on market structure, size, expected demand levels and the nature of competition (Roberts and Stekoll, 1993). The encounter of any problems generally indicates lack of cooperation among stakeholders.

Conclusions

Seaweed farming activity in Laikang Bay is mainly conducted using the long mono line method by seaweed farmers who were formerly exclusively small-scale fishermen who found seaweed farming as a more lucrative livelihood. At present, seaweed farming has become the main income source for these small-scale fishermen because it provides substantial additional household income besides the usual income from occasional fishing activity.

From both farming and marketing perspectives, middlemen play important roles to support the fishermen; 1) to provide the financial capital expeditiously and 2) to collect/buy the dried seaweed from seaweed produce farmers. The existence of middlemen is crucial in the dried seaweed supply chain in Laikang Bay, as long as the local/central government could not implement a better and effective market chain for seaweeds at the local level. Because most farmers have low educational background or are sometimes illiterate, borrowing from middlemen eliminates the need for financial institutions which require complicated documentation and strict repayment schemes. Middlemen can offer more flexible repayment terms in kind or goods. This works better for farmers because of the flexibility it offers and assured disposal of their dried products even if the middlemen-farmer relationship is perceived by some respondents as exploitative and unfair. This is because the seaweed buying price is mostly set by middlemen and most farmers usually cannot sell to other traders who may be offering higher buying prices. Indeed, this traditionally

disadvantageous relationship will be maintained in the absence of government intervention and big industry players which can offer more equitable business terms to further encourage seaweed farming. The acute supply of raw materials these days should prompt processors to set up more vigorous procurement efforts by putting up buying programs characterized by higher prices and easier credit extension.

The growing dependence of many fishing communities to seaweed farming as a main income source will allow seaweed farming to develop more quickly potentially resulting to greater prosperity in the coastal areas. However, the density of seaweed plots and the unclear definition of farm ownerships are prone to lead to conflicting claim among interested parties. The issues about foreshore claims should be addressed by village and government leadership to avert a socio-economic crisis in the future. Furthermore, ecological studies should be conducted on the carrying capacity of the coastal environment in Laikang Bay and how seaweed farming can impact on the environment in an effort to strike a balance of social acceptability and positive ecological effects of this particular activity.

ACKNOWLEDGEMENTS

First of all, the authors wish to acknowledge their gratitude to the anonymous reviewers who gave freely time and effort, constructive recommendations that enhanced the value of this manuscript. The authors also would like to express their deepest thanks and appreciation to all the seaweed farmers who participated in the interview research and Dr. Lawrence Liao, visiting professor of the Graduate School of Biosphere Science, Hiroshima University for his academic suggestions. Special thanks go to the Monbukagakusho Scholarship for supporting the studies of the first author that enabled him to conduct this research.

Endnotes

¹The production volume increased from 1,076,750 tonnes in 2001 to 2,163,674 tonnes in 2005.

²IDR = Indonesian Rupiah (1 USD = 9,013 IDR updated on November 2010) cited from www.bi.go.id

³Three main policies: 1) increase aquaculture production for export, 2) development of aquaculture production for in-country consumption and 3) establishing mechanism for controlling the use (exploitation) of aquaculture resources.

Three core programmes: 1) the programmes for increasing aquaculture production for export (In Indonesia called: *PROPEKAN*), 2) the programme for increasing aquaculture production for in-country consumption (In Indonesia called: *PROKSIMAS*) and 3) the protection and rehabilitation of aquaculture resources

(In Indonesia called: *PROLINDA*).

Three support programmes: 1) the development of infrastructure for aquaculture, 2) the development of seed production systems, 3) the development of production systems, 4) the development of fish and development health and management systems, 5) the development of aquaculture business systems and 6) the development of administrative and organizational systems.

REFERENCES

- Badan Pusat Statistic - "Central Bureau Statistic" (BPS) (2010). South Sulawesi in Figure 2008. Nat. Stat. agency – South Sulawesi Province. BPS (1985). Statistical Yearbook of Indonesia. Central Bureau Statistic. Jakarta. Indonesia.
- BPS (1995). Statistical Yearbook of Indonesia. Central Bureau Statistic. Jakarta. Indonesia.
- BPS (2005). Statistical Yearbook of Indonesia. Central Bureau Statistic. Jakarta. Indonesia.
- Cooke FM (2004). Symbolic and social dimensions in the economic production of seaweed. *Asia Pasif. Viewpt*, 45(3):387-400.
- Crawford B (2006). Seaweed farming: an alternative livelihood for small-scale fishers? Working paper. Coastal Resources Center. Univ. of Rhode Island, available at http://www.crc.uri.edu/download/Alt_Livelihood.pdf (accessed 19 July 2010).
- Crona B, Nystrom M, Folke C, Jiddawi N (2010). Middleman, a critical social-ecological link in coastal communities of Kenya and Zanzibar. *Mar. Pol.* 34(4):761 - 771.
- Dahuri (2004). Indonesia berpotensi menjadi produsen ikan terbesar (Indonesia has the potential to become the largest fish producer). *Mina Bahari*, 2(10):16-17.
- Day GS (2000). Managing market relationships. *J. Acad. Mark. Sci.* 28 (1):24-30.
- Directorate General of Culture Fisheries (DGCF) (2008). The production of Indonesian wet seaweed, available at www.dkp.go.id (accessed 4 April 2010).
- Gadde LE, Snehota I (2001). Rethinking the role of middlemen. Paper for IMP 2001, BI, Oslo, 9 – 11 September, available at <http://www.impgroup.org/uploads/papers/182.pdf> (accessed 9 December 2010).
- Hurtado AQ, Agbayani RF (2002). Deep-sea farming of *Kappaphycus* using the multiple raft, long-Line method. *Bot. Mar.* 45(5):438-444.
- Johri A, Leach J (2002). Middlemen and the allocation of heterogeneous goods. *Int. Econ. Rev.* 43(2):347-361.
- Ju J, Linn SC, Zhu Z (2010). Middlemen and oligopolistic market makers. *J. Econ. Manag. Strateg.* 19(1):1-23.
- Li Y (1998). Middlemen and private information. *J. Monet. Econ.* 42:131-159.
- Marais L, Botes L (2006). Income generation, local economic development and community development: paying the price for lacking business skills? *Com. Dev. J.* 42(3):379-395.
- Masters A (2007). Middlemen in search equilibrium. *Int. Econ. Rev.* 48(1):343-362.
- Masters A (2008). Unpleasant middlemen. *J. Econ. Behav. Organiz.* 68(1):73-86.
- Mira, Mulyawan I, Zamroni A (2006). Analisis Keunggulan Kompetitif Usaha Budidaya Rumput Laut di Indonesia (Competitive Advantage Analysis of Seaweed Farming in Indonesia), in Semnaskan UGM 2006 proceedings of the 3rd annual meeting of marine and fisheries research in Yogyakarta, Indonesia, July 27, 2006, UGM, Gajah Mada University, Yogyakarta, Indonesia, pp. 655-662.
- MMAF, JICA (2009). Indonesian Fisheries Book 2009. Ministry of Marine Affairs and Fisheries and Japan International Cooperation Agency (JICA), p. 83.
- Msuya FE, Shalli MS, Sullivan K, Crawford B, Tobey J, Mmochi AJ (2007). A Comparative Economic Analysis of Two Seaweed Farming Method in Tanzania. The Sustainable Coastal Communities and Ecosystems Program. Coastal Resource Center, University of Rhode

- Island and the Western Indian Ocean Marine Science Association. p. 27
- Munoz L, Freile-Pelegrin Y, Robledo D (2004). Mariculture of *Kappaphycus alvarezii* (Rhodophyta, Solieriaceae) color strains in tropical water of Yucatan, Mexico. *Aquaculture* 239 (1-4):161-177.
- Namudu MT, Pickering TD (2006). Rapid survey technique using socio-economic indicators to assess the suitability of Pacific island rural communities for *Kappaphycus* seaweed farming development. *J. Appl. Phycol.* 18:241-249.
- Neish IC (2007). Assessment of the seaweed value chain in Indonesia. USAID, available at <http://www.amarta.net/amarta/ConsultancyReport/EN/AMARTA%20Value%20Chain%20Assessment%20Seaweed.pdf> (accessed 24 June 2010).
- Nurdjana ML (2006). Indonesian aquaculture development. Directorate General for Aquaculture, MMAF, available at <http://www.agnet.org/library/bc/55007/> (accessed 1st December 2010).
- Ogawa K, Koyama Y, Oda SH (2006). A Middleman in an ambiguous situation-experimental evidence. *J. Soc. Econ.* 35(3):412-439.
- Rawwas MYA, Konishi K, Kamise S, Al-Khatib, J (2008). Japanese distribution system: The impact of newly designed collaborations on wholesalers' performance. *Indust. Market. Manag.* 37(1):104-115.
- Roberts WA, Stekoll MS (1993). Commercial potential of seaweed from St Lawrence Island, Alaska: Evaluation of market opportunity. *J. App. Phyco.* 5(2):167-173.
- Rosenbloom B (2007). The wholesaler's role in the marketing channel: disintermediation vs. reintermediation. *Int. Rev. Retail, Dist. Cons. Res.* 17(4):327-339.
- Rust J, Hall G (2003). Middlemen versus market makers: A theory of competitive exchange. *J. Polit. Econ.* 111(2):353-403.
- Samali AC, El-Ansary AI (2007). The role of wholesalers in developing countries. *Int. Rev. Retail, Dist. Cons. Res.* 17(4):353-358.
- Shevchenko A (2004). Middlemen. *Int. Econ. Rev.* 45(1):1-4.
- Sievanen L, Crawford B, Pollnac R, Lowe C (2005). Weeding through assumptions of livelihood approaches in ICM: seaweed farming in the Philippines and Indonesia. *Oce. Coast. Manag.* 48(3-6):297-313.
- South Sulawesi Province (2010). Sekilas tentang Provinsi Sulawesi Selatan (overview of the South Sulawesi Province). Available at <http://www.sulsel.go.id/indonesia/media.php?module=peta>, (accessed 17 January 2011).
- Stobutzki IC, Silvestre GT, Garces LR (2006). Key issues in coastal fisheries in South and Southeast Asia, Outcomes of a Regional Initiative. *Fish. Res.* 78(1-3):109-118.
- Sudartanto E (2010). Penyuluh dan bibit sebagai kendala rumput laut (Extension staff and seed as obstacles in seaweed culture), available at <http://www.dkp.go.id> (accessed 19 April 2010).
- DKP and Narayana Adicpta Persero (2007). Final report of Small Scale Natural Resource Management in Takalar. South Sulawesi (Unpublished).
- Thirumaran G, Anantharaman P (2009). Daily growth rate of field farming seaweed *Kappaphycus alvarezii* (Doty) Doty ex P. Silva in Vellar Estuary. *World J. Fish. Mar. Sci.* 1(3):144-153.
- Tjahjana (2010). Produksi rumput laut Indonesia terbesar di dunia (Indonesia is largest producer of seaweed in the world), available at http://www.bipnewsroom.info/?_link=loadnews.php&newsid=60849. (accessed 23 April 2010).
- Torii A, Nariu T (2004). On the length of wholesale marketing channels in Japan. *Japan. Econ.* 32(3):5-26.
- Vesala T (2008). Middlemen and the adverse selection problem. *Bull. Econ. Res.* 60(1): 1-11
- Zamroni A, Purnomo AH, Mira (2006). Kondisi sosial ekonomi pada budidaya dan pemasaran rumput laut di Bulukumba dan Palopo: studi kasus *Euचेuma* dan *Gracillaria sp* (Socio-economic performance of culture fisheries and marketing of seaweed in Bulukumba and Palopo: Case study of *Euचेuma sp* and *Gracillaria sp*). *J. Keb. Sos. Ekon. (J. Pol. Soc. Econ.)* 1(1):83-100.