



Problem analysis and development strategy of shrimp culture in Tanah Laut Regency, South Kalimantan Province, Indonesia

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Abstract. This study was intended to identify the shrimp culture condition, analyze the shrimp farmer's problems, and create the concept of the development strategy. It was carried out in Muara Kintap village, Tanah Laut regency. It applied SWOT analysis on the internal and external factors. Results showed that the shrimp pond condition got very strong environmental pressure from various mining and plantation activities nearby so that the shrimp culture could not productively work. SWOT analysis found that shrimp pond culture was in quadrant IV (FSI -0.21 and FSE -0.71) reflecting weak position due to very strong external environmental threat in which the internal force was not capable enough of controlling it or being in defensive strategy. Pond culture development in the study site could be done through revitalization and conservation of protected area and mangrove, and access limitation to the coastal area. Stakeholder's role and concern for coastal and marine environmental preservation is needed in order to support the productive economic development of local communities, especially fisheries and promote community's participation in the management of aquatic environment and mangrove ecosystem.

Key Words: coal mining, ecological pressure, SWOT, revitalization, management.

Introduction. Fisheries resources have been long used for various people's productive activities, such as aquaculture and fisheries as major source of their livelihood in Tanah Laut regency. There were 467 fisheries households as shrimp farmers in 2008 that declined to 393 fisheries households in 2012, and there were 3,749 fisheries households as fishermen in 2008 that fell to 1,979 households in 2012 (Hidayat 2014). Beside high fisheries resources availability, this regency possesses also rich mining and mineral resources (coal is distributed as extensive as 314.4 million m² area). Nevertheless, high mining activities have made shrimp culture cannot be productive.

According to Hidayat (2014), aquaculture fisheries production in Tanah Laut regency has decreased since 2008 because of culture pond area declined. In 2008, the shrimp production was 1,661.10 tons with the culture area of 1,940.30 ha and the productivity of 856.10 kg ha⁻¹ yr⁻¹, while in 2012 it drastically fell to 199.22 tons with the total area of ponds of 1,759.36 ha and the productivity of 113.24 kg ha⁻¹ yr⁻¹. This condition is inversely proportional to the national shrimp production which continues to increase from 2009-2013 with an average growth of 19% (Ministry of Marine Affairs and Fisheries 2015). Nowadays, most of shrimp culture activities in Tanah Laut are terminated. These two different conditions indicate that shrimp pond activity in this regency have serious problem from environmental pressures, particularly coal mining activities.

The exploitation of mining and mineral resources has also occurred fast since early 1990s especially after Regional Autonomy Law of 2004. Based on the Regional Development Planning Board data of South Kalimantan province in 2012, there were 53 mining companies under Permit Holder and Working Agreement on Coal Mining Concession in the coastal area of Tanah Laut regency covering about 58,960 ha (Regional Development Planning Board of Tanah Laut Regency 2014).

Muara Kintap village, Kintap district, is one of the coastal villages in Tanah Laut regency whose population is mostly fishermen and fish farmers (pond). It, however, occurs also in the area where there is shipping facility of several coal mining companies. The operations of the specific port and the stockpile of coal companies in Kintap river pass the Fish Landing Base of Muara Kintap that is mooring site of the fishermen's boats. These activities certainly give physical impacts on the density of the cruise line in Kintap river. Besides, the operations of several specific ports along the coastalline have caused many coal barges moor to line up for coal loading.

Mining activities have remarkably given positive benefit on the regional economic development of Tanah Laut regency, particularly regional revenue (Brutto Regional Domestic Product of mining sector increased from 4.4 % in 1999 to 9.52% in 2006, 10.90% in 2012, and 25.62% in 2015), but these could also give potential negative impact on the coastal environmental quality degradation (BPS 1999, 2006, 2012, 2016).

Based on the previous study, the traditional fishermen of Muara Kintap, especially bottom gill-netters (fish and shrimp), are not affected by transportation activities of the coal mining in the study sites since their fishing grounds are in 3-6 mile-lane and they use more than one fishing gear so that fishing can be done along the year. Mean monthly income is higher than the minimum wages of South Kalimantan and the fishermen of Bawah Layung village, Kurau district, except that the traditional fishermen of Muara Kintap are still in low category due to access limitation to the fisheries resources (Hidayat et al 2014).

Hidayat et al (2014) also added that the presence of coal mining companies in this area did not significantly raise people's prosperity of Muara Kintap. Their condition is worse than that in Tanah Laut regency as a whole based on education and residential indicators.

Based on the condition above, this study formulated the following issues: how are the conditions, problems of the shrimp pond culture, and its development strategy? The objectives of the study were to identify the pond culture condition, analyze the shrimp farmer's problems, and create the concept of the farmer's pond culture business development strategy in the study site.

Material and Method. The study employed survey method with descriptive method. The study site was purposely determined in Muara Kintap village, Kintap district, Tanah Laut regency, South Kalimantan province. The selection of Muara Kintap as the study site was because this area had had very high shrimp culture development in the past, so that irrigation facility was built in 1990s under Japanese Aid. After regional autonomy implementation, the government issued the permit of coal mining activities and since then it gradually affects the shrimp culture development.

The study was carried out from August to November, 2015. Sample in this research was fisheries households of shrimp pond farmers. Determination of the number of samples is done by using the formula from Slovin (Sekaran 2000). Number of shrimp farmer's household in Muara Kintap Village was only 30 households, and 23 respondents (more than 90%) of the total shrimp farmer's households were taken as samples for interviews. These sample numbers were considered to be enough to represent the shrimp farmers in Muara Kintap.

Data collection was directly done through interviews following the prepared questionnaires and in-depth interviews to the key person. The analysis of pond culture activity condition and problems in the study site was conducted descriptively based on field study supported with relevant previous findings. Preparation of management strategy concept to shrimp farming business in study area used strength, weakness, opportunity and threat (SWOT) analyses (Rangkuti 2005). This method includes internal and external factors identification, determination and formulation of strategic factors, and determination of SWOT strategy alternatives. Internal factors have positive contribution (strength) and negative contribution (weakness). External factors have also the same features, positive (opportunity) and negative (threat). Internal Factors Analysis Strategy (IFAS) and External Factors Analysis Strategy (EFAS) were employed for internal and external factors, respectively.

Results and Discussion

Respondent characteristics. The pond farmer respondents were 25-65 years old, in which 57% belonged to very productive age, 26-45 years old. The shrimp farmer's formal education generally (79%) finished Elementary School education. All respondents are immigrants from Maros, South Sulawesi even though their arrival in this area does not simultaneously reflect their duration variations of inhabiting the area. Meanwhile, 65% of them have lived there between 16-25 years.

Fish farmer respondents on study possess relatively large dependents based on number of members in a family. Most of them (74%) had more than 4 family members, and only 26% had 4 family members.

Pond culture business condition and problems. Major facility supporting the pond culture in this area was irrigation as pond water inlet and outlet. It was built around 1999-2000 from Japanese Government's Aid Program, Sector Program Loan (SPL)-OECF, used for Pond Development and Hatchery Program. The irrigation facility condition is now not well-maintained, especially on the outlet part flowing to Kintap river, due to silting so that water exchange has not worked well. Similar condition also happened in the lower part of the irrigation (inlet) facing the sea and flowing to the main irrigation channel.

Pond culture business in Muara Kintap, Tanah Laut regency, has not nowadays been intensively run by the owner. The farmers seemed to be no longer dare to stock the shrimp seeds in their pond due to very high mortality after few weeks of stocking. This failure happened in the last few years and made the farmers be not able to afford their new pond culture activity.

The termination of shrimp pond culture activities also occurred in other pond areas of Tanah Laut regency. The indication of low shrimp culture activities appeared from the termination of fisheries company operations in shrimp culture and trading (cold storage), both inter-island and export. In 2000, there were 14 fisheries companies actively doing export and inter-island tradings, one of which, PT Suri Tani Tani Pemuka, also ran its own pond culture business. Nevertheless, there were only 5 companies left in 2007 that were still conducting their business under the recommendation of Tanah Laut Marine and Fisheries Services to prolong the Fisheries Business Permit (Marine and Fisheries Services of Tanah Laut regency 2008). In 2010, the fisheries industries (cold storage) operating in Tanah Laut regency fell to 4 companies, PT. Ebi Mas Besar, PT. Borneo Surya Abadi, PT. Karimata Timur, and PT. Bumi Menara Internusa (Regional Development Planning Board of Tanah Laut Regency 2014).

Direct interviews with several community leaders found that pond culture business in this area has been unproductive since 2007 due to very high mortality from disease infection. It is in line with the interviews for the farmer respondents that in the last several years they were no longer dare to stock shrimp seeds in the pond because of repeated failures.

The fisheries production of Tanah Laut regency from pond culture in 2007 was 1,661.10 tons from the stocking area of 1,940.30 ha with a productivity of $856.10 \text{ kg ha}^{-1} \text{ y}^{-1}$. In 2011, the pond production drastically fell to 199.22 tons from total pond area of 1,759.36 ha with a productivity of $113.24 \text{ kg ha}^{-1} \text{ y}^{-1}$ (Regional Development Planning Board of Tanah Laut Regency 2014).

No operation of the shrimp pond culture business was also physically known from unmaintained pond plot, and damaged dyke, water inlet-outlet, and guard house. Transportation access to the pond area was mostly damaged so that it was difficult to visit the houses in the area. Dyke damages mostly occurred in the pond area along Kintap river, and even some areas have become mooring site of barges and tug boats lining up in the coal specific port. Small number of ponds was operated by the farmers rearing fish and shrimps that entered the pond through tidal current, and the yield was used for daily consumption.

Previous study in 2007 entitled "*Study Post-Stock File and Coal Specific Port in The Coastal Area*" concluded that coastal area degradation in Tanah Laut regency tended to result from terrestrial ecosystem degradation (erosion and pollution) into the coastal

area due to catchment area destruction. This destruction yields increased water mass disturbance towards the downstream and raises the river water discharge diluting the coastal water salinity. Habitat and mangrove ecosystem destruction from salinity dilution and land conversion make the coast lose the natural sediment trap system that results in reduction or loss of terrestrial forming ability seawards through sedimentation (Marine and Fisheries Services of Tanah Laut regency 2008).

Analysis on Coastal Area Zonation and Small Islands preparation of Tanah Laut regency of 2014 found that main limiting factor for pond culture area development in Tanah Laut regency was low water salinity as a result of many rivers flowing to this area, especially in rainy season. Other factor was the impact of water pollution, especially ponds near the river around palm oil plantation area, mining sites, port, residential area potentially yielding water pollution. Besides, low topographic condition of the pond area makes it be easily flooded in high rainfalls and high tides (Regional Development Planning Board of Tanah Laut Regency 2014). Water quality measurements in 2012 at 4 points around Muara Kintap indicated very low water salinity, 6.0 ppm at 115°15'44.919" E and 3°53'41.136" S, 10.0 ppm at 115°15'26.153" E and 3°53'44.134" S, 3 ppm at 115°15'37.394" E and 3°53'32.736" S, and 5.0 ppm at 115°14'58.641" E and 3°53'44.843" S, respectively (Regional Development Planning Board of Tanah Laut Regency 2014). According to Al Qadri (1999), for fish culture development, the range of 20-26 ppm is categorized as suitable enough and 27-32 ppm as suitable and for seaweed development, the salinity of > 22 ppm is categorized as suitable for cultured fish growth. The diversity index of phytoplankton in Tanah Laut regency ranged from 0 to 2.427, and thus, based on Magurran (1988), the phytoplankton community structure in the study sites was categorized as unstable to more stable community conditions, while based on Wilhm & Dorris (1968), all waters of the study site could be categorized as being moderately polluted with diversity index range between 1.0 and 3.0. Furthermore, the heavy metals analyzed in this study were iron (Fe), cadmium (Cd), copper (Cu), lead (Pb), and mangan (Mn). Laboratory analysis demonstrated that all locations measured had higher Fe, Mn, and Cu than the standard threshold established by the Decree of Living Environmental Minister No. 51/2004 (Regional Development Planning Board of Tanah Laut Regency 2014).

Several water quality parameters above reflect that failures in shrimp pond culture activities are caused by decline in water quality condition. This condition could be improved through improvement of entire environmental quality, and for this, strong efforts are needed from all stakeholders and under high cost as well (Regional Development Planning Board of Tanah Laut Regency 2014).

Pond culture household's income. The pond culture business that cannot be expected to provide some income to the shrimp farmers of Muara Kintap makes them have to find other income source, such as catching crabs, making fishing gear, workman service, and selling fish to support their families. Even the pond area of Muara Kintap, the sub-village 5 and 6, directly bordering with the palm oil plantation area of PT. Kintap Jaya Watindo (PT. KJW) was partly sold for IDR 20,000,000 per Ha. Similar condition also occurred for the pond area near the specific port of PT. SSDK.

The fish farmers near the coal specific port area (sub-village 8 and 9) worked as coal mining labors. This work was done by collecting coal with a price of IDR. 3,000,-per bag, and they could earn between 150,000 to IDR. 300,000,- per working day. However, the work could not be carried out everyday since it takes very large energy. Working as field mining labor only sustained until the end of 2013, then they could not do it anymore because the activity was considered as illegal job by the authorities.

Other jobs that could be taken by the people near the coal companies were security, port checker, and ship mooring binder. These jobs could give the people an income between IDR. 2,000,000,- to IDR. 3,000,000,- per month. Nevertheless, not many people could get these jobs at the coal companies, and so far only about 6 people did. Other job taken was coal-loading barge controller going out the rivermouth of Kintap. This work was taken by fishermen with about 7 GT-boat involving 4-5 people with a payment of IDR. 1,500,000,- per trip.

Number of local people that could work in this mining company is more or less in line with a previous study that the presence of coal mining companies did not significantly have positive impact on the working opportunity for local community and did not also make the economic structure develop around the mining area (Siska 2013). If there is working opportunity for local community, it would usually be inhibited by education level and skill (Ilmi Hidayat 2010) and very few people could enter the mining field (Apriyanto & Harini 2012). Low education level of the fishermen and fish farmer's households reflects the common education condition of Indonesia coastal villagers. It is in agreement with Muflikhati et al (2010) that fishermen's prosperity level is considered as very low educational indicator. Prihandoko et al (2012) more strongly stated that fishermen in the north part of west Java averagely followed the formal education only about 5 years or similar to year 5 of the elementary school.

In contrast, Kitula (2006) found that the presence of large-scaled mining company in Gieta District, Tanzania, has given good benefit to the people around the mining, such as working opportunity of 42% respondent, 20.3% increase in road construction, water supply, and school development, food plant supplier of 10.8%, and small-scaled business of 8.1%, and even 33.8% of the population could work in the mining company.

SWOT analysis

Valuation of internal strategic factor. Based on the pond farmer's household analysis, the present study identified several internal factors potentially directly or indirectly affecting the pond culture business in Muara Kintap as major livelihood. The positive internal factors belong to strength components and the negative internal factors become weakness components (Table 1).

Table 1
External factor identification of pond farmer's households in Muara Kintap, Tanah Laut regency

No	Strategic factor	Indicator	S/W
<i>Strength (S)</i>			
1	Good pond culture business experience	65% of Muara Kintap fish farmers live there for 16-25 years and do the pond culture business in this area; they all came from Sulawesi	W1
2	Large pond area availability	Muara Kintap fish farmers have sufficiently large pond areas, averagely 2-4 ha, and even some had a dozen ha	W2
3	Availability of irrigation facility	There is irrigation in the pond areas of Muara Kintap functioning as water exchange facility	W3
4	Strong business will and effort	Meeting and interviews with the shrimp farmers of Muara Kintap indicate their strong desire to go back doing the shrimp culture business again	W4
<i>Weakness (W)</i>			
1	Very low business capital capability	Repeated failures have made the farmers of Muara Kintap be no longer able to do the intensive shrimp seed stocking	W1
2	Low education and skill	79% of Muara Kintap farmers only finished elementary school level	W2
3	Culture facility assets are not well managed	Culture facilities, such as pond, dyke, water inlet, guard house, and others, were in not well-maintained condition	W3
4	Low awareness of the importance of enough mangrove area presence as culture success requirements	Simultaneous opening of pond area did not enough consider the ration of mangrove carrying capacity and pond culture	W4
5	Getting used to the government's aid program	Getting used to the government's aid program has made the farmers be less self-support and creative	W5

Source: processed primary data.

Evaluation on external strategic factors. Positive external factors belong to opportunity components, while the negative ones become threats as presented in Table 2.

Table 2
External factor identification of pond farmer's households in Muara Kintap, Tanah Laut regency

No	Strategic factor	Indicator	O/T
<i>Opportunity (O)</i>			
1	Continuous market demand for shrimps	Decreased cultured shrimp production at the national level and import prohibition make market demand be ever-opened	O1
2	Shrimp price is relative stable and tends to be better	Harvest failures in several other countries make the shrimp price get better: IDR. 42,000,- /kg (52 ind/kg) in 1010 became IDR. 52,000/kg in 2011 and IDR. 86,000,-/kg in 2013 (Head of Shrimp Club Indonesia (SCI) of Eastern Indonesia)	O2
3	Transportation facility is getting better	Road reconstruction to the city was better using hotmix asphalt	O3
4	The presence of provisions for mining companies to empower local communities	Act Number 4/2009 that requires the IUP and IUPK holders to develop the development program and the community empowerment, and the companies have not touched on the pond business	O4
<i>Threat (T)</i>			
1	Environmental carrying capacity degrades as a result of high mining activities around	Rapid development of the economic activity in this area has made the mangrove area and water catchment be highly reduced resulting in decreased aquatic environmental quality for aquaculture	T1
2	Disease threat infecting the shrimp seeds	Previous experience of Muara Kintap shrimp farmers related with mass mortality of shrimp seeds after stocking	T2
3	Procurement program of cultivation production facilities from government is very limited	Program allocation for pond culture business is very limited, and even absent in the last several years	T3
4	Low availability of shrimp seeds from nature	In the last 4-5 years, fries were very few and almost no fisherman was looking for them as well	T4
5	Increasing environmental pressures as a result of increased plantation activity and other economic activity	Various activities on land, upstream, and coastal waters discharge wastes potential to water pollution	T5

Source: processed primary data.

Valuation of internal and external factors. To measure the effect of internal and external factors on pond culture business management in Muara Kintap, Internal Factors Analysis Summary (IFAS) table and External Factors Analysis Summary (EFAS) table were employed.

Based on the IFAS analysis on the internal factor of pond farmer's households, it was apparent that the fish farmers of Muara Kintap, Tanah Laut regency, basically have some strengths, such as business experience, owner of large pond area with irrigation, but this basic capital is not well-maintained, so that the strength is lower than other various weakness factors (Table 3).

Table 3

Internal factor analysis of pond farmer's households in Muara Kintap, Tanah Laut regency

<i>No</i>	<i>Variable</i>	<i>Score</i>	<i>Rating</i>	<i>Score x Rating</i>
1	<i>Strength</i>			
	High experience in pond culture business	0.12	3.5	0.42
	Availability of large pond area	0.14	2.5	0.35
	Availability of irrigation	0.12	2.5	0.3
	Strong desire and effort	0.1	3	0.3
	Sub-total	0.48		1.37
2	<i>Weakness</i>			
	Very low business capital capability	0.12	-3.5	-0.42
	Low education and skill	0.1	-3	-0.3
	Culture facility assets are in poor maintenance	0.12	-3	-0.36
	Low awareness of the importance of sufficient mangrove area as requirements for aquaculture success	0.1	-3	-0.3
	Getting used to the government's aid program	0.08	-2.5	-0.2
	Sub-total	0.52		-1.58
	Total	1.00		-0.21

Source: processed primary data of 2015.

EFAS analysis on external factors potentially affecting the culture business run by the farmer's households of Muara Kintap found that negative external factors or threats were higher than positive factors or opportunity. This result is obtained under consideration of ideal condition requirements of an area for aquaculture, either present or future conditions. Detailed EFAS analysis on aquaculture business is presented in Table 4.

Table 4

External factor analysis of pond farmer's households in Muara Kintap, Tanah Laut regency

<i>No</i>	<i>Variable</i>	<i>Score</i>	<i>Rating</i>	<i>Score x Rating</i>
1	<i>Opportunity</i>			
	Continuous market demand for shrimp	0.1	3	0.3
	Shrimp price is relatively stable and tend to be better	0.1	3	0.3
	Infrastructure and means of transportation are getting better	0.1	3	0.3
	The presence of provisions for mining companies to empower local communities	0.12	3	0.36
	Sub-total	0.42		1.26
2	<i>Threat</i>			
1	Environmental carrying capacity decreases as a result of high mining activities around	0.14	-4	-0.56
2	Disease threat infecting the shrimp seeds	0.1	-3	-0.3
3	Procurement program of cultivation production facilities from government is very limited	0.1	-3	-0.3
4	Very low natural seeds	0.1	-2.5	-0.25
5	Increasing environmental pressure as a result of increased plantation activities and other economic activities	0.14	-4	-0.56
	Sub-total	0.58		-1.97
	Total	1.00		-0.71

Source: processed primary data.

Alternative strategy. IFAS and EFAS analyses were taken as basis to do SWOT analysis in order to know what position the pond culture business of Muara Kintap farmer's households was against the owned strength, weakness, opportunity, and threat. Based on

the approach, various alternative strategies as SO, ST, WO, and WT were created as follows:

SO-strategy:

- to use the available pond area through implementation of various alternative cultivation of other commodities that need no large capital and have low risk in order to meet daily needs, such as the use of ponds with fish and shrimps trapped in tidal current. This activity could at least maintain some of the culture facilities, such as pond, water inlet, and dyke;
- to find collaboration with mining companies to develop alternative concept of pond culture, such as silvofishery system development or searching for alternative commodities in the pond area. Thus, the role of the regional government is highly needed, particularly in communicating with the mining companies.

WO-strategy:

- to guide the farmers on access development over all capital sources for their productive business and its alternatives;
- to provide working capital to run an alternative business during unfavorable environmental conditions for shrimp culture.

ST-strategy:

- to actively initiate activities to recover the environmental conditions through mangrove planting around the pond area and along the margin of Kintap river as buffer zone;
- to communicate collaboration program with mining companies on natural resources conservation commitment program and environmental quality rehabilitation acceleration program of coastal areas and Kintap river.

WT-strategy:

- to provide counseling in order to open the insight and build the awareness of the importance of good environmental conditions around the pond area, especially mangrove ecological roles and its minimum areal maintenance for the success of shrimp culture;
- to build the farmer's resources quality through training program on alternative culture skill (concept and commodity) or other skill to develop their creativity and self-support.

Analysis of pond culture management strategy. This strategy indicated that the grand strategy matrix of shrimp culture done by the farmers of Muara Kintap, Tanah Laut regency occurred at quadrant IV (x,y), the weak position under very strong external environmental threat in which the internal strength was still not enough capable of controlling it or in defensive strategy (Figure 1). This condition was based on SWOT analysis reflecting that the threat and weakness are more dominant than the current strength and opportunity. It shows the internal strategic factor with lower strength than weakness (-0.21) and the external strategic factor with higher threat than opportunity (-0.71).

The success of pond culture cannot be separated from the occurrence of mangrove forests around, while the culture pond area itself is the output of previous mangrove forest conversion. According to Gunarto (2004), pond development was intensively conducted in Indonesia (early 1990) through mangrove forest conversion effort. Increased pond area with reduced mangrove forest in the coastal area have triggered the environmental damages as pollution of aquaculture activities.

Besides pond area opening in the coastal area of Muara Kintap, Tanah Laut, and there were also various mining and plantation activities potentially contributing to the environmental quality degradations. High number of external factors threatening the shrimp culture business in the area makes this activity very difficult to recovery without starting from environmental quality rehabilitation program, particularly mangrove forests around the ponds and Kintap river.

South Kalimantan that does not belong to one of the provinces recommended to do shrimp pond revitalization program by the Ministry of Marine Affairs and Fisheries of Indonesia Republic is not certainly separated from the current coastal area condition evaluation. This fact is also, of course, implied in the availability of government's shrimp pond empowerment programs for South Kalimantan from the central government.

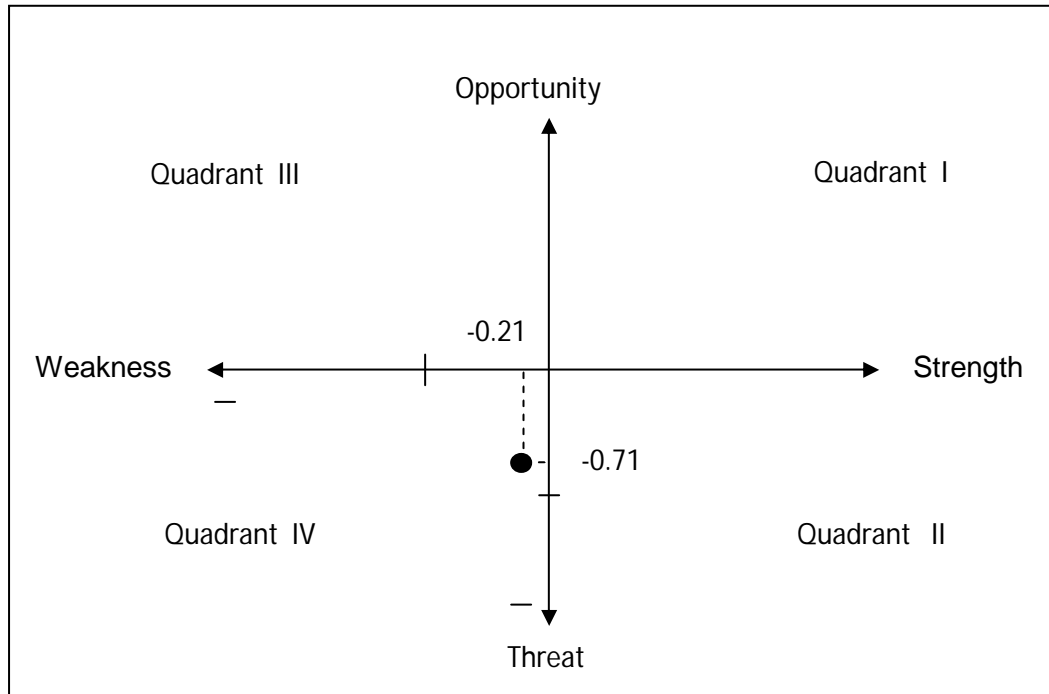


Figure 1. SWOT diagram of shrimp pond culture.

Analysis of Coastal Area and Small Islands Zonation Planning of Tanah Laut reGENCY in 2014 indicated that Kintap district had 430.9 ha of mangrove forest with 1,883.6 ha of pond area under sufficiently suitable and suitable categories for aquaculture. Thus, if 1 ha of fish pond needs 2.8 ha of mangrove forest to degrade P waste in semi-intensive culture and 21.7 ha of mangrove area in intensive pond culture, Kintap district requires 4,843.2 ha for semi-intensive pond and 38,990.9 ha for intensive pond. Based on condition above, to implement shrimp culture activities, either traditional, semi-intensive, intensive or silvofishery system, mangrove forest rehabilitation or reforestation should be done.

Silvofishery can be taken as one of the alternatives potential to develop in this area through collaboration with mining companies under government's active roles, since this concept has an obligation to improve or replant the mangrove forest for the success of culture activities, and for this, nearby community's commitment and active role are highly needed. It is in agreement with Barbier (2006) and Ocampo-Thomason (2006) that local community's role and participation are highly needed to control the mangrove forest from destructions. The community-based management of the present mangrove forest and replanting will help reducing the worst impact on the coastal area. Institutional development supporting the community management could also help preventing destructions and conflicts from excessive use of the mangrove forests.

This silvofishery pond culture is very feasible to be considered as a problem solution for the farmer's households in Muara Kintap, because silvofishery is a sufficiently good technical approach pattern (Fitzgerald 2000), consisting in a series of integrated activities between fish culture activities and mangrove forest planting, rearing, and conservation efforts. This system has simple technology, can be done without damaging the present mangrove forest, and as an interval activity while attempting to reforest the green belt area in the critical coasts. Based on other studies, mangrove utilization for fish ponds should be done under silvofishery system that gives

the highest feasibility level relative to other utilization, such as intensive shrimp pond, charcoal production, mangrove planting, and prioritized mangrove forests (Harahab et al 2011).

Conclusions. Based on condition, problem and SWOT analysis, the development strategy and program of pond culture business in Muara Kintap village were as follows:

- the revitalization and conservation of protected area and mangrove and limitation of coastal area opening: this strategy could be done by (a) returning the role of Muara Kintap beach border and Kintap river border through revegetation/reforestation; (b) controlling the space opening in the coastal area and the upstream of Kintap river through permit restrictions and spatial plans regulations; and (c) control on post-mining phase implementation (reclamation and revegetation);
- stakeholder's role and concern development for coastal area and marine environmental preservation: this strategy could be done through the following program: (a) forming and functioning Co-Management by involving all stakeholders (government, community, company, and NGO); (b) making simultaneous planning, implementation, and monitoring programs on environmental management; (c) developing monitoring functions of all related institutions through resources utilization in the coastal and marine area; (d) insight and knowledge development, skill increment, development of community's motivation and concern on environment;
- nearby community's productive economic activity development: this strategy could be done through: (a) alternative aquaculture development (system or commodity) to make use of the available area; (b) environmentally-friendly fish culture pilot program of the government or company through local community empowerment.
- community's participation development in aquatic environmental and mangrove management: this strategy could be done through the following program: (a) insight and knowledge development, skill improvement, and development of community's motivation and concern on the environment (counseling, training, poster, leaflet, baliho); (b) training on mangrove planting and mangrove nursery; (c) appreciation program for the community practicing mangrove culture and planting.

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