Socio economic assessment of brackish water aquaculture business in Aceh Tamiang Regency

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Abstract. Brackish water aquaculture is an essential business in Aceh Tamiang Regency. Data and information about the brackish water business collected from selected villages in four regencies from April until August 2020. In 2019, the brackish water farmers run their business 91.1% as the traditional type of aquaculture, 2.0% as semi-intensive, and 6.9% as intensive practices. The traditional brackish water farm is depending on "toke" as the source of funding. Meanwhile, the last two types of businesses grew with rent and sharing system. The brackish water activities only give limited benefits to the local community because they highly depend on other regions for seed, feed, pesticides, and labor, and the local institution supports the brackish water business not yet created. This research recommends: the village's government should develop and implement the regulation for the involvement of local people in business activities; the brackish water institution should be created in the location especially for water management, control water pollution, and sources of various information regarding brackish water business. The Village Business Agency (Badan Usaha Milik Gampong) should improve its capabilities and play a role in the village's brackish water business.

1. Introduction

The economy of Aceh Tamiang Regency, based on Badan Pusat Statistik/BPS (Central Bureau of Statistics) data, depends on three sectors, namely the agricultural, mining, and processing industry. In 2019, the contribution of these three sectors to Aceh Tamiang was: 40.44%, 11.06%, and 6.12%, respectively. Those three sectors have their own role to the economy. Processing industry has strategic role, there are two palm oil processing industries supporting 44,000 hectares of palm oil plantation, managed by 26 plantation companies. Mining sector is vital in relation to locally-generated revenue (PAD) meanwhile agriculture is considered as the leading sector looking at its contribution to the gross regional domestic income (Pendapatan Domestik Regional Bruto-PDRB). Data [1] shows that the contribution of the agricultural sector in Aceh Tamiang economy, based on prevailing prices, tends to increase from 36.52% (2015) to 40.28% (2019). In addition, data from [2] shows that the growth rate of this sector was 5.92% (2016) and 5.08% (2019).

The contribution of fisheries as one of the business fields in the Aceh Tamiang agricultural sector was 3.41% (2015) and 3.56% (2019) with the growth rate was 3.96% (2015) and 3.90% (2019) [1]. Within the fisheries, brackish water aquaculture is an important economic activity for the Aceh Tamiang Regency. It covers 4.29% of the Aceh Tamiang Regency area [3]. Brackishwater activities support coastal communities' economy in 4 districts (Manyak Payed, Seruway, Banda Mulia, and Bendahara). In 2019, there were 3,624.5 hectares of brackish water pond in Aceh Tamiang where 52.4% of it was used to produce Tiger Prawns, 25.6% for Milkfish, 16.2% for Vaname Shrimp, and 5.7% for Crab.
This research records that the development of brackishwater aquaculture in Aceh Tamiang has several problems. The first is the conversion of a brackish water pond to palm oil plantations [4]. The second is related to water contamination for the aquaculture pond [5] and, the third, is the lack of infrastructure and social capital for supporting the post-harvest activities [6, 7]. This assessment aims to provide information on the existing socio-economic conditions of brackishwater aquaculture in Aceh Tamiang as an input for its future development program.

2. Data and Methods
This study uses secondary and primary data. The secondary data was obtained from the Marine and Fisheries Food Agency while the Primary data was from key informants in Alue Sentang Village - Manyak Payed District, Alue Nunang Village - Banda Mulia District, Bandar Khalifah Village - Bendahara District, Sungai Kuruk III Village - Seruway District. The number of key informants interviewed in each village was six persons. All the persons were choice based on their comprehensive knowledge about the Tamiang’s brackish water history. The total number of the interviewed key informants was 24, conducted from April to the second week of August 2020. The analysis is using descriptive method, utilizing information obtained during the field visit completed by various references.

3. Results and Discussion
3.1. The Brackish Water Pond Development
The brackish water aquaculture area in Aceh Tamiang continues to shrink. The study conducted by [8] indicated that the decline was due to the conversion to palm oil plantations. During the period 2008 - 2019, the conversion rate was -3.63% per year. The highest rate was experienced by Seruway District which reached -6.87% per year; in Bendahara, Manyak Payed, and Banda Mulia Districts were recorded at -3.49%, -3.76%, and -1.34%, respectively.

| District           | Brackish Water Aquaculture Area (hectares) per year | Conversion rate (%) |
|--------------------|-----------------------------------------------------|---------------------|
|                    | 2008  | 2017  | 2018  | 2019  |                    |
| Seruway            | 1,507.0 | 451.7 | 457.3 | 652.5 | -6.98              |
| Bendahara          | 383.2  | 195.5 | 193.0 | 252.0 | -3.49              |
| Manyak Payed       | 2,068.2 | 912.3 | 950.5 | 1,317.0 | -3.76             |
| Banda Mulia        | 1,648.5 | 1,269.6 | 1,271.6 | 1,403.1 | -1.34             |
| Total              | 5,606.9 | 2,829.0 | 2,872.3 | 3,624.5 | -3.64             |

Source: Aceh Tamiang Marine and Fisheries Food Office

The interviews with respondents indicated that the conversion was caused by:
- The spatial plan for coastal land use in these four districts has not been implemented because supervision is minimal. For example, the chicken farming business is currently being developed on the river bank and pond channel in Sungai Kuruk III Village. In several pond locations, swallow farm businesses is also in progress.
- The conversion is also influenced by the revenue/cost (R/C) ratio in Tiger Prawns production; Ratio of 1.4 - 1.5 means that if the farmer spends Rp. 1, they only get additional revenue of Rp. 0.4 - Rp. 0.5. Whereas the R/C ratio of Vaname Shrimp production is 1.7, which means that Rp. 1 that is spent by the farmer will get additional revenue of Rp. 0.7. For the Milkfish aquaculture, the ratio is 1.4 shows that every Rp. 1 that spends by the farmer will only get additional revenue of Rp. 0.4. During the COVID-19 pandemic in March - July, the price of pond products at the farmer level was meager. Vaname shrimp reached Rp. 45,000/kg and Milkfish (size for consumption) in August 2020 was still Rp. 10,000 - Rp. 12,000/kg. These prices are not
profitable and make farmers no longer use most of these ponds. Price becomes a barrier to participation in the aquaculture business [9]. In addition, the conversion of ponds to oil palm plantations is an attractive factor for farmers to participate in the local government's oil palm plantation program.

- Production activities in unconverted ponds was carried out in a partnership system. There are several types of partnerships in this business, namely sharing costs and risks between "toke" (middleman) and the farmer. This form of cooperation is producer-driven models [10, 11] and can increase farmers' bargaining position. Another type of collaboration is a combination of monthly salaries and profit-sharing between "toke" and the farmers, which is called a buyer-driven model [11]. Besides, there is cooperation in the form of land rent by feed companies applying monthly salaries and bonuses for pond workers [12, 13]. The interview results show no ponds in Aceh Tamiang that operate under contract farming [14]. Partnerships formed because of asymmetric price information of the aquaculture product [15, 16]. The farmers still profit at the production node, but this profit is minimal compared to traders' profit at the distribution and market nodes. The asymmetric information happened because the purchase price (shrimp) at the farmer level is determined unilaterally by the big traders in Medan.

3.2. Water Pollution and Business Infrastructure

Water pollution is a problem which is faced by ponds in four districts in Aceh Tamiang Regency. This pollution causes the relatively high mortality rate and disturbs the growth of cultivated commodities so that production yields and quality are not the same as are expected.

Ponds pollution in Aceh Tamiang comes from two sources: rivers and the aquaculture area. The river in Aceh Tamiang has high sedimentation rate. The suspended matter value was 228 mg/l, and BOD was 2.77 mg/l [3]. The river was polluted with palm oil waste at certain times so that DO reaches 6.8 mg/l [3]. This sedimentation caused a delta at the mouth of the river in Aceh Tamiang. The water from the river's mouth flows into the ponds through a canal/channel called "paluh." In the pond area, pollution is caused by feed waste in ponds and chicken farm waste that has been developed in several villages in the watershed area. This waste reduces the water quality in the aquaculture area. The cost around Rp 2 million – 3 million per hectare is required to dispose the feed waste in the ponds that created by workers from outside the region.

Apart from the above problems, brackish water aquaculture in Aceh Tamiang is also hampered by lack of pre-production and post-production infrastructures. In Aceh Tamiang, there is only 1 Cold Storage unit with capacity of 20 tons, and there is no ice factory. The ice supply for fish and shrimp preservation comes from outside the city, including Medan. Moreover, the source of production factors such as seeds, medicines, fertilizers, and part of the workforce comes from outside the region. The supply area for nener (milkfish seeds) is from Bali while benur (shrimp seeds) from Bieruen or Medan. Feed and medicines depend on Medan. Workforce for cleaning waste on the floor of ponds and sorting the products also come from Medan.

3.3. Institutions in the Ponds Business

Adequate institutions is necessary to materialize the potential for brackish water aquaculture in Aceh Tamiang. In the ponds community, only groups of farmers that receive assistances from the government. In 2020 there is a PITAP (Pengelola Irigasi Tambak Partisipatif) group in Sugai Kuruk III Village. The PITAP group was responsible for administrative implementation of irrigation improvement. According to [17], this top-down group was not effective in supporting the project's sustainability because the vision and goals of project implementers were not the same as the farming community.

Several institutions must be developed and formed primarily to support the pre-production, production, and post-harvest activities of pond products. Institutions that need to establish are Badan Usaha Milik Gampong (BUMG), PITAP+, and Badan Musyawarah Gampong (BMG). BMG can play a role in making regulations or rules at the village level regarding the requirements for doing
business in the village. This rule binds all activities in the village. These regulations are at the initial stage in controlling pollution caused by livestock business, controlling mangrove forest utilization in relation to charcoal production. Various rules might be required such as the one that manage pond irrigation, etc.

BUMG has been established in each village; this institution can play an important role in supplying various ponds requirements such as feed, nener, shrimp seeds, drinking water for pond workers, etc. BUMG might become village-owned business whose benefits can be felt by the village community. PITAP role must evolve into PITAP+. Its activities might be expanded to regulate and maintain irrigation channels, collaborate with BMG to make regulations on ponds in villages, arrange planting and harvest schedules to encourage ponds businesses in Aceh Tamiang to compete with other regions. PITAP+ is expected to play a role in controlling shrimp and fish diseases in Aceh Tamiang

The above institutions, according to [18], can be built according to function and objectives. According to function, institutions are an effort to design interaction patterns between business actors (within and outside groups) so that agreements can be occurred and implemented (for example, PITAP institutions). In relation to the objectives, institutional is an effort to create economic efficiency with power, economic, political, and social structures within the village to achieve the planned targets-the institutional forms such as BUMG and BMG.

4. Conclusion

This paper shows that the shrimp and milkfish business in Aceh Tamiang faces many challenges. Production inputs (feed, milkfish fry, shrimp fry, and workforce) supplied from outside the region. Production activities have occurred through cooperation in various forms because the ratio of income and costs at the production node is less competitive, while the trade node is more competitive. Brackish water aquaculture business institutions must develop from existing institutions, and new institutions also need to be formed, especially in managing water, irrigation, and control pollution. The post-harvest plan in Aceh Tamiang also needs to develop to support the production of shrimp and milkfish.

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