

# Barramundi (*Lates calcarifer*) cultivation center in Meranti Islands Regency, Riau, Indonesia: SWOT analysis and development strategy

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**Abstract.** Barramundi (*Lates calcarifer*) has been cultivated in several areas in Indonesia, including in the Meranti Islands Regency. This region has been designated as one of the nation's primary hubs for barramundi farming by the government. This study aimed to conduct a SWOT analysis of this policy and compose a set of development strategies. Primary data was collected through field observations, and interviews with some community leaders, government officials, and the business community. Secondary data were acquired from public and private organizations. This study revealed that this area is appropriate to become a *L. calcarifer* farming hub. In this research, the business strength factors identified include: availability of land and water, human resources, local government commitment, and local private sector interest. The limited capital owned by cultivating fishermen, supporting facilities, local larvae and broodstock, and fishermen's skills are the limiting factors. However, the economic growth and increasing market demand, market locations that are relatively close, and relatively good transportation are significant opportunities, while several major threats exist, however, such as the competition from similar businesses, fluctuations in feed prices, and the possibility of pest and fish disease attacks. Following the analysis, some strategies were recommended: increasing the coordination between the government, local communities, and the private sector, providing supporting facilities, strengthening local seed and broodstock centers, building feed factories in this area, strengthening marketing networks, and strengthening the cultivation skills of fishermen, are part of the strategy. Cultivation of other fish species as supporting commodities can also support this business.

**Key Words:** Asian seabass, floating net cages, mariculture, feasibility studies, water quality.

**Introduction.** Barramundi (*Lates calcarifer*), also known as Asian seabass or Australian seabass, is a demersal fish that lives in coastal waters, estuaries, lagoons, and rivers, both in clean and turbid waters, usually in the temperature range of 26–30°C (Vij et al 2014; Jerry 2013). The fish has been cultivated in several areas in Indonesia, including in the Meranti Islands Regency, mainly reared in floating net cages (FNC) at sea. Broodstocks and their larvae have also been reared on land and in ponds for the needs of larvae and seeds in the aquaculture industry (GMIR 2019; GAPR 2022). Meranti Islands Regency is located on the east coast of the island of Sumatra, with a coast bordering some neighboring countries, and is included in the Indonesia-Malaysia-Singapore Economic Growth Triangle (IMS-GT). It has indirectly become the hinterland area of the Free Trade Zone (FTZ) Batam - Tanjung Balai Karimun. It takes advantage of the opportunities and advantages of geographical position and encourages economic growth in the border region with neighboring countries Malaysia and Singapore, having the potential to function as a Cross-border Gate/International Gate that connects mainland Riau with neighboring countries by sea (RPRR 2019).

SWOT is an acronym for the words "strengths, weaknesses, opportunities, and threats" in a project or business activity (Leigh, 2009; Vlados, 2019). SWOT is a strategic planning analysis method used to monitor and evaluate the company's environment, both external and internal, for a particular business objective. This analysis involves setting specific business or project speculation goals and identifying favorable and

unfavorable internal and external factors in achieving these objectives (Phadermrod et al 2019). Analysis of internal and external strategic factors is a study of strategic factors in the internal and external environment by giving weights and ratings to each factor. Strategic factors are the dominant factors of strengths, weaknesses, opportunities, and threats that influence the existing conditions and situations and provide benefits if positive actions are taken. Analyzing the internal environment (IFAS) is useful for knowing various possible strengths and weaknesses internally. Meanwhile, analyzing the external environment (EFAS) is useful for knowing the various possible opportunities and threats that are beyond the company's control (Wijayati et al 2019).

The Indonesian Ministry of Maritime Affairs and Fisheries, the Riau Provincial Government, and the Meranti Islands Regency Government have decided that this area will become one of the National Barramundi Center areas. The marine and fisheries business development strategy has been directed at three main pillars, namely the development of aquaculture supported by capture fisheries, the processing of fishery products, and the development of fishery human resources. The development of fisheries in this regency is more focused on the development of aquaculture, both in the sea, brackish and fresh water. As an illustration of future business and economic prospects, it is, therefore, necessary to compile a study on the strategy for the development of barramundi cultivation centers in this regency (RPRR 2019; GAPR 2022). This study aimed to conduct a SWOT analysis and develop a strategy for developing *L. calcarifer* aquaculture centers in Meranti Islands Regency.

## Material and Method

**Time and place of research.** This research was conducted from February to November 2022 in the waters of the Selatpanjang Strait, Meranti Islands Regency, Riau Province, Indonesia (Figure 1). Observation and data collection of water quality and other water conditions are focused on 5 stations (Figure 2); Station 1 (Tebing Tinggi Barat District), Station 2 (Ransang Barat District), Station 3 (Tebing Tinggi District), Station 4 (Ransang District) and Station 5 (Tebing Tinggi Timur District).

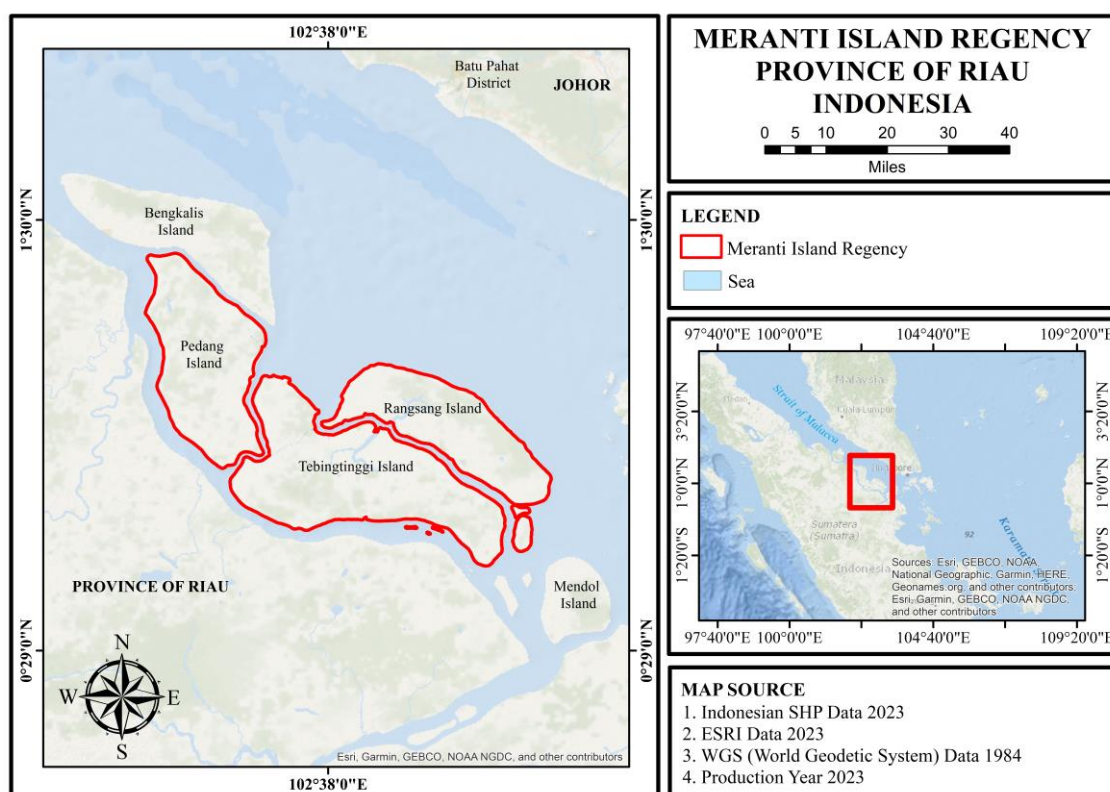


Figure 1. Meranti Islands Regency, Riau Province, Indonesia.

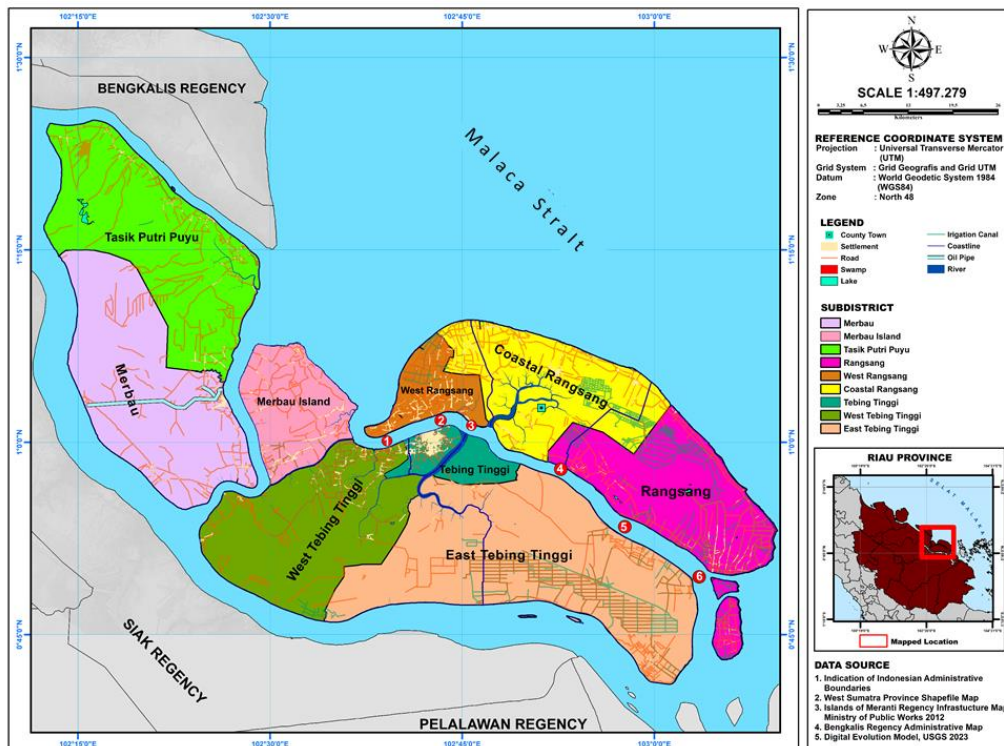


Figure 2. Research sampling stations.

**Research methods.** This research was conducted using a survey method. Primary data was collected through direct observation in the field, and interviews with some respondents (community leaders, government officials, business people, and others) based primarily on pre-prepared questionnaires. Data collection was carried out by purposive sampling, which is based on the respondents and individuals interviewed. Secondary data was obtained from all information from various parties related to the study, such as government and private agencies.

**Respondent nomination.** Respondents were selected among formal and informal figures representing their communities to be interviewed through a questionnaire guide. Respondents were selected from elements of the government, namely the Fisheries Service, the Agriculture Office, the Central Statistics Agency, the Transportation Service, Planning Service Office, the Environment, and Forestry Agency, and so on. From the community elements, community leaders, youth leaders, and religious leaders were selected. Meanwhile, from the elements of industry and fishery entrepreneurs, samples were selected from fishermen, fish farmers, and fish product processors.

**Water quality data.** Water quality parameters measured include temperature, pH, dissolved oxygen, salinity, brightness, nitrate, phosphate, and ammonia. This data was collected through direct observation and measurement in the field.

## Result and Discussion

**The existing condition of barramundi cultivation in Meranti Islands Regency.** The Provincial Government of Riau and the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia have designated Meranti Islands Regency as a center for barramundi cultivation. 1,350 ha of sea area is the estimated potential for barramundi cultivation. Fish farming with the FNC system (Figure 3) has long been known by the local community. Until November 2022, there were 32 groups of FNC farmers with a total of 632 cage units (Table 1). Generally, the member of the group is fishermen, so the cost of feed can be reduced from the results of their bycatch. The types of fish cultivated in FNC are barramundi, pomfret, and grouper. FNC production in 2018 was 30.92 tonnes

and 4.15 tonnes in 2019, consisting of 2.65 tonnes of barramundi and 1.5 tonnes of pomfret. In 2022, 20.5 tonnes of barramundi have also been harvested (GAPR 2022).



Figure 3. Barramundi floating net cages in Bantar and Sialang Pasung villages.

Table 1  
Number of floating net cages in Meranti Islands Regency, Riau, Indonesia

No.	Fishermen group	Village/District	Number of cages (unit)
1.	Bawal Mas	Bantar, Rangsang Barat	52
2.	Sekayuh	Sialang Pasung, Rangsang Barat	40
3.	Famili Mutiara	Sialang Pasung, Rangsang Barat	40
4.	Konsip	Sialang Pasung, Rangsang Barat	28
5.	Cemerlang Pesisir	Lemang, Rangsang Barat	16
6.	Camar Famili	Insit, Tebing Tinggi Barat	16
7.	Camar Laut	Meranti Bunting, Merbau	12
8.	Mina Marwah Negeri	Selatpanjang Timur, Tebing Tinggi	28
9.	Bintang Jaya Laut	Selatakar, Tasik Putri Puyu	72
10.	Lumba-Lumba Air Payau	Banglas, Tebing Tinggi	12
11.	Karya Pesisir	Banglas, Tebing Tinggi	16
12.	Pelita Bahari	Repan, Rangsang	8
13.	Suir Lestari	Banglas, Tebing Tinggi	16
14.	Pelantai Mandiri	Pelantai, Merbau	8
15.	Kakap Mas	Banglas, Tebing Tinggi	16
16.	Tirus Putih	Bantar, Rangsang Barat	20
17.	Mina Repan Mandiri	Repan, Rangsang	16
18.	Berkah Sehati	Sialang Pasung, Rangsang Barat	4
19.	Fajar Harapan	Selatakar, Tasik Putri Puyu	8
20.	Tuah Samudra	Tebun, Kec Rangsang	12
21.	Berkah Illahi	Bantar, Rangsang Barat	32
22.	Koperasi Sjb	Bantar, Rangsang Barat	104
23.	Jales Veve	Insit, Tebing Tinggi Barat	4
24.	Sinar Usaha	Sialang Pasung, Rangsang Barat	8
25.	Sinar Sejahtera	Sialang Pasung, Rangsang Barat	8
26.	Rezeki Selat	Sialang Pasung, Rangsang Barat	4
27.	Jala Armada	Sialang Pasung, Rangsang Barat	4
28.	Mina Berkah	Insit, Tebing Tinggi Barat	8
29.	Permata Laut	Banglas, Tebing Tinggi	4
30.	Terubuk Mutiara	Tebun, Rangsang	8
31.	Mutiara Sakti	Alahair, Tebing Tinggi	4
32.	Penyagun Jaya	Penyagun, Rangsang	4
	<b>Total</b>		<b>632</b>

Source: GAPR 2022; KMRP 2021.

In addition to good waters, cultivators are also supported with cheap feed. In Meranti Islands Regency, trash fish for barramundi feed costs only USD 0.1-0.13 kg<sup>-1</sup>. If



the FCR is 7-8, the production cost per kg will be less than USD 1.33. The selling price can reach USD 4.0-4.7 kg<sup>-1</sup>. From these calculations, it can be seen that the production costs are very cheap and the margins that will be obtained by cultivators are very promising. One more thing that makes the regency the right area to develop *L. calcarifer* is its strategic location. It is a stopover area from mainland Riau to maritime Riau (archipelago) so that the area becomes a transit location for the community. In addition, this regency is close to neighbouring countries, Malaysia and Singapore, so it is an added value because these two countries are destination countries for fish exports from Indonesia (GAPR 2022; Rafi et al 2021). This is also in line with development policies and strategies that have been prepared by the local government (KMRF 2021; RRMIR 2019; RRMIR 2020). The Meranti Islands Regency Fisheries Service and the Riau Province Maritime Affairs and Fisheries Service have also been working together with the Batam Mariculture Fisheries Center (BMFC) since 2019. The Sekawan Logik program, created by BMFC, may offer a solution to the community's need for high-quality larvae. Additionally, it is hoped that these larvae will be reasonably priced and can reduce the high shipping costs brought on by the distance between the production sites and the hatchery centers (Siregar et al 2020).

**Water quality for *L. calcarifer* cultivation centers.** The location of *L. calcarifer* cultivation centers in Meranti Islands Regency, based on the results of previous studies and empirical experience, has been determined at 6 locations in 6 districts along the Selatpanjang Strait (Figure 2). In this study, the 6 areas were re-evaluated for their suitability for the above objectives. Water quality data (Table 2) and aquatic ecosystem conditions at 6 research stations indicated that this location is relatively suitable to be used as a center for barramundi development. Temperatures ranged from 20-25°C, pH ranged from 6.4-7.2, current speeds ranged from 10-15 m hour<sup>-1</sup>, salinity ranged from 25-30 ppt, strait width between 200-300 m, mangrove conditions are relatively good and depths are ranging from 10-15 m. According to the seawater quality standards, this water quality data for fish farming is still relatively good (DME 2004; Effendi 2003). *L. calcarifer* may be cultivated in fresh, brackish, and saline water since it tolerates a wide range of ecological conditions and salinities from 0 to 56 (Venkatachalam et al 2018; Sorphea et al 2019).

Table 2

Data on water quality and conditions of aquatic ecosystems at 6 research stations in Meranti Islands Regency

Station	Temp. (°C)	pH	DO (mgL <sup>-1</sup> )	Salinity (ppt)	Brightness (m)	Nitrate (mgL <sup>-1</sup> )	Phosphate (mgL <sup>-1</sup> )	Ammonia (mgL <sup>-1</sup> )
1	30.3	8.5	5.5	24.3	7.5	0.003	0.02	0.24
2	30.3	8.2	5.4	25.4	6.5	0.005	0.07	0.20
3	30.1	8.3	5.4	25.4	7.0	0.003	0.03	0.22
4	31.0	8.2	4.8	24,6	6.5	0.004	0.05	0.28
5	31.0	8.1	5.3	25.3	6.9	0.005	0.02	0.30
6	30.5	8.0	5.5	25.8	6.7	0.006	0.03	0.25
Standards	25-31*	7.0-8.5*	>5.0*	<+ 5*	27-138**	0.008**	0.15**	<0.3**

\* DME 2004; \*\* Effendi 2003.

**SWOT analysis and development strategy for *L. calcarifer* cultivation centers.** In this study, a SWOT analysis and strategy for the development of *L. calcarifer* cultivation centers in Meranti Islands Regency have been carried out. The internal factors for the development of aquaculture businesses in the SWOT analysis consist of the strengths and weaknesses presented below. Strength factors in this study are advantages possessed by aquaculture from upstream to downstream in the Meranti Islands which are identified as follows: 1) Technically, the land and seas are wide and meet the standards; 2) There are sufficient human resources for fishermen and fish farmers; 3) Local government policies and commitment; 4) Local private sector interest in this business.

Weakness factors in this study are limitations or deficiencies that are considered to seriously impede the performance of aquaculture business development in the Meranti Islands. Among those are identified as: 1) Fishermen, farmers, and entrepreneurs have limited capital; 2) Supporting cultivation facilities are still lacking; 3) The local Fish Seed Center still does not meet the needs; 4) Mastery of barramundi cultivation technology is still limited. Strategic external factors in the SWOT analysis consist of opportunity factors and threat factors. The opportunities for the *L. calcarifer* cultivation center in Meranti Islands Regency are identified as follows: 1) Barramundi cultivation technology is available; 2) Economic growth and market opportunities continue to increase; 3) Relatively close market locations (Pekanbaru, Batam, Karimun, Malaysia and Singapore); 4) Transportation to and from the central location is relatively easy and it is not difficult to navigate. Threat factors, namely a condition that originates from outside and has the potential to weaken the performance of developing *L. calcarifer* cultivation businesses in the Meranti Islands which is identified as follows: 1) Competition with similar business actors from other regions; 2) Fluctuations in *L. calcarifer* production costs (feed & fry); 3) Price competition with other types of fish; 4) Possible natural disturbances such as pests and diseases as well as water quality. If each of these 4 factors is pitted against each other, a strategy will be obtained.

**Development strategy.** In a SWOT analysis, this development strategy is structured in such a way as to elaborate existing internal strengths and eliminate internal weaknesses to seize the opportunities created and win the competition, which is an external factor. In more detail, this is presented in Table 3.

Table 3  
SWOT analysis results of Sentra Budiya Barramundi, Meranti Islands Regency

	<b>Strengths (S)</b>	<b>Weaknesses (W)</b>
	<ol style="list-style-type: none"> <li>1. Land and waters technically meet the requirements and are extensive.</li> <li>2. There are sufficient human resources for fishermen and fish farmers.</li> <li>3. Local government policies and commitments.</li> <li>4. There is interest from the local private sector for this business.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fishermen, farmers, and entrepreneurs have limited capital.</li> <li>2. Supporting cultivation facilities are still lacking.</li> <li>3. The local Fish Seed Center still does not meet the needs.</li> <li>4. Mastery of barramundi cultivation technology is still limited.</li> </ol>
<b>Opportunities (O)</b>	<b>STRATEGY SO</b>	<b>STRATEGY WO</b>
<ol style="list-style-type: none"> <li>1. Barramundi cultivation technology is available.</li> <li>2. Economic growth and market opportunities continue to increase.</li> <li>3. Relatively close market locations (Pekanbaru, Batam, Karimun, and Singapore)</li> <li>4. Transportation to and from the central location is relatively smooth.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increasing the capacity building of the institutions involved.</li> <li>2. Coordination between related institutions, both government and private.</li> <li>3. Involvement of business people who are interested in business development.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fulfillment of supporting facilities by involving business people and the government.</li> <li>2. Strengthening the Meranti Islands Regency Fish Seed Center</li> </ol>
<b>Threats (T)</b>	<b>STRATEGY ST</b>	<b>STRATEGY WT</b>
<ol style="list-style-type: none"> <li>1. Competition with similar</li> </ol>	<ol style="list-style-type: none"> <li>1. Construction of a feed</li> </ol>	<ol style="list-style-type: none"> <li>1. Strengthening the skills</li> </ol>

business actors from other regions. 2. Fluctuations in barramundi production costs (feed & seed). 3. Price competition with other fish species. 4. Possible natural disturbances such as pests and diseases as well as water quality.	factory around the location of the Barramundi center. 2. Strengthening the barramundi commodity marketing network.	of fishermen, farmers, and barramundi entrepreneurs. 2. Maintenance of other types of fish as supporting commodities.
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**S-O Strategy.** S-O strategy is based on internal strengths to seize opportunities that may be achieved (Taherdoost & Madanchian 2021). One of the strengths in the development of *L. calcarifer* cultivation center is the existence of several institutions that are fully committed to this program. For this reason, it is necessary to increase the capacity building of these related institutions. It is also necessary to strengthen coordination between the institutions involved, both government and private. In addition, the involvement of business people who are interested in business development is the key to the success of this program (Effendi et al 2021). Of course, this *L. calcarifer* cultivation activity will later be owned, implemented, and developed according to professional business management by entrepreneurs. Bleischwitz (2004) mentioned that the government's main function is only to act as an initiator, stimulator, and coordinator. Furthermore, these government programs will be fully managed by the community and the business world.

**W-O Strategy.** It is a combination of opportunity factors and internal institutional weakness factors (Benzaghta et al 2021). The capital owned by fishermen, farmers, and entrepreneurs is limited, cultivation support facilities are still lacking, the capacity of the local Fish Seed Center is still not meeting the needs and the mastery of barramundi cultivation technology is still limited, which is an internal weakness. For this reason, efforts to fulfill supporting facilities are needed and they could be achieved by involving business people and the government. The government's role is expected to be more dominant at the beginning of the program (Sesar & Hunjet 2021; Darwis et al 2021). Furthermore, it is also necessary to strengthen the Fish Seed Center of the Meranti Islands Regency. Improving the quality of human resources for the mastery of barramundi cultivation technology and business management is a very important thing to do (Jamali & Sagirani 2021). Adequate technological and managerial mastery is the key to the success of a program. For this reason, this is considered one of the strategies for the development of barramundi cultivation in this area.

**S-T Strategy.** Some external threat factors in the barramundi cultivation center development program in Meranti Islands Regency include competition with similar business actors from other regions. Fluctuations in barramundi production costs in the form of feed and seed prices can also be a threat factor. Likewise, price competition with other types of fish is also very likely to occur. The risk of natural disturbances such as pests and diseases as well as an inappropriate water quality can also be a threat to the business. To overcome this threat, the recommended strategy includes the construction of a feed factory around the location of the Barramundi center. Apart from that, it is also considered necessary to strengthen the marketing network for barramundi commodities in order to secure the distribution of the production outcome and the commodity sales prices (Achrol & Kotler 2022).

**W-T Strategy.** Internal improvement to eliminate the company's internal weaknesses must always be pursued, which is intended to increase the sustainable productivity and competitiveness (Sesar & Hunjet 2021; Effendi et al 2022). To achieve this, the recommended strategy is strengthening the skills of barramundi fishermen, farmers, and entrepreneurs through training programs. Cultivation of other species of fish as supporting commodities can also be part of the business strategy in this area. For example, cultivating star pomfret and salt tilapia in brackish water ponds around this

location can increase the income of cultivators. This strategy can also be an alternative place to cultivate fish if there is severe pest and fish disease in the strait waters (Candido et al 2006).

**Conclusions.** This study revealed that the studied area is suitable to become a *L. calcarifer* cultivation center. The identified strength factors were: 1) land and waters technically meet the requirements, 2) availability of human resources, 3) local government policies and commitment, and 4) strong local private sector interest. The identified weaknesses factors were: 1) limited capital owned by fishermen, 2) supporting facilities are still lacking, 3) local fish larvae and broodstock still does not meet the needs, and 4) fishermen's skill is still limited. The opportunity factors were: 1) cultivation technology is already available, 2) economic growth and market opportunities continue to increase, 3) relatively close market locations, and 4) transportation from and to central locations is relatively smooth. The threatening factors were: 1) competition with similar businesses from other regions, 2) fluctuations in feed costs, 3) price competition with other species of fish, and 4) possibility of pest and disease attacks and water quality. The recommended development strategies are: 1) increasing the capacity building of related institutions, 2) coordination between government and private sectors, 3) involvement of business people who are interested in business development, and 4) fulfilling supporting facilities by involving local businessmen and the government. Further recommendations are: 5) strengthening the local larva and broodstocks center, 6) construction of a feed factory in the regency, 7) strengthening the barramundi commodity marketing network, 8) strengthening the skills of fishermen, farmers, and barramundi entrepreneurs, and 9) cultivating of other species of fish as supporting commodities.

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