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Short Communication

Gendered Participation in Seaweed Production - Examples from Indonesia

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Abstract

Despite the significant presence of women in seaweed production in Indonesia, most of the data collected in official statistics fail to capture their participation. These data gaps reinforce the policy neglect of gender issues in seaweed culture that also affects strategy to increase seaweed production and quality. This study examines the role of women and men in seaweed production in Nusa Tenggara Timur Province, Indonesia. The case study took place in three districts (Alor, Rote and Kupang districts) which represent the production area of seaweed in Nusa Tenggara Timur (NTT). The study presents the different characteristics of producers, including their socio-economic classes, and ethnic groups. A value chain analysis was used to provide insights and to help develop strategies to improve women's contributions to increasing seaweed production. The results demonstrate that men and women contribute similar amounts of labour to most processes in seaweed production in NTT. Therefore, to address issues of improving production and quality, women and men farmers need comprehensive basic and upgraded skills to reduce post-harvest losses. The involvement of both genders in seaweed farming needs recognition and both need to be taken seriously in the planning, and implementation of initiatives in order to improve production and quality.

Introduction

Seaweed is globally traded, used and consumed. Much of it is produced by rural villagers in remote areas, processed by companies in other places or countries, for example in China, Philippines, Spain, Japan, USA and Denmark, and consumed all over the world in end products such as tooth paste, capsules, cosmetic products, processed meat, dairy products, water gels, soft candy, pet

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food among others. In 2014, the worldwide culture of seaweed reached 27 million tonnes (FAO 2016). Cultured seaweeds are mainly those that produce carrageenan (*Kappaphycus alvarezii* (Doty) Doty ex P.C.Silva 1996, and *Eucheuma* spp. - 10.9 million tonnes), followed by the alginate-producing brown seaweeds (kelps – 7.6 million tonnes) (FAO 2016). Indonesia is one of the major producers of cultured seaweed.

In Indonesia, seaweed production increased from 2002 to 2014. The production reached more than 10 million tonnes in 2014, and contributes 70 % of mariculture production by volume (MMAF 2015). In 2014, more than 70 % of seaweed production was for export and 29 % was absorbed by national industries (Ministry of Industry 2016). This production increased gradually and the target for seaweed production in Indonesia is 19.5 million tonnes by 2019 (MMAF 2016a). The government of Indonesia supported 3,000 seaweed seedlings farm units in 2016 and planned to support 500 packages for seaweed farming development in 2017 (MMAF 2016b). The government also plans to continue to support seaweed farming. Many private sector companies and NGOs also provide support to increase seaweed production. All of these interventions need to carefully consider the beneficiaries. This paper presents an insight into the actors, their roles and relationships under this trend of increasing production and support. The objective of the study is to contribute to initiatives for selecting the beneficiaries and strategies for approaching the potential beneficiaries in an effective way.

Seaweed farming is important for small scale farmers who live in remote areas and have few economic alternatives. A study in 6 major seaweed producer countries showed seaweed farming was a profitable business that contributed to family incomes (Valderrama et al. 2013). In Solomon Islands, the average annual cash income of seaweed producers was 52 % higher than non-seaweed farming families (Kronen et al. 2010). In Tanzania, the revenue from seaweed farming empowered women and helped family food security (Besta 2013). Phillips et al. (2016) found that a growing number of small producers were operating seaweed farms. In the Philippines, seaweed farming revenue increased the income of the communities (Alin et al. 2015; Espaldon et al. 2010). These studies showed that seaweed farming can be essential as a family's source of cash income.

To increase production and improve the quality of seaweed, farmers and supporters need to understand how the system works in seaweed farming. Opportunities to improve production and quality are in the hands of the actors, the relations among them, and the farming management skills. Any intervention needs to recognize the key actors if it is to be effective. The aim of this paper is to demonstrate the gender dimension of seaweed farming. The specific objectives are to: (1) to examine the role of women and men in seaweed production in NTT Province, Indonesia; and (2) identify the different characteristic of producers, including socio economic classes, and ethnic groups.

Materials and Methods

The study areas are in Nusa Tenggara Timur Province, Indonesia. Nusa Tenggara Timur (NTT) is the second largest producer of seaweed in Indonesia. In 2013, three provinces were large producers of seaweed: South Sulawesi that produced 2.3 million tonnes; East Nusa Tenggara that produced 1.8 million tonnes and Southeast Sulawesi that produced 9.17 million tonnes (MMAF 2015).

3 districts were selected as study areas in NTT province: Kupang, Alor, and Rote Ndao (Fig.1) 10 villages from which represented the center of seaweed production in NTT Province. Villages in the respective districts were: 4 villages in Alor District (Kabir, Blangmerang, Kayang and Marisa); 3 villages in Rote (Oeseli, Oenggaot and Daiama); and 3 villages in Kupang District (Onansila, Akle, Nakean).

In NTT, the characteristics of seaweed production are that it is located in small islands in remote areas that have poor infrastructure. The proportion of women in the population were: 48.8 % in Kupang District, 51.2 % in Alor and 49 % in Rote Ndao (Table 1). In all 3 districts, more than 20 % of the population were poor (Table 1), which was higher than the national level of 11 % (WFP 2015). NTT province is also vulnerable to food and nutrition insecurity, as indicated by the percentage of households with no access to drinking water, female illiteracy levels and the Human Development Index. The percentage of households with no access to drinking water in NTT is above the national percentage. Female illiteracy in Kupang was 12.35 % in 2015 followed

by Rote Ndao at 9.28 % and Alor 7.1 % (Table 1). The Human Development Index (HDI) was between 66 and 69 and was considered as average for NTT province.

Table 1. Characteristics of study area

Study area	Population Census in 2010	% of women in population	Poverty (%)*	Household with no access to drinking water (%)*	Female illiteracy (%)*	HDI in 2013 (BPS 2015)
Kupang District	321,384	48.8	20.26	36.44	12.35	66,74
Alor District	196,179	51.2	20.11	51.69	7.1	68,93
Rote Ndao District	127,911	49	28.25	34.50	9.28	67.7
NTT Province	4,683,827	50.3	20.24	44.2	11.31	68.77
Indonesia	183,931,945	49.7	10.96	34.4	8.6	73.81

* Source: WFP (2015)

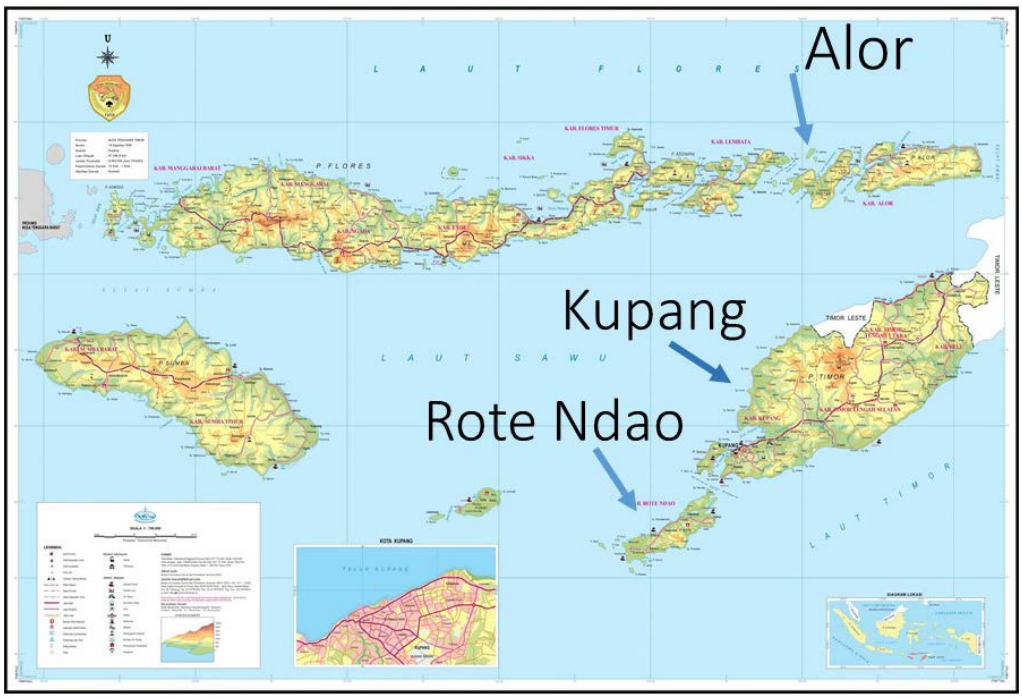

Fig. 1. Maps of study sites in Nusa Tenggara Timur Province, Indonesia

The author used elements from a value chain analysis (VCA) to understand the role of men and women in seaweed production and their relations to others. VCA is a tool to analyse how the market works, by identifying the core processes and full range of activities (e.g. production, processing, and distribution) conducted by actors and their relationships and the product values transferred along the chain as the product is brought to the final consumers (Kaplinsky and Morris 2001; M4P 2008; Hempel 2010). The VCA was combined with a gender division of labor approach to highlight the role, benefits and risks of women and men in seaweed farming (Choo et al. 2008; Harrison 2000; Kruijssen et al. 2013). Utilising the gender division of labor approach in VCA helps in understanding the constraints and identifying strategies to increase benefits and reduce the risks of each actor including men and women (Giuliani et al. 2005; Loc et al. 2010; Mitchell et al. 2011).

The study applied the following steps in mapping the value chains of seaweed from the study sites: (1) mapping the core process in farming activities; (2) describing the activities conducted by actors along the value chain, especially at producer level; and (3) identifying leading actors and the relationships between actors.

The data used in the present paper are a compilation from several works collected in different years. The data from Alor were collected as part of PhD research in 2009-2010; data collected in Kupang were part of a study of "Participatory Value Chain Analysis and Development Plan for Seaweed in Kabupaten, Kupang" in 2014; and the data collected in Rote were part of a study of "Sustainable Use of Marine Resources that Benefit People and Biodiversity in Rote Ndao" in 2015.

Data were collected through observation and discussion with producers, local traders and community leaders. The main data and information were collected through focus group discussions with producers. Only in Oenggaot and Daiama, Rote, data were collected through interviews with local leaders (Table 2). During focus group discussion at village level, several leading questions were used. It related to attributes along the chain such as activities, actors, and the relationship between actors. Information about activities related to what they did to get the best harvest, while information about actors identified the actors and with whom they did business. The relationships

between actors identified how each set of actors interacted, such as rules of agreement in business transactions, channels of information, and reward systems. Questions were also asked about challenges in the businesses. Further information was verified during the discussion and with key leaders.

At least one focus group discussion was conducted in each village, except in the cases of Oenggaot and Daiama where the information was gathered through interviews with local leaders (Table 2). The participants of the discussions were mainly farmers. Men farmers dominated the participation in the focus group discussions in all villages. This related to male domination in the public sphere; females were generally shyer than males when attending public meetings. The discussions were conducted in farming areas or in the village halls.

Table 2. Number of people involved for the discussion at village level and number of farmers

Sites	# of FGD	# of participants		No. of Farmers	Dominant ethnicity of farmers
		Male	Female		
Kupang*					
Onansila	2	32	4	100 households	Helong, Rote, Bajau
Akle	2	33	4	243 households	Helong, Rote
Nakean	2	35	18	72 households	Helong, Rote
Alor**					
LabuhanBajau	1	10	0	44 farmers	Alorese
Blangmerang	1	8	6	14 farmers	Bajau
Kayang	1	10	8	72 farmers	Alorese
Marisa	1	35	16	100 farmers	Alorese, Bajau
Rote Ndao***					
Oeseli	1	4	0	213 female; 184 male	Rote
Oenggaot	1	1	0	918 farmers	Rote
Daiama	1	1	0	800 farmers	Rote, Bajau
Total	13	169	56		

*Source: Fitriana (2014a), ** Source: Fitriana (2014b), *** Source: Fitriana (2015)

Based on the data collection, in Kupang district, the farmers in the study sites were identified as working in family businesses and, therefore, farmers were counted per household (Table 2). In a family business, the farm is owned by a family and the farming activities are conducted by family members. In Rote Ndao and Alor, on the other hand, individual women or men farmers were identified as the owners of seaweed farming and counted accordingly (Table 2). The dominant ethnicities of farmers in Kupang were Helong and Rote. In

general, these two ethnic groups live in the farming villages. In Onansila village, a group of Bajau also farmed seaweed. In Alor, the dominant ethnic seaweed farmers were Alorese and Bajau. In Rote, Rote people mostly farm seaweed, although a group of Bajau farmed in Daiama village.

Results

Seaweed Farming

The seaweed value chain includes: inputs, production, collection stage, intermediary trade that includes exporting to China or Philippines, processing, retailing and consumers. For this study, the scope only covers pre-farming, farming and post-harvest stages. Inputs at the beginning of the value chain provide supplies to farmers, such as ropes supplied by kiosk owners at the village level or credit by village collectors, seedlings gathered from neighbouring farmers, dugout canoes for harvesting, and equipment for sun-drying the seaweed. The dominant species farmed in these 3 districts were *Kappaphycus alvarezii* (Doty) Doty ex P.C. Silva 1996 and *Eucheuma* spp. Seedlings were mostly gathered from mature harvested plants. Farmers either buy or cut off their existing plants to become the seedlings for the next farming cycle or buy these from neighbouring seaweed growers. The participants of group discussions in Rote and Kupang considered they could maintain their seedlings now by keeping and harvesting about ten ropes of seaweed in 20 days and then culling the healthy branches of propagules and attaching them to new ropes. Farmers in Akle, Kupangand Marisa-Alor sourced seedlings locally as the waters in front of their village could be used for farming year round. Similarly, in Rote farmers had no difficulty in sourcing seedlings as they could farm and harvest all the year. Villagers in Nakean and Onansila (Kupang), however, had concerns about seedlings during the low season for farming. Similarly in Rote, Oeseli and Daiama (Rote Ndao) villagers could farm the whole year and had few problems with supplies of seedlings.

Ropes, important equipment for seedlings, could be gathered in the farmers' home villages and in the capital cities of each district. When the rope was provided by local traders, farmers had to sell the harvested seaweed to the local collectors. In special cases, the farmers could also sell to other collectors and had to pay after they received the cash from seaweed sales.

The farming methods included “long line” and “off bottom” methods. The use of long line term refers to a farming method that uses ropes floating in the water column. Meanwhile off bottom farming method uses ropes that are held near the surface of the seafloor. In one site, the farmers applied several methods (long line and off bottom) depending on the monsoon and tidal systems (Table 3). The average length of rope was about 50 m but the average varied from farmer to farmer. In Kupang District, in Onansila, farmers each had 36 ropes on average, in Akle 132 ropes, and in Nakean 135 ropes. In Rote, the average number of ropes per farmers were 80-90 ropes in Oeseli, 150 ropes in Oenggaot and 100 ropes in Daiama.

Table 3. Farming characteristics

Sites	Farming Method	Length of ropes	Average number of ropes/farmers	Best Harvest Season
Kupang				
Onansila*	long line	45 m	36 ropes	June to August
Akle*	long line	30-50 m	132	March to August high productivity season. Farm all the year
Nakean*	long line	35 m	135 ropes	March to May
Alor				
Blangmerang**	Off bottom, long line	50 m	-	January to May
LabuhanBajo**	Off bottom, long line	50 m	-	January to May
Kayang**	Long line	50 m	-	January to May
Marisa**	Long line	50 m	-	January to May
Rote Ndao				
Oeseli***	Off bottom, long line	35-50 m	80-90 ropes	Off bottom: November to March Long line: May to August
Oenggaot***	Off bottom but flexible	25-30 m	150 ropes	November to March
Daiama***	Long line	50 m	100 ropes	April–September: 3 times; Nov-Dec: 1 time; Jan-March: 1 time

* The asterisks refer to the sources of data as given in Table 2

The best farming season varied from area to area (Table 3). In Kupang, Onansila village experienced its best harvest season from June to August while villagers in Nakean experienced the best harvest season from March to May.

Akle village could farm all year, with high productivity from March to August. In Alor, the best harvest season was from January to May. In Rote District, seaweed had high productivity from November to March in Oeseli and Oenggaot. In Daiama village, villagers were able to farm 3 times between April and September.

The seedlings of seaweed were attached to the ropes (rope diameter 5-6 mm) using plastic rope or smaller size nylon rope (2 mm size). Having attached the seedlings to the rope, the ropes with attached seedlings were carried to the sea and attached to the main rope. The seaweed would be maintained by clearing the ropes from other algae or mud or re-tying seedlings that fell down. In many cases, the farmers let the seaweed grow with little maintenance, even though regular inspection and maintenance from planting to harvesting was crucial to ensure the plants were clear of sediment, diseased plants removed, branches growing well, lines and stakes were not broken or loose.

Seaweed was harvested approximately 45 days after ropes with seedlings were deployed. At high tide, the farmers harvested seaweed using dugout canoes, and, at low tide, by walking. One dugout canoe could carry only one or two lines. Seaweed was brought to the shore and untied. The untied seaweed was then sundried by spreading it on the rubble or plastic that lay on the ground or using “para-para” (bamboo racks). The sundrying process took 2-3 days depending on the availability of sunlight. Then, the seaweed was packed into a sack and sold to village traders or collectors.

The different ways of sundrying seaweed affected its quality. The use of *para-para* helped water to drain and kept the sundried seaweed clean from sand. When farmers sundried the seaweed on the rubble, they had to collect it carefully to avoid sand being collected.

In other areas in Indonesia, people sundry seaweed like drying clothes. This way, farmers do not have to untie it first and sundry. The hanging method helps water drain easily but the plastic rope is exposed directly to the sunlight, destroying its integrity. As some of the destroyed plastic rope could fall into the sack for sale, this reduced the purity of the product.

During the focus group discussion, we asked farmers why they still sundried on the ground although it allowed contamination. Farmers in Akle Kupang said they sundried on the ground only during times of high production when they lacked sufficient bamboo racks. Meanwhile farmers in Nakean and Onansila (Kupang) didn't realise the benefit of bamboo racks and kept the seaweed pure although dried on the ground. Also, bamboo racks meant additional investments. Considering the investment and quality tradeoffs, awareness raising initiative to improve the quality of seaweed by encouraging group efforts to build bambo racks is essential.

The village traders weighed the harvested and dried seaweed and paid the farmers in cash. Normally the village traders had the scales, and farmers accepted their accuracy. The village traders collected the seaweed from several points of sale and then the collectors transported it to a warehouse in Kupang, the capital city of NTT Province. The traders in Kupang randomly checked the quality of seaweed. They stored the sundried seaweed in a warehouse, waiting until the quantity was sufficient to be sent by container to, e.g., Surabaya. The traders gave new empty plastic sacks to village traders, replacing the sacks they collected.

Labour and gender participation

Seaweed farming was conducted by family members, including women, and men. The core processes in seaweed farming included providing inputs (seedlings and ropes), cleaning the ropes, tying seedlings to ropes, attaching these to the main rope sat sea, daily maintenance at sea, collecting fallen seaweed, harvesting, untying seaweed, sun drying, and selling it to traders.

In providing input (Table 4), men mostly obtained the inputs as this sometimes entailed travelling to other villages. In some cases, buyers provided inputs by agreements that farmers sell all of their harvest to the buyers. Men and women were involved in cleaning the ropes on land before the seedlings were attached. All members of the family helped in tying the seaweed seedlings to the ropes, although the women dominated this activity. The farmers considered this activity as "family work". Men would take the ropes with seaweed to sea by dugout canoe and attached the tied seaweed to the main ropes. The men were helped by their relatives or neighbouring farmers. The men checked and cleaned

the ropes daily. During harvest time, women collected fallen seaweed and untied the seaweed from the ropes. In Alor District, women dived to collect fallen seaweed, while, in Kupang and Rote, women collected seaweed along the coast. Other activities were conducted by both genders (Table 4). For selling to traders, women sold their seaweed if the trader was also a woman. This may have made them feel comfortable in dealing with the traders. Data shows that women and men contribute similar amounts of labour to most processes in seaweed production.

Table 4. Gender differentiation in Seaweed activities

Activities	Male	Female	Notes
Providing input (Seedlings, ties, ropes)	√	-	Find seedlings; mostly conducted by men as it required travelling to other villages
Clean the ropes	√	√	Men and women involved in cleaning the ropes before seedlings were tied
Tying seedlings to rope	√	√√	Family work, predominantly done by women. Sometimes children were involved.
Attach to the main rope in the sea	√√	√	Mainly conducted by men as they needed to attach ropes to the main ropes at sea. Women helped.
Daily maintenance in the sea	√	-	Seaweed left to grow but maintained by checking the ropes and cleaning them from other algae and mud.
Collect fallen seaweed	√	√√	Women mostly collected fallen seaweed. In Alor, women dived to collect fallen seaweed; in other areas women collected the fallen seaweed along the coast.
Harvest	√	√	Men harvested the seaweed at sea, using dugout canoes and bringing it to shore.
Untie seaweed	√	√√	Women mostly untied seaweed.
Sun-drying process	√	√	This was family work; once untied, seaweed was sundried on the rubble/plastic rack for two days. Dried seaweed was put into plastic sacks.
Selling to traders	√	√	Men normally dealt with local traders. If the local trader was a woman, the woman producer dealt with the woman trader.

Note: √= this gender does this activity
√√= more number of people in this gender do this activity

Working system and farming location

Different study areas had different working farm systems (Table 5). The working system was basically run by family members in Labuhan Bajo, Kayang and Marisa in Alor (Table 5). At times, the farmers worked in groups with their neighbouring farmers in Onansila, Akle in Kupang, Blangmerang in Alor and Daiama in Rote Ndao. In Kupang, farmers worked in groups during the tying and untying processes. The working system was called Madene, and members of the groups were normally relatives or friends whose farm locations were close to each other. About ten people worked together attaching the seaweed to ropes or during harvesting. No formal agreements existed. Assistance given was expected to be returned in kind. In most cases, people sat and worked together.

Table 5. Working system in seaweed farming

Kupang	
Onansila	Working in groups "Madene" for tying and untying the seaweed during post-harvest
Akle	Working in groups "Madene" for tying and untying. Members were those whose seaweed ropes was close to each other; helping was mutual.
Nakean	Hired people to tie the seaweed
Alor	
Blangmerang	Working in groups during tying process
LabuhanBajo	Family work
Kayang	Family work
Marisa	Family work
Rote	
Oeseli	Individual work
Oenggaot	Individual work, hired labour for tying seaweed
Daiama	Working in group during tying process

One person tied seedlings onto 4-5 ropes per day, with the rope about 40-50 m long. Ten people in a group could tie seaweed onto around 15-20 ropes per day, attach to each of 40-50 lengths of rope. At harvest, for the loop tied system which used nylon rope, the farmers, in a group, could release about 30 ropes each day, and 10 people could untie 15-20 ropes per day of plastic line as each of these had to be untied manually. In Nakean village Kupang district,

farmers hired others to help them in tying the seaweed, paying each person 1 USD for each rope. In Alor District, farmers consider seaweed farming family work and all members of the family were involved in the farming.

Where farming was considered family work, all members of a family, husband, wife, children and other relatives, conducted it and the family owned the farming enterprise. As a family owned business, the head of the household, the man, was considered as the farmer. Females were considered as supporting their husbands to conduct seaweed farming. This system applied in Kupang and Alor Districts. In Rote, seaweed farming was considered individual work and individuals owned and conducted the enterprises. Women and men (wife and husband) owned their seaweed farms separately and had different farm locations (e.g. Oeseli and Landu Island). During the tying process, however, they worked in groups as it was intensive labor.

The farming areas were open to anybody from within the village. The first person who farmed in a spot was considered the owner. Nobody could trespass on the farm of another community member. If someone did trespass, the neighbours would reproach him/her. If a seaweed farmer abandoned a farm, the site was still considered as his/her property. If another farmer planned to use the abandoned site, she/he needed to ask permission from the owner. If the farming area was beyond the village area, the farmers needed to ask permission from the village leader of that area. Having obtained permission, the villager could then go ahead with the farm. Although there was no formal marine tenure in Indonesia, the first person who farmed seaweed on a spot was considered the owner.

Farming sites were close to each other, and this enabled farmers to work together when intensive work was required, e.g., during tying. Conflicts over farming sites rarely occurred, but sometimes conflict happened over claims to fallen seaweed. Accusing someone of stealing from another farm could cause disputes among farmers. Therefore, farmers had to build trust among those farming nearby. Trust was built by working together, e.g., “Madene” in Kupang District helped to build trust as well as helping each other in seaweed farming.

Discussion

Seaweed farming is a prosperous industry for small scale coastal villagers. In eastern Indonesia, seaweed farming has become one of the main commodities and many people in remote and small islands depend on it. The present case study showed the extent to which women and men are involved in seaweed farming in NTT Province. Such participation also occurs in other provinces of Indonesia. For example, in South Sulawesi (Eranza et al. 2015), North Sulawesi (Crawford 2002), and Aceh (Jamandre et al. 2009). NTT province is the second largest contributor to seaweed production in Indonesia. NTT has a high rate of poverty (20 % of the total population) (WFP 2015). In 2013, seaweed has contributed 1.4 million USD to the economy of NTT Province, based on calculations of production and the price in local trades. Seaweed has rapidly emerged as a major cash mariculture in NTT Province.

Seaweed is a productive activity as a family business and the farmers benefit economically. The farmers, either men or women, earn cash and use it for their daily family expenses. During focus group discussions, the participants in the 3 sites told how seaweed farming gave them extra income for renovating their houses, buying motorbikes, in addition to other daily expenses. Women used the extra money for daily expenses, whereas men used their extra money for bigger investments, such as buying motorbikes and renovating houses. Children also experienced additional pocket money, as reported by kiosk owners who found that the number of their underage customers increased during the high season of seaweed farming.

All these examples show that the significant additional cash income from seaweed farming was used to improve people's lives. On the other hand, seaweed farmers also need to save for unfavourable times in farming, to repair the ropes and buy new seedlings. The main ropes can be used for up to 3 years, while plastic ropes only could be used for up to one year. In addition, seaweed farming in NTT has undergone boom and bust cycles due mainly to disease and price fluctuations. Many men and women farmers used all their gains from seaweed farming without considering possible bad seasons that could cause their farming businesses to collapse. Farmers who did not save to re-invest had then to depend on external support. Although women and men farmers experienced good benefits from seaweed farming, they were likely to be

vulnerable. Local traders are some of the key helpers, however, they tend to put pressure on their client farmers over prices and product quality. Farmers risk being trapped into long term relationships with the traders.

Efforts are needed to increase farmers' awareness of re-investment and savings needs, and to relate income and expenditures within families to controlling household budgets and resilience. Participants in Rote, Alor and Kupang considered women to be the day to day managers of the home and in control of family money. Typically, larger expenses were decided jointly by husbands and wives. To increase awareness of re-investment, interventions should target both women and men so the family can discuss and prioritise budget allocations and both genders have equal roles in farm development.

These 3 study areas in NTT province showed how households and individuals were connected to seaweed farming. In Kupang and Alor, the farm owner and typically the head of the household is a man. Women, men and children supply the farm labor. Seaweed farming is considered as a family business, and both women and men work with a division of labour between them. In Rote, women and men work in different locations and ownership is classified differently.

Farm ownership needs to be understood or the wrong target beneficiaries could be selected for transferring skills and technology. Often, the heads of households are invited to meetings and women are left behind. This also happened in focus group discussions where more men than women attended the meetings. Typically, men participate in community meetings. Women felt inferior in attending and considered male participation was enough, even though both genders were encouraged to participate. Achieving gender equality at community level, e.g., in meetings, relates to changing society's views on the role of women in the public domain (Moser 1993). In NTT, women actively work in every aspect of seaweed farming, except where travel to distant places leads to men dominating the work, for all ethnicities.

Women and men have different knowledge, skills, interests and perspectives in seaweed farming and both genders have to learn how to adapt to the sea and improve farming methods. Farmers need to adjust to changing sea

temperatures. The actors in post-harvest handling need to be recognised, as well as their methods and the market requirements.

Women and men farmers described their work days as like daily work in an office. They had to start early in the morning and continue until sundown. Especially the tying and untying processes required time and energy, with long hours of work, wind and seawater. All were full time farmers. The geographical distance between family homes on the island and production sites meant the farmers had to limit their time caring for their school-age children. In Alor, the farming area was a different island from their home island. The farming area in Kupang and Rote was far from homes. Social problems sometimes resulted, such as school children living at home without their parents' guidance. Increasing production might require parents to leave their home villages for longer periods. In other cases, women, as part of their domestic role of caring for children and family, have to go back and forth from the farming area to home village more frequently than the men, adding a double responsibility and risk to the already burdened women. To function in their domestic roles, women need improved technology, services and infrastructure.

Conclusions

Achieving Indonesia's target of seaweed production of 19.5 million tonnes in 2019 (MMAF 2016) needs an effective strategy to target the real actors. One way is to recognise the participation of both genders in every aspect of seaweed production so that interventions to increase production will be effective. Women and men both have important roles in seaweed farming and post-harvesting. To address issues of improving production and quality and reducing post-harvest losses needs a comprehensive upgrading of the skills of all farmers. Ignoring men's or women's roles in seaweed farming undermines the challenge in reaching the producers. Women and men's farming knowledge covers different elements of the farming practices as both play significant roles for different tasks in farming and post-harvesting. Knowing who does what can guide strategies for efficient technology transfer and for improving product quality.

Although seaweed farming is a family business and women and men work together in Kupang and Alor, the communities still consider women as

only "helpers" and see the women's main role as helping the household. Yet, women play significant farming roles from pre-farming, farming and post-harvest. Apart from targeting the real actors, it is also important to raise awareness of both genders in re-investing family resources in seaweed farming.

Interventions for improving seaweed production should also address social problems such as that farm sites that are distant from home villages place extra burdens on women who have to go back and forth, increasing their responsibilities and risks. Better farming needs to be integrated with wider development to support women in their domestic and productive roles.

The involvement of women in seaweed farming needs to be recognised and they should be taken seriously in the planning and implementation of initiatives to improve production and quality. Equal participation in the public domain needs to be encouraged at societal forums, even though this requires change in individual, household and social relations. The opportunity for women to achieve equality and enable them to voice their concerns and priorities will require a long term intervention.

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