

Feasibility Study on the Profitability of Vannamei Shrimp Aquaculture on Coastal Area of Keburuhan Village, Purworejo Regency

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Abstract

Djumanto, Ustadi, Rustadi, and Bambang Triyatmo. 2016. Feasibility Study on the Profitability of Vannamei Shrimp Aquaculture on Coastal Area of Keburuhan Village, Purworejo Regency. *Aquacultura Indonesiana*, 17 (1): 7-11. Brackish water vannamei shrimp aquaculture in Keburuhan village of Purworejo Regency is one of the shrimp aquaculture activities developed since 2010. Shrimp aquaculture enterprises were done by local communities which use sandy land coated by plastic sheet with an area of 1000-4500 m². Some farmers suffered losses due to lack of technical knowledge in shrimp aquaculture, environmental carrying capacity, ecological and economic feasibility. The aim of this study was to determine the general condition of vannamei shrimp aquaculture and shrimp farming feasibility. The study was conducted by field surveys, interviews and questionnaires to 30 farmers. The survey was conducted in May-June 2016 by purposive sampling of farmers who were members of a joint venture group of Minamulyo. The results showed shrimp pond size aquaculture area was varied, with a range of 1000-1500 m², 1500-2000 m², 2000-3000 m² and 3000-4500 m². An average fixed cost required for construction and operation of shrimp pond aquaculture was approximately IDR 6,620,934 to 12,606,666 million/plot/cycle shrimp production, while the variable costs of each cycle production ranged from IDR 45,876,733 to 78,861,666. The revenue and net profit varied according to pond size. The net gain for the smallest pond (1000-1500 m²) was IDR 48,702,332/plot/cycle, and the largest pond (3000-4500 m²) was IDR 58,131,666/plot/cycle. The shrimp farmers could recover the original investment incurred within a period of 4-6 months (one half cycles). Vannamei shrimp aquaculture in Keburuhan village of Purworejo regency brings a variety positive and negative impacts to the development of the economic, social and environment. Positive impact included increase of income and welfare of farmers, while the negative impact was a decline in the quality of the pond environment.

Keywords: Keburuhan; Purworejo; Sandy land; Shrimp; Vannamei

Introduction

The vannamei shrimp (*Litopenaeus vannamei*) was a native shrimp in Latin America waters. Its entered to Indonesia in the year 2001. The shrimp was active in dark condition (nocturnal), able to survive in a wide range of salinity, has the nature of cannibals, like to stay in the water column, eat slowly, but constantly foraging. As compared with other species of shrimp, the vannamei shrimp is the widely cultivated because it is more resistant to disease and able to tolerate unfavorable environmental condition, high stocking densities and high yields (Maulina *et al.*, 2012; Simamora *et al.*, 2014).

The penaeid shrimp is the one of the non-oil export commodities and to be the excellent fishing for contributing value to increase country revenues. Revenue in the year of 80's shrimp become the largest supplier of foreign exchange, mainly derived from catching. However, most of the coastal area in Indonesia are overexploited. An alternative way to increase shrimp production was through aquaculture, especially shrimp

farming. The potential of shrimp farming in Keburuhan village is very huge with sandy beaches stretching along the coast of the Keburuhan village. Farmers were motivated to conduct shrimp farming because of the success on vannamei shrimp (*Vannamei littopenaeus*) aquaculture in Bantul regency, Yogyakarta (DIY), which has similar ecological conditions (Diatin and Kusumawardany, 2012). The potential for vannamei shrimp aquaculture in Keburuhan village is great due to large land area for shrimp ponds, good supply of water, good soil quality and adequate infrastructure (Rangka and Gunarto, 2012).

These farms can provide considerable economic benefit and may encourage people in the vicinity to switch profession to shrimp aquaculturist. This farming activities, however, are without proper studies on the environmental capacity and suitability of land as well as its economic feasibility (Garno, 2004). Feasibility study on vannamei shrimp aquaculture in Keburuhan village is very important in order to obtain optimum economic benefits on the

sustainable basis. The purpose of this study was to determine the feasibility of vannamei shrimp aquaculture in Keburuhan village Ngombol District of Purworejo Regency in Central Java.

Materials and Methods

Data collection

The research was conducted in the village of Keburuhan, District of Ngombol, Purworejo regency. The study was conducted in June-July 2016 using descriptive analytic method, by conducting a survey of 30 farmers. Type of data collected were primary data obtained by direct interview to farmers as the research object, by using a questionnaire. Primary data includes the identity of respondents, the cost of production, production capacity, marketing, depreciation tool, the cost of fertilizers, medicines, seeds, feed, energy maintenance, fuel, harvesting costs, and lease land.

Data analysis

Data was analyzed using qualitative descriptive. Financial analysis undertaken was included: payback period analysis, analysis of break even point (BEP) production and prices, the net present value analysis, analysis of R/C ratio, and sensitivity analysis on rising feed prices and decreasing in shrimp price.

The financial analysis was done using the following formula:

1. *Net Present Value (NPV)*

$$NPV = \sum_{t=1}^n \frac{(Bt - Ct)}{1 + i^t}$$

Description: Bt = gross revenue years to t
 Ct = gross cost years to t
 n = economic life
 i = interest rate

2. *Revenue Cost Ratio (R/C ratio)*

$$R/C = \frac{TR}{TC}$$

Description: TR = total revenue
 TC = total cost

3. *Analysis of Break Even Point (BEP Production)*

$$BEP\ Production = \frac{FC}{P - AVC}$$

Description: FC = fixed costs
 P = Shrimp price
 AVC = average variable cost

4. *Analysis Break-Even Point of Price (BEP Price)*

$$BEP\ Price = \frac{Total\ Cost}{total\ production/year}$$

5. *Payback Period (PP)*

$$PP = \frac{cost\ of\ investment}{annual\ cash\ in\ flows}$$

Result

The vannamei shrimp farming in the Keburuhan village has been growing rapidly since 2013. The shrimp were cultured on public or private sandy dry lands. The rapid development of shrimp aquaculture during the last three years was due to the technological development of shrimp aquaculture in ponds that come with plastic mulch to the sandy land and water uptake through absorption wells.

The shrimp pond in the study site was constructed on sandy land or dry land with sizes ranged from 1000 m² to 4400 m² per plot. The size area of shrimp pond would affected the total cost, increasing of pond size would make the total cost increased. Based on interview to the farmers, the size area of shrimp ponds could be categorized into four groups as shown in Table 1.

Table 1. Number of respondents per plot of vannamei shrimp farms in Keburuhan village

Pond Size (m ²)	Number of Respondents
1000-1500	21
1500-2000	1
2000-3000	3
3000-4500	5

Source: Primary Data Analysis (2016)

Table 1 shows that most respondents have shrimp pond of 1000-1500 m² category, while the other ponds were small. The shrimp farms were harvested three times a year with harvest cycle of every four months.

Basically, vannamei shrimp aquaculture was aimed to increase revenue and prosperity of farmers. Financial analysis of vannamei shrimp pond aquaculture was explicitly aims to determine the capital and investment required for the operation of a shrimp ponds per cycle, so that shrimp farmers could find out acceptance and benefits gained as well as how long the investment capital may be returned along with

sensitivity analysis on rising feed prices and a decline in shrimp prices (Diatin and Kusumawardany, 2010). The results of the financial analysis of Vannamei shrimp pond aquaculture in Keburuhan village can be seen in Table 2.

Operational cost is variable. Values were influenced by the amount of output produced. The more output produced, the greater the operational cost. The components of operating expenses in the cultivation of vannamei shrimp in Keburuhan village were included: shrimp fry, feed, vitamins, energy, fertilizer, lime, probiotics, labour, maintenance costs, and harvest cost. The feed contributed more than 60% of the operational cost. Feed has to be given regularly at least three times a day. The amount of feed given, feeding time and feed type would affect the growth of vannamei shrimp. However, frequency of feeding and feed quality increased production cost. The more number of feed given and the better feed quality used, the more production of vannamei shrimp. Furthermore, to determine the net present value (NPV), the operating costs in the next harvest season was assumed to remain, with a fix production capacity.

The results showed that the feed component was the most influencing factor determining production cost. In addition, fluctuation in price of vannamei shrimp also affect revenue. Therefore, an analysis of break-even point (BEP) was conducted and the result is as shown in Table 3.

It was found that reduction in the selling price of vannamei shrimp up to 39% and 49% was still able to provide profit to 3000-4500 m² and 2000-3000 m² pond categories, respectively. On the other hand, the rise in feed prices did not have significant effect on profits since the break-even point was more than 100%.

Discussion

The investment cost of vannamei shrimp farms was included the cost for construction, plastic mulch, fence nets, water pumps, pinwheel, water pumps and pipes, wells, generators, guard house, engine house and buckets. Each component of investment has different economic ages, so the reduction of costs become fixed costs which were not affected by the scale of production. The largest cost component of investment in vannamei shrimp aquaculture was the pinwheel with a cost higher than 40% of the total investment cost. Pinwheel has a very

important function in the cultivation of vannamei shrimp i.e. to supply oxygen to the ponds, assist in the mixing of mineral substances in the lower and upper layers of the culture water as well as to maintain stable water quality.

The average of revenue for each ponds in one cycle of shrimp aquaculture production in Keburuhan village (Table 2) was varied from IDR 101,200,000.00 to IDR 149,600,000.00. The revenue from one cycle of shrimp pond aquaculture increased with increasing of ponds size. Vannamei shrimp ponds which have pond size area of 1,500-2,000 m² produced the total revenue approximately IDR 114,400,000.00. That revenue was bigger than the pond which has pond size area 1,844 m² in Trisik beach of Bantul regency, with revenue IDR 107,482,468.00 (Supardjo *et al.*, 2014). Therefore, the land area of sandy beach in Keburuhan village of Purworejo regency was suitable for shrimp pond aquaculture, since the revenue was relatively high within 1 cycle of harvesting.

Costs in term of business activities consist of fixed costs and variable costs (Table 2). The fixed costs of vannamei shrimp aquaculture with pond area of 1000-1500 m² per cycle amounting to IDR 6,620,934.36, while pond size area of 3000-4500 m² would increase to IDR 12,606,666.67. Variable costs also increased with increasing of vannamei shrimp pond size. In pond size of 1000-1500 m², the variable cost increased to IDR 45,876,733.33, while the pond size of 3000-4500 m² increased to IDR 78,861,666.67. Production costs, the risk cost, and the revenue was also increased along with the extensive shrimp aquaculture. However, the profit of vannamei shrimp aquaculture was tend to decrease with the shrimp pond size 2000-3000 m² (Supardjo *et al.*, 2014).

Net Present Value (NPV) was the difference between the present value of benefits and costs (Sundong and Tiong, 2002). The business of vannamei shrimp aquaculture was feasible if the magnitude of NPV higher than zero, and the business was not feasible if the magnitude of NPV less than, whereas if the amount of NPV is zero, then the returns of business equivalent to the money invested. NPV value of vannamei shrimp aquaculture with ponds size of 1500-2000 m² was the highest, i.e. IDR 200,513,993.00 (Table 2). However, among the size categories of vannamei shrimp ponds showed that the businesses were eligible to run.

Table 2. Financial analysis of vannamei shrimp culture in Keburuhan village of Purworejo regency

Pond Area (m ²)	1000-1500	1500-2000	2000-3000	3000-4500
Investment Cost (IDR)	70,836,364.00	88,225,000.00	111,150,000.00	131,550,000.00
Reduction Cost (IDR)	6,620,934.36	8,220,555.56	10,406,666.67	12,606,666.67
Variable Cost (IDR)	45,876,733.33	49,838,333.33	67,215,000.00	78,861,666.67
Production (IDR)	52,497,667.69	58,058,888.89	77,621,666.67	91,468,333.33
Revenue (IDR)	101,200,000.00	114,400,000.00	132,000,000.00	149,600,000.00
Profit/Loss (IDR)	48,702,332.31	56,341,111.11	54,378,333.33	58,131,666.67
Risk Cost (IDR)	15,180,000.00	17,160,000.00	19,800,000.00	22,440,000.00
R/C Ratio	1.93	1.97	1.70	1.64
NPV (IDR)	178,265,777.79	200,513,992.67	187,705,722.00	197,667,687.33
BEP of Production (Kg)	183.51	220.70	321.27	403.96
BEP of Revenue (IDR)	12,111,333.93	14,566,407.66	21,203,673.69	26,661,037.16
Payback Period (Months)	4.02	4.32	5.26	5.65

Source: Primary Data Analysis (2016)

Table 3. Increase break even price of feed and decrease in selling price of vannamei shrimp aquaculture

Pond Area (m ²)	1000-1500	1500-2000	2000-3000	3000-4500
Increase BEP Feed (%)	154	178	132	122
Decline BEP Selling Price (%)	48	41	49	39

Source: Primary Data Analysis (2016)

Analysis of R/C ratio can indicate the revenue for every IDR spent in shrimp aquaculture. Businesses was declared eligible if the value of R/C ratio > 1 (Diatin and Kusumawardany, 2010; Suratiyah, 2011). The rate of R/C ratio obtained from vannamei shrimp aquaculture in the study site differs according to pond sizes. Pond with the size of 3000-4500 m² produced R/C ratio of 1.64 but ponds measuring of 1500-2000 m² was 1.97. This value was greater than 1, which indicates the business is feasible to run. These values could also be interpreted that any expenditure of IDR 1.00 would gain revenue by IDR 1.64 for a pond size of 3000-4500 m², and up to IDR 1.97 in ponds measuring of 1,500-2,000 m² (Table 2).

The break-even point refers to the revenues needed to cover a total amount of fixed and variable costs that spent during a specified period of time, where total revenue = total cost (TR = TC) (Ibrahim, 2009). BEP consisted of BEP production and BEP revenue. Analysis of BEP production was aimed to determine the minimal production of vannamei shrimp in order to cover all the fixed expense. BEP production of vannamei shrimp at farm size of 1000-1500 m² was 183.51 (Table 2), thus the minimal production of vannamei shrimp would be at 183.51 kg/cycle. If the production of shrimp less than 183.51 kg/cycle, then the business may be on the losing side and if the production of shrimp higher than 183.51 kg/cycle, then the business will have profit. Based on the analysis,

BEP value of production become greater with the increase in pond size.

In addition to the BEP production, the value of BEP revenue was also analyzed. BEP revenue is the minimum revenue must be obtained by farmers in order to recover all the fixed costs already spend. The BEP revenue for vannamei shrimp aquaculture with pond sizes of 1000-1500 was IDR 12,111,333.93, and the BEP revenue increased with the extent of the pond size, namely to IDR 26,661,037.16 in pond size of 3000-4500 m² (Table 2). If the total revenue earned by farmers more than the value of the BEP revenue then the business is profitable. The BEP value was directly proportional to the BEP production.

The payback period is the length of time required to recover the costs of investment. Pay back period is the minimum time to return the initial investment in the form of cash flow based on total revenue minus all costs (Kusuma and Nur, 2014). The minimum time to return the initial investment in the various categories of vannamei shrimp farm in Keburuhan village ranged from 4.02 to 5.65 months (Table 2). In general, the vannamei shrimp aquaculture in Keburuhan village may recover the capital when the business was already running for 1.5 cycles, so that this business can be said to be feasible to run.

The vannamei shrimp aquaculture in Keburuhan village was strongly influenced by selling price of the shrimp compared to the price of feed (Table 3). It can be seen from the

declining BEP value of vannamei shrimp prices, that was much smaller than the rising BEP value of feed prices. The declining BEP vannamei shrimp value in prices was ranges between 39-49%, which means if the vannamei shrimp prices decrease more than 39%, it will cause losses for shrimp farmers with a pond size of 3000-4500 m²

The financial and sensitivity analyses show that the vannamei shrimp aquaculture in Keburuhan village was feasible to run. Based on the highest value of the R/C ratio and NPV, as well as the lowest variable costs per kg of vannamei shrimp, the categories of pond size, it was found that the most feasible farming activity was to have ponds with 1500-2000 m² size category. Despite rising in feed prices, pond with size category of 1500-2000 m² still exhibits the highest value R/C ratio and NPV, so this pond sizes are feasible.

Conclusions

The business of vannamei shrimp aquaculture in Keburuhan village of Purworejo regency was feasible to run since the business analyses, i.e. the NPV > 0, R/C ratio > 1, and a relatively quick return on investment (1.5 cycles) are on positive side. The most profitable farm to run is aquaculture ponds with sizes between 1500-2000 m² because this pond size category maintains revenue even during feed price hike. Decrease in selling price give more influence to the loss in profit, compare to increase in feed price.

Recommendations

The vannamei shrimp aquaculture in Keburuhan village was strongly influenced by the selling price of shrimp. Therefore, the quality of vannamei shrimp must always be maintained by the principle of sustainable aquaculture through management of aquaculture environmental, and management of waste water and solid wastes of aquaculture activities.

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