



Financial profitability of small scale shrimp farming in a coastal area of Bangladesh

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Abstract

Aquaculture especially shrimp farming has significant contribution to the economy of Bangladesh. The southwest coastal area is more prominent for commercial shrimp farming due to its auspicious environment, higher economic returns, nutrition value and for employment opportunity. The present study estimates the socioeconomic status and financial profitability of small scale shrimp farming in selected areas of Khulna district. One hundred (100) shrimp farmers were selected and data were collected through direct interview method. Financial profitability was analyzed from different point of view. Study revealed that about 35% farmers lie in prime working age group. Most of the farmers completed primary level of education while a few of them were illiterate. Family size of 65 % farmer's was medium and 40% farmer's main occupation was shrimp farming. Study also revealed that gross profit margin was high i.e. 59% indicating that farmers did well in managing their farm and farmers has more to cover for operating, financing and other cost. Break-even price for the small scale shrimp worked out Tk. 311 per kg while break-even production was found 155 kg per acre. Benefit cost ratio and net profit margin were found more than one and positive respectively, indicated that small scale shrimp farming was commercially profitable. The research concludes that there is ample scope and possibility for sustaining and developing the small scale shrimp farming in the coastal area of Bangladesh.

Introduction

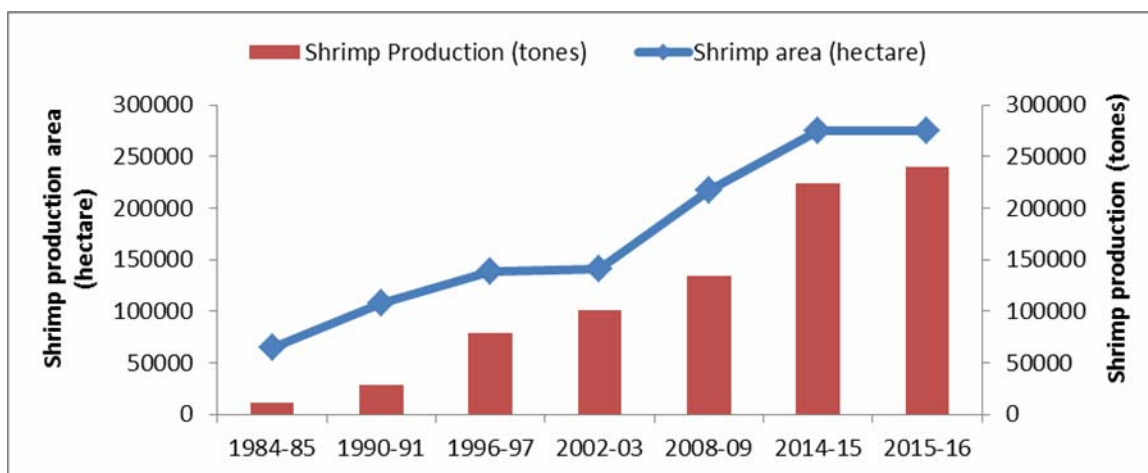
Fisheries sector plays significant role for food, nutrition, income and livelihoods of hundreds of millions people around the world. World per capita fish annual consumption has reached a new record in 2015 (20 kg per capita) due to tremendous fish production (FAO, 2016). This sector emerges as the fastest growing protein source that meets up the increasing protein demand of huge population in developing countries. In Bangladesh aquaculture sector has expanded rapidly all over the country (Khan *et al.*, 2017). More than about 15.6 million people of the country are directly and indirectly involved in this sector (Islam and Bhuiyan, 2016; Ahasan, 2012).

Shrimp farming is one of the major parts of aquaculture sector. It has been recognized as a part of Blue Revolution for the geographic features of southwest coastal area (Islam, 2008; Ahmed, 2013; EJJ, 2004; Rahman *et al.*, 2006; Pokrant, 2014). Shrimp farming created a wage-earning employment opportunity to the poor peasant households throughout the shrimp oriented region of Bangladesh. They involved in fry collection, farming, harvesting, and processing of shrimp (Barmon, *et al.*, 2006; Swapan and Gavin, 2011). A large number of processor unit are adding value to the shrimp by producing cooked and semi-cooked food and the

consumers are willing to pay 20–30% premium price for that product (Ullah, 2013; Nupur, 2010).

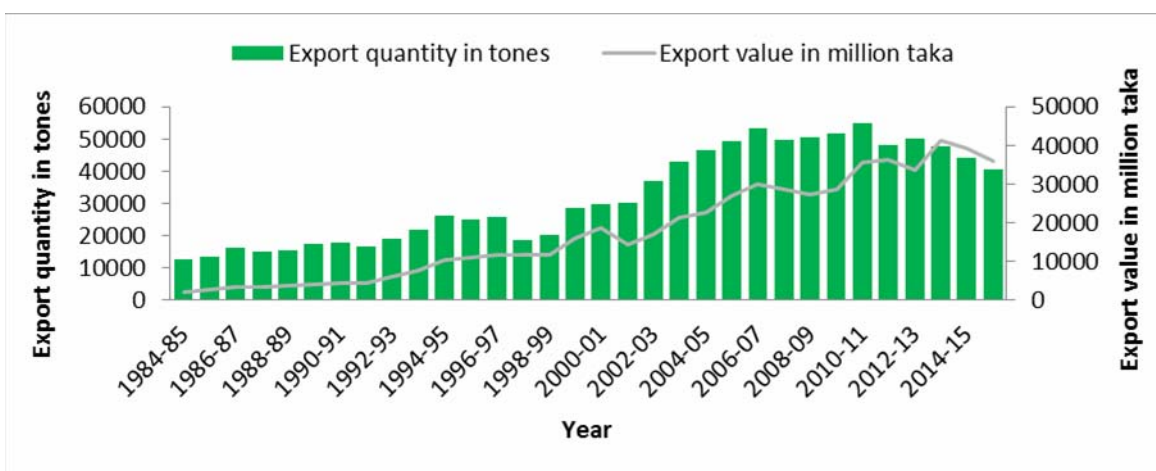
During the last three decades not only shrimp farming area but also production has tremendously increased (Figure 1). In the year 2015–16, total production of shrimp was 239798 tons from 275509 hectares of water bodies (DoF, 2015–16). Shrimp production expanded rapidly in this area because of higher demand in the international and local market, higher economic return from investments and favorable government policies (Alauddin and Tisdell, 1998; Pokrant, 2014).

Shrimp is one of the major valuable export items and also the second largest sources of earning foreign currency after garments industry in Bangladesh (Ahasan, 2012; Rahman and Hossain, 2009). Bangladesh is exporting frozen and value added shrimp products to Europe, USA, Japan, and some others Asian countries. A total of 75338 tons of fish were exported from Bangladesh in the year 2015–016 while shrimp was 40726 tons (DoF, 2015-16). Only shrimp contribute 61% of total fish export earnings which was Tk.4283 million in 2014-2015 (FRSS, 2016; DoF, 2015-16). Figure 2 shows the export quantity and export earnings from shrimp sector during last 3 decades.



Source: DoF, 2015–16

Figure 1. Trends of shrimp production and area



Source: DoF, 2015-16

Figure 2: Export trends of shrimp

Although shrimp farming has significant contribution to the economy of Bangladesh (Rahman and Islam, 2013; Pokrant, 2014; Paul and Vog, 2011; Rahman *et al.*, 2013; Kumar *et al.*, 2016 and Sathiadhas *et al.*, 2009) but there is an uneven distribution of land ownership in the coastal regions of Bangladesh, with a significant proportion of land in the hands of large landowners (Alauddin and Tisdell, 1998). Land holding of small and marginal farmers has declined during the past decades while large farmers have acquired more land. This was happened because this sector is controlled by the influential and political people. Small scale farmers are bound to give lease their land to the influential people. This skewed the sources of income of the small scale farmers and resulted more poverty in the saline area. Several studies have been conducted on shrimp farming in Bangladesh. Karim *et al.*, (2014) conducted a study on three new technologies for measuring profitability of shrimp farming and found that the farmers gained significantly higher net returns when practicing improved shrimp farming systems as compared to

traditional farms. Swapan and Gavin, (2011) found a positive effect of shrimp farming on GDP of Bangladesh and there is also an adverse impact to the livelihood of landless and marginal farmers in coastal region of Khulna. Umesh *et al.*, (2010) conducted a study on shrimp farmers in India and found that the organization of small scale shrimp farmers increased stakeholder interaction and involvement. Alam, (2007) conducted a study on economic returns of disease-affected extensive shrimp farming in southwest Bangladesh. He revealed that profitability of shrimp farming is distressed by fluctuating yields and price due to severe diseases. Karim, (2006) found that shrimp farming has positive effect on GDP of Bangladesh.

Most of the literature or research conducted on large commercial shrimp farmers. Therefore, this study tried to find out the socioeconomic status and financial profitability of small scale shrimp farming in southern part of Bangladesh.

Materials and Methods

Khulna, Sathkhira and Bagerhat are the main shrimp producing areas of Bangladesh. Dacope upazila of Khulna was purposively selected for this study due to its auspicious resources and good climatic conditions for shrimp farming where shrimp farming is closely related in one or another way of life for the people. This study was conducted on local small scale farmers who have shrimp farm area less than 250 decimal (small farms means who have less than 250 decimal). One hundred (100) small scale farmers were selected from the study area following stratified random sampling techniques. A draft schedule was developed and pre-tested with a few sample farmers. Then the interview schedule corrected and finalized according to the objectives. Cross-sectional data were collected through direct interview method.

Some statistical measures like average, percentage and ratios were calculated in tabular form for measuring socio-economic characteristics and financial profitability. Farmer’s financial profitability were calculated in different ways such as gross margin (GM), net return (NR), benefit-cost ratio (BCR), gross profit margin (GPM), net profit margin (NPM) and break-even analysis.

Total cost (TC) of shrimp farming was divided into variable cost (VC) and fixed cost (FC). In this study, variable cost includes labor, fingerling, feed, fertilizer, manure and other miscellaneous cost. Fixed cost were land use cost, construction of water supply and housing, canal digging and dyke re-construction and interest on operating capital. Total cost is the summation of variable and fixed costs. The formula for calculating total cost was given as follows:

$$TC = \sum_{i=1}^N X_i \cdot W_i + \sum_{i=1}^N TFC \dots\dots\dots (1)$$

Where, X_i is quantity (kg/acre) of the i^{th} variable input and W_i is per unit price (Tk/kg) of the i^{th} variable input.

Gross return (GR) was calculated by the quantity produced with multiplying the prevailing price of product. The formula was used for calculating GR as follows:

$$GR = \sum_{i=1}^N Q_{ai} \cdot P_{ai} + \sum_{i=1}^N Q_{bi} \cdot P_{bi} \dots\dots\dots (2)$$

Where, Q_{ai} is the quantity of the shrimp (kg/acre), P_{ai} indicates per unit price (Tk/kg) of shrimp, Q_{bi} is quantity of fin-fish or other fish (kg/acre), and P_{bi} is per unit price (Tk/kg) of fin-fish.

Gross margin (GM) is the difference between gross return and total variable cost. The formula was given as:

$$GM = \sum_{i=1}^N Q_{ai} \cdot P_{ai} + \sum_{i=1}^N Q_{bi} \cdot P_{bi} - \sum_{i=1}^N X_i \cdot W_i \dots\dots\dots (3)$$

Net return (NR) or profit means the total monetary sales value minus total cost of production. It estimated as:

$$\pi = \sum_{i=1}^n Q_i \cdot P_i - \sum_{i=1}^n (W_{xi} \cdot X_i) - TFC \dots\dots\dots (4)$$

Benefit-cost ratio (BCR), gross profit margin (GPM) and net profit margin (NPM) were indicators whether the farm is financially profitable or not. Higher ratio means the farm is higher profitable. The benefit-cost ratio (BCR) is a relative measure, which is used to compare benefit per unit of cost. The BCR estimated as a ratio of gross returns and gross costs. The formula of calculated BCR (undiscounted) was as follows:

$$BCR = \frac{\sum_{i=1}^N Q_{ai} \cdot P_{ai} + \sum_{i=1}^N Q_{bi} \cdot P_{bi}}{\sum_{i=1}^N X_i \cdot W_i + \sum_{i=1}^N TFC} \dots\dots\dots (5)$$

Gross profit margin is a percentage which indicates real measure of profitability. It must be high enough to cover costs and provide profits. It is a measure of how much a farm keep of the revenue that collects from sale. It implies the difference between how much revenue capture and how much spend to capture, expressed in terms of percentage. Gross profit margin refers to sale minus cost of products sold. Here’s the formula of gross profit margin was given as:

$$GPM = \frac{GR - TVC}{GR} \times 100 \dots\dots\dots (6)$$

Net profit margin means the ratio of gross return and net return. It represents the proportion of sales that is left over after all relevant expenses have been adjusted. Net profit margin can be estimated as:

$$NPM = \frac{NR}{GR} \times 100 \dots\dots\dots (7)$$

Break-even point is a simple but effective analysis for measuring financial profitability. This is the point of no profit no loss. After break-even point, a portion of each value of return contributes to profits. It is use to evaluate the relationship among volume of production, fixed costs, sales price per unit and variable cost per unit. Sales price per unit measured as weighted average price per kg and variable costs per kg measured by total variable cost dividing with per acre of production. Three break-even points as: break-even production, break-even monetary sale and break-even price were estimated in this study. The formulas of these types were given as:

$$\text{Break – even production} = \frac{\text{Fixed costs}}{\text{Sales price per kg – variable cost per kg}} \dots\dots\dots (8)$$

Break-even sale value was measured as: Break-even production per acre* average price of product per kg and Break-even price written as:

$$\text{Break – even price} = \frac{\text{Fixed costs}}{\text{(Volume of production)}} + \text{Variable costs per kg} \dots\dots\dots (9)$$

Results and Discussion

Socio-economic characteristics

Generally, socioeconomic factors of the farmers directly or indirectly influence their farm decision making. Therefore, this section deals about some of the major socio-economic factors such as age, level of education, farm ownership, occupation status and family size etc. (Table 1).

Age of farmers have an influence on the production and in the better management of the farming system. In this study age of the farmers were classified into five groups (www.indexmundi.com). Result reveals that about 35% of the shrimp farmers were lies in the age category of 25–54 years (prime working age group). In prime working age, farmers are more active, experienced and efficient in resource use with maintaining better management practices in shrimp farming than the others. Mohammad *et al.*, (2018) and Begum *et al.*, (2015) found the consistent result.

Table 1. Socio-economic characteristics of shrimp farmers

Characteristics	Frequency (percentages of respondent)
Age distribution (years)	
0–14 (Children)	2
15–24 (Early working age)	12
25–54 (Prime working age)	35
55–64 (Mature working age)	28
65 & above (elder)	23
Total	100
Family size (Members)	
Small (1–4)	8
Medium (5–7)	65
Large (8 and above)	27
Total	100
Level of education	
Illiterate	15
Primary level	48
Secondary level	21
Above secondary	16
Total	100
Occupation status	
Shrimp farming	40
Service	12
Business	18
Rickshaw pulling	6
Wage labor	10
Others	14
Total	100
Leasing category	
Owned	75
Leased in	13
Others	12
Total	100

Source: Field Survey, 2015

Family size has a great contribution in farm management process. It is assume that farm management is easy if a family consists more active member. Family in the present study was defined as a group of individuals living together, taking meals together from the same kitchen and living under the administration of the same head of the family. It included husband, wife, son, daughter, brother, sister, parents. Family size was classified into three groups as: small, medium and large (Ahmed *et al.*, 1992). Study found that about 65% shrimp farmers were leading medium size (5 –7) of family. The study of Mozumder *et al.*, (2018) found that about 67% of the total fish farmers are belonging of medium family. Tammaroopa *et al.*, (2016), Rouf and Jenson, (2001) also found similar result for the family members. Education plays an important role in accelerating the pace of the agricultural development and it greatly influences the new technology and scientific knowledge in farm practices. Education has categorized as illiterate, primary, secondary and above secondary level. Study found only 15% farmers were illiterate but majority of the farmers completed primary (48%) level and 21% farmers completed higher secondary school. Tammaroopa *et al.*, (2016); and Mozumder *et al.*, (2018) also found similar results. Since, most of the farmers were literate in the study area therefore; they applied their knowledge during production period for maintaining the scientific management practices. The distribution of principal occupation is fascinating because it varies greatly depending on how much they are involved in and what level of income is earned from the present occupation. In the study area all selected farmers were involved with shrimp farming but they also had different alternate occupation. The study revealed that 40% of the farmers were engaged in shrimp farming as their main occupation while service, business, rickshaw pulling, wage labor, and the others were 12%, 18%, 6%, 10%, 14% respectively. Tammaroopa *et al.*, (2016) found that shrimp farming was the principle occupation of the farmers as like as the current study. Farmers were chose shrimp farming as their main occupation due to low investment, higher profit and favorable water condition.

In the study area, there are three types of farm ownership system i.e. owned farm, leased farm and mixed where mixed means both own land and leased land for shrimp farming. It was revealed that majority (75%) of the small shrimp farmers ‘culture their own land while leased in was 13% and the mixed was 12% respectively.

Cost-benefit analysis

The main objective of producer is to maximize profit; therefore financial profitability assessment is very much important for any farm business. In this section, financial profitability of small scale shrimp farming was estimated with different point of view. Initially, different cost items and its quantity were presented then profitability was estimated (Table 2). Both purchased and home supplied inputs were used by shrimp farmers in the study area.

Table 2. Total cost of small-scale commercial shrimp farming (per acre)

Item	Quantity	Taka/ unit	Cost (Tk.)	% of cost
Variable cost item				
Labor (man-days)	140	275	38500	26.63
Fingerling (number)	21500	1.75	37625	26.02
Feed (Kg)	415	40	16600	11.48
Lime (Kg)	110	15	1650	1.14
Urea (Kg)	90	22	1980	1.37
TSP (Kg)	105	28	2940	2.03
Manure (Kg)	500	1	500	0.04
Miscellaneous cost			3000	2.07
Total Variable Cost			102795	71.09
Fixed cost item				
Lease value			29750	20.57
Construction of water supplying canal and housing cost and guard shed			5356	3.71
Canal digging and dyke reconstruction cost			2030	1.40
Interest on operating capital			4665	3.23
Total Fixed Cost			41801	28.91
Total Cost			144596	100

Source: Field Survey, 2015

Cost items of shrimp farming were classified into two major categories as: variable cost and fixed cost. Labor, shrimp fry, feed, lime, urea, TSP, manure and miscellaneous costs were considered as variable cost.

Both family and hired labor were used in the study area. The prevailing wage rate in the market for hired labor was considered as the opportunity cost of family supplied labor. In this study, a man-day was considered to be 8 hours of work. For avoiding complexity, average rate has been taken into account, thus the average calculated wage rate was Tk. 275.00 per man-day for shrimp farming. Labor cost was found about 27% of total production cost. Farmers used purchased fingerlings from the fry collectors and hatchery. There was a variation in the per unit price of fingerlings from location to location and time to time. Therefore, fingerling cost was calculated on the basis of actual price paid by farmers in different times. The average price of fingerling was Tk. 1.75 per piece and stocking density per acre was about 21500. Per acre fingerling cost found Tk. 37625 which was 26% of total production cost. Supplementary feed was applied for better growth and survival of shrimp fry. In the study area, it was observed that the shrimp farm owners used different kinds of supplementary feeds which were rice bran, wheat bran and oil cake etc. Total cost of feed per acre was Tk.16600 which was about 11.5% of total cost. The study reveals that the total variable cost (TVC) of shrimp farming was Tk. 102795 per acre and it consists about 71% of total cost of production. In the study area, shrimp farmers had to bear some other costs. These cost items were torch light, rope, umbrella, bamboo, transportation, commission for caretaker etc., which have been used for various purposes of shrimp farming. These miscellaneous costs were calculated on the basis

of actual price paid by the farmers. In this study, miscellaneous costs were estimated at Tk 3000.00/acre.

On the other hand, fixed costs are those costs which are not varying with the volume of production. Land use cost, construction of water supplying canal and housing cost, canal or dyke reconstruction cost and interest on operating capital were the major fixed cost item of shrimp farming. In study area, generally alternate shrimp-rice farming is practiced where farmer usually practice shrimp farming for six (6) months and rice for four months. For calculating the cost of shrimp production, land leasing cost is calculated for six months and it was found Tk. 29750 per acre.

Water supplying canal was used in the shrimp farm in order to facilitate the intake and drain out of water when necessary. Guard shed was constructed to protect shrimp from thieves and dacoits. Cost for constructing guard shed, office and other houses included depreciation cost, interested on operating capital, repairing cost, etc. These costs were about 8.34% of total production cost.

Revenue calculation was not so straightforward because of the size of shrimp. It was observed that harvested shrimp size was different and graded as: Grade A, Grade B and Grade C. The selling price was different on the basis of size. Therefore, total revenue was calculated considering all grades.

Table 3. Gross return from small scale commercial shrimp farming (per acre in a year)

Output	Production (kg/acre)	Price (Tk./kg)	Return (Tk.)
A-Grade	80	700	56000
B-Grade	180	500	90000
C-Grade	205	400	82000
Total shrimp	465	490	228000
Fin fish	150	150	22500
Gross Return			250500

Source: Field Survey, 2015

There were three grade categories as: A-Grade, B-Grade and C-Grade (Table 3). A total of 465 kg of shrimp were produced in per acre of pond land, whose financial value is about Tk. 228000. Individually, per acre production of Grade-A is 80 kg, Grade-B is 180 kg and Grade-C is 205 kg while their monetary value is Tk. 56000, Tk. 90000 and Tk. 82000 respectively. Apart from this, few species of shrimps and fishes were also grown in shrimp farm which is known as fin fish. Per acre average yield of fin fish was 150 kg and its money value was Tk. 22,500. Gross return from per acre of land was Tk. 250500 and percentages of gross return of Grade-A is 25%, Grade-B is 39%, Grade-C is 36% and return from fin fish was 8.92% (Figure 3).

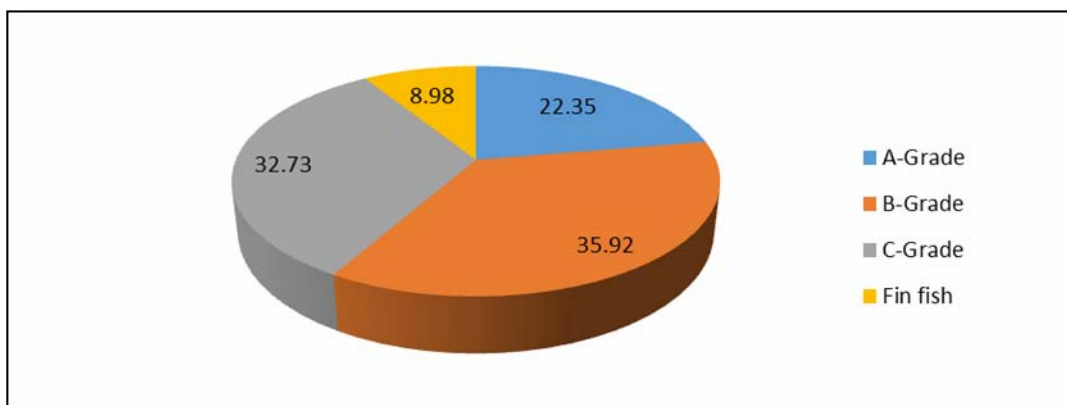


Figure 3. Percentage of different gross return

Table 4. Financial profitability analysis of small-scale shrimp farming

Cost	Quantification of indicators
Variable Cost (VC)	Tk.102795
Fixed Cost (TFC)	Tk.41801
Total Cost (TC)	Tk.144596
Production	
Shrimp production	465 kg per acre
Fin fish production	150 kg per acre
Total production	615 kg per acre
Return	
Return from shrimp	Tk.228000
Return from fin fish	Tk.22500
Total return (TR) or Gross return (GR)	Tk.250500
Gross Margin (GM)	Tk.147705
Net Return (NR)	Tk.105904
Benefit Cost Ratio (BCR)	1.73
Gross Profit Margin (GPM)	59%
Net Profit Margin (NPM)	42%
Break-even Production	155 kg per acre
Break-even Production in Monetary value	Tk.76120
Break-even Price	Tk.311 per kg

Source: Field Survey, 2015

Gross margin from per acre shrimp farming was found Tk. 147705 and benefit-cost ratio was 1.73 (Table 4). It implies that by investing Tk.1, farm earned Tk. 1.73 indicates that the small-scale shrimp farming was profitable. This support to the study of Paul and Vog, (2011); Rahman *et al.*, (2013); Kumar *et al.*, (2016) and Sathiadhas *et al.*, (2009).

Study revealed that gross profit margin was 59% which indicates managing cost of sales and other expenses is 41%. In other words, about 59% of the revenue is available that earned from total sale in the farm after covering costs. Study also revealed that the net profit margin was 42%. It means, it managed to convert 42% of its sale into net income of shrimp farming.

Study also found the break-even production was 155 kg per acre while monetary value of break-even production was Tk.76120. This is the point of 'zero loss or profit'. Hence, total production of shrimp was 465 kg and gross

return was Tk. 2, 28,000 per acre that covers the break-even point of quantity and its monetary value. In addition, break-even price was Tk. 311 per kg. At this break-even price level, farm can cover the cost of production by selling shrimp. The study reveals, average weighted price (Tk. 490.23) exceeds the break-even price (Tk. 311) per kg of shrimp. Since per acre of production, gross return and per kg of price higher than the break-even point, so the small scale shrimp farming was financially profitable venture in the study area.

Conclusion

This study tried to find out the socioeconomic status and the financial profitability of small scale shrimp farming in coastal area of Bangladesh. Financial profitability was measured from different point of view. It was revealed that most of the farmers were in prime working age group. They completed primary level of education while a few of them were illiterate. Family size of the farmer's was medium (65%) and main occupation of the shrimp farmer's was 40%. Study also revealed that small scale shrimp farming was profitable. Benefit cost ratio, gross profit margin, net profit margin and break-even point indicated that small scale shrimp farming is profitable in the study area. It can be recommended from the study that small scale shrimp farmers should continue their business and should not give lease their land to the large farmers.

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