Analysis of the feasibility of a polyculture pond business (tilapia – tiger shrimp – crab) (case: Belawan Sicanang Village, Medan Belawan, Medan City)

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Abstract. This study aims to determine the management system of the polyculture pond business, to analyse the revenue and income of the polyculture pond business, and to analyse the feasibility of a polyculture pond business. The methods of analysis used are descriptive, income analysis, and feasibility analysis. The results showed that the management system of the Polyculture Pond Business was carried out using a semi-intensive system with mixed methods in same pond, the production costs incurred by per hectare were IDR 20,110,213/6 months, all expenses are used together, with revenue of IDR 34,944,000/6 months, the income received is IDR 14,833,787/6 months and the value of R/C is 1.73.

1. Introduction
Coastal and marine areas have an important role as a source of livelihood for the Indonesian population. These two regions are estimated to be the foundation for the development of the Indonesian nation in the future. This is due to the fact that most of Indonesia is a coastal and marine area which has various resources and various environmental services. There are several coastal natural resources that can be managed and developed, including fishery resources which include capture fisheries and aquaculture resources. Cultivated fisheries include brackish, coastal and marine cultivation. The decreasing production produced by capture fisheries, the business of using pond land, especially brackish water cultivation (ponds) is expected to be able to support the national fishery production target [1].

Aquaculture can be carried out in a poly-culture, namely the integrated cultivation of more than one type of fish. Integrated and synergistic polyculture cultivation is currently widely researched and studied because it can improve water quality and can maximize the use of cultivated land [2]. In Table 1 it can be seen that the development of brackish water aquaculture (pond) aquaculture production according to fish species in 2010-2016 in Medan City.

One of the places for aquaculture development is in Belawan Sicanang Village with various commodities, namely tilapia, tiger prawns, and crabs and is also a pond area that implements polyculture. This study aims are to determine the management system, to analyse the revenue, income and to analyse the feasibility of a polyculture pond business.
Table 1. Brackish water aquaculture (pond) fishery production by fish type in Medan City, 2010-2016 (Tons) [3].

| Types of fish   | Year   | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  |
|----------------|--------|-------|-------|-------|-------|-------|-------|-------|
| Milkfish       |        | 3,490 | 3,447 | 3,447 | 3,240 | 1,821 | 3,425 | 1,350 |
| Tilapia        |        | 1,206 | 606   | 606   | 645   | 737   | 1,294 | 2,366 |
| Grouper        |        | 1,182 | 1,713 | 1,713 | 297   | 408   | 888   | 1,084 |
| Snapper        |        | -     | 127   | 127   | 228   | 265   | 336   | 645   |
| Tiger shrimp   |        | 7,165 | 7,579 | 7,579 | 9,627 | 8,325 | 5,635 | 11,423|
| Vanamei shrimp |        | 19,438| 19,413| 19,413| 19,790| 16,160| 17,474| 28,439|
| Crab           |        | 694   | 711   | 711   | 1,577 | 1,576 | 375   | 438   |
| Seaweed        |        | 259   | 240   | 240   | 98    | 50    | 57    | 6     |
| Other fish     |        | 87    | -     | -     | 1.5   | -     | -     | 43    |
| **Total**      |        | 33,523| 33,836| 33,836| 35,323| 29,342| 29,484| 45,794|

2. Research methods

2.1. Types of data
The types of data used in this study are secondary data and primary data. Primary data were obtained from direct interviews with polyculture farmers using a questionnaire. Secondary data were obtained from the Department of Marine Affairs and Fisheries, the Central Bureau of Statistics, and other related agencies.

2.2. Analysis methods

2.2.1. Descriptive analysis method. Describe the management system of the polyculture pond business using descriptive analysis methods.

2.2.2. Income analysis methods. Analysing the level of income using descriptive analysis, by comparing the income level of the polyculture pond business in the study area with existing references, with the following formula [4]:

\[ \pi = TR - TC \]  \hspace{1cm} (1)

2.2.3. R/C ratio analysis method. Analysing the feasibility of a polyculture pond business in the study area, namely by using the R/C ratio analysis method with the following formula [5-6]:

\[ \text{R/C ratio} = \frac{TR}{TC} \]  \hspace{1cm} (2)

Where:
\( \pi \) = Income
\( \text{R/C ratio} \) = revenue cost ratio
TR = total revenue
TC = total cost
Feasibility indicators:
R/C > 1, then the business is efficient and profitable to run.
R/C = 1, then the business has no loss and no profit (break-even).
R/C < 1, then the business is not efficient or profitable to run.
3. Results and discussion

3.1. Polyculture farm management system (Tilapia - Tiger shrimp - Crab)

The aquaculture business in Belawan Sicanang Village is carried out using the same overall cultivation system, namely using a semi-intensive cultivation system. The land used in this cultivation is quite extensive, which varies from 0.5 Ha to 3 Ha. This cultivation business is carried out in a polyculture manner, in this case cultivating tilapia, tiger prawns and crabs simultaneously in the same pond and each type of commodity is mixed and not separated.

The stages of this cultivation activity are divided into four stages, namely:
1. Pond preparation
   At the pond preparation stage, activities such as drying, liming and irrigation are carried out. The location of the pond used is a location that is affected by tides. This is so that water changes can be carried out, besides the harvesting process also utilizes the tidal process of sea water.
2. Stocking of seeds
   The first seeds that enter are tiger shrimp seeds, after the tiger shrimp seeds have adapted / are calm, then the tilapia fish are entered and the last one includes the crab seeds. For the distribution of crab seeds cannot be spread excessively because the crab can damage the fort in the pond.
   The time to spread the seeds is in the morning. Spread of seeds for tilapia as many as 6000-9000 heads / ha, then for tiger prawns stocking as many as 15000-16000 heads / ha and for crabs stocking as many as 70-80 kg / ha with a size of 10-12 fish / kg.
3. Maintenance
   The maintenance activities carried out are providing food, administering medicines and maintaining the safety of the ponds before harvest time arrives.
4. Harvest and Post-Harvest
   The process of harvesting tiger prawns when they reach the age of 3 months, farmers begin to carry out the whole harvest process. Shrimp that are harvested according to their age are usually around 30 heads / kg. The tilapia harvesting process is carried out at the age of 6 months. Tilapia harvested can reach 3-4 fish / kg. The harvesting process for crabs when the crabs are 1 month old, the farmers begin to harvest each month, but not as a whole. Crabs that are harvested can reach 3-4 heads / kg.
   There are two ways of post-harvest processing and marketing of tilapia, tiger prawns, and crabs, the first and most common way is that the buyer comes to the pond location, and the second way is that the harvest is brought to the place of purchase.

3.2. Revenue and income from polyculture farm business

3.2.1. Production cost. Average Production Costs of Polyculture Farms Per Ha can be seen in Table 2. Table 2 shows that the production cost of the Polyculture Pond Business is IDR 20,110,213. To achieve production in this pond business, the number of tilapia seedlings distributed is 7,628 heads / ha and tiger prawns, the number of seeds stocked is 14,564 heads / ha. 1,500 tilapia fish / ha and 10,000 tiger shrimp / ha. It was found that in the research location the density of tilapia seedlings per hectare was not classified as dense (still below standard) and for tiger prawns per hectare, it was already dense because it was above the standard. The number of crab seeds that are stocked is 70.26 kg / ha or 800-900 heads / ha, when compared with the journal (Business Status of Mud Crab in terms of Opportunities and Prospects), for polyculture around 10,000 crab seeds can be stocked. Therefore, the density of crab seeds per hectare in the study location is not classified as dense.
   The dose of pellet feed given was 18.66 sacks / ha or 466.5 kg / ha, ruca fish as much as 212.82 kg / ha and fine corn as much as 32.15 kg / ha during the maintenance cycle for 6 months. When compared with previous studies for pellet feed which was given as much as 223 kg / ha / year and ruca fish feed as much as 579 kg / ha / year, the dose of feed given was still relatively small.
Table 2. Average production costs of polyculture farms per Ha.

| No | Types of Production Costs                      | Total Cost (IDR) | Percentage (%) |
|----|------------------------------------------------|------------------|----------------|
|    | Fixed cost                                      |                  |                |
| 1. | Land rental fees and LBT fees                   |                  |                |
|    | - Land rental                                   | 1,500,000        | 7.46           |
|    | - LBT                                           | 200,000          | 0.99           |
| 2. | Equipment depreciation cost:                   |                  |                |
|    | - Hoe                                           | 23,376           | 0.12           |
|    | - Copper tools                                  | 26,658           | 0.13           |
|    | - Pipe                                          | 167,072          | 0.83           |
|    | - Fishing nets                                  | 158,974          | 0.79           |
|    | - Bucket                                        | 122,863          | 0.61           |
|    | - Fish traps                                    | 46,731           | 0.23           |
|    | Total                                           | 2,245,674        |                |
|    | Variable cost                                   |                  |                |
| 1. | Cost of production facilities:                 |                  |                |
|    | - Tilapia                                       | 762,821          | 3.79           |
|    | - Tiger shrimp                                  | 728,205          | 3.62           |
|    | - Crab                                          | 2,107,692        | 10.48          |
| 2. | Feed cost                                       |                  |                |
|    | - Pellets                                       | 4,666,667        | 23.21          |
|    | - Smooth corn                                   | 80,385           | 0.40           |
| 3. | Drug costs                                      |                  |                |
|    | - Saponin                                       | 68,385           | 0.34           |
|    | - Lodan                                         | 74,974           | 0.37           |
|    | - Ursal                                         | 264,205          | 1.31           |
|    | - Dolomite                                      | 65,692           | 0.33           |
|    | Labour cost                                     |                  |                |
|    | - Labour in the family                          | 6,730,128        | 33.47          |
|    | - Labour outside the family                     | 1,676,923        | 8.34           |
|    | Total                                           | 17,864,538       |                |
|    | Total Cost (TC)                                 | 20,110,213       | 100            |

Source: Primary Data Analysis (2020)

3.2.2. Revenue and income. The production yield in this case is the volume of tilapia, tiger prawn, and crab production produced in the pond business for 1 culture cycle. The duration of 1 cultivation cycle, varies for the type of commodity. In the following analysis, the longest rearing cycle is taken, which is 6 months. Production and Revenue of Polyculture Farm Business per Ha can be seen in Table 3.

Table 3 show that the productivity of tilapia is 412 kg / ha and tiger prawns is 163 kg / ha when compared to the production standards based on the Regulation of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia in 2016, which determines the productivity of tilapia at 300 kg / ha and tiger prawns of 100-300 kg / ha, it is known that the productivity of tilapia and the productivity of tiger prawns in the study area is high because it is higher than the production standard. Crab productivity of 149 kg / ha, when compared with the results of previous studies, which was 123 kg / ha, it is known that the productivity of crabs in the study area is also high. Polyculture Farm Business Income per Ha can be seen in Table 4.
Table 3. Production and revenue of polyculture farm business per Ha.

| No | Type of commodity | Production (Kg/Ha) | Selling price (IDR/Kg) | Revenue (IDR) |
|----|-------------------|-------------------|------------------------|---------------|
| 1  | Tilapia           | 412               | 17,000                 | 7,004,000     |
| 2  | Tiger shrimp      | 163               | 80,000                 | 13,040,000    |
| 3  | Crab              | 149               | 100,000                | 14,900,000    |
|    | **Total**         |                   |                        | **34,944,000**|

Source: Primary Data Analysis (2020)

Table 4. Polyculture farm business income per Ha.

| Description | Total (IDR) |
|-------------|-------------|
| Production cost | 20,110,213 |
| Revenue      | 34,944,000  |
| **Income**   | **14,833,787** |

Source: Primary Data Analysis (2020)

Table 4, shows that the amount of income from the polyculture pond business is IDR 14,833,787 per 6 months. This means that farmers get an income of IDR 2,472,298 / month. If this monthly income is compared to the 2020 Medan City Minimum Wage (UMK), which is IDR 3,222,500 / month, it is known that the income obtained by farmers from this polyculture pond business is still low, because it is still below the existing minimum wage standards.

3.2.3. R/C ratio. Business Feasibility of Polyculture Pond (Tilapia - Tiger Shrimp - Crab) Per 1 Cultivation Cycle can be calculated using the formula R/C ratio (Return Cost Ratio). If R / C > 1 then the farming is efficient and feasible to run. The results of the feasibility analysis can be seen in the Table 5.

Table 5. Analysis of R / C of polyculture pond business per ha per cultivation cycle.

| Description | Total (IDR) | Explanation |
|-------------|-------------|-------------|
| R/C         |             |             |
| · Revenue (TR) | 34,944,000  |             |
| · Total Cost (TC) | 20,110,213  |             |
| R/C = TR/TC  | 1.73        | Feasible    |

Source: Primary Data Analysis (2020)

In Table 5, the R / C analysis shows that the R / C result is 1.73, meaning that each additional input of 1 will produce an output of 1.73. So it is denied that the Polyculture Farm Business (Tilapia - Tiger Shrimp - Crab) Per Ha for each polyculture farmer in Belawan Sicanang Village is efficient and feasible to be cultivated or continued.

4. Conclusions
The management system of Polyculture Farm Cultivation per hectare in the study area, namely the density of the stocking of tilapia, tiger prawns and crab seeds was not yet up to standard because the stocking of seeds was not classified as dense. Feeding pellets, soft corn and ruca fish is not up to standard because the feed dose is still relatively small. The production of tilapia, tiger prawns, and crabs is above the standard because the production is already high. Polyculture pond business (Tilapia
- Tiger Shrimp - Crab) is a profitable business, but the monthly business profit is still below the 2020 Minimum City Minimum Wage (UMK) standard for Medan City. The polyculture pond business is efficient and feasible to continue.

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