# PROFITABILITY OF SHRIMP FARMING: A STUDY IN SOME SELECTED AREAS OF BANGLADESH

**NAIM AHMMED**

**DEPARTMENT OF DEVELOPMENT AND POVERTY STUDIES**
**SHER-E-BANGLA AGRICULTURAL UNIVERSITY**

**SHER-E-BANGLA NAGAR, DHAKA-1207.**

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**PROFITABILITY OF SHRIMP FARMING: A STUDY IN SOME SELECTED AREAS OF BANGLADESH**

BY
**NAIM AHMMED**

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**Approved by**

……
**(Dr. Mohammad Mizanul Haque Kazal)**
Supervisor
Professor
Dept. of Development and Poverty Studies
Sher-e-Bangla Agricultural University,
Dhaka -1207

……..……..…
**(Bisakha Dewan)**
Co-Supervisor
Assistant Professor
Department of Agribusiness and Marketing
Sher-e-Bangla Agricultural University,
Dhaka -1207

……
**(Dr. Ashoke Kumar Ghosh)**
Assoc. Prof. & Chairman
Dept. of Development and Poverty Studies
Sher-e-Bangla Agricultural University, Dhaka -1207

DEPARTMENT OF DEVELOPMENT AND POVERTY STUDIES
**Sher-Bangla Agricultural University**
Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh

# CERTIFICATE

This is to certify that the thesis entitled **"PROFITABILITY OF SHRIMP FARMING: A STUDY IN SOME SELECTED AREAS OF BANGLADESH"** submitted to the department of Development and Poverty Studies, Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka in partial fulfilment of the requirements for the degree of **Master of Science (MS) in Development and Poverty Studies**, embodies the result of a piece of bona fide research work carried out by **NAIM AHMMED, Registration No. 10-03904** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, as has been availed of during the course of this investigation has been duly acknowledged by the Author.

Dated:
Dhaka, Bangladesh

.....
**(Prof. Dr. Mohammad Mizanul Haque Kazal)**
Supervisor
Department of Development and Poverty Studies
Sher-e-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka-1207

THIS THESIS IS LOVINGLY DEDICATED TO

MY PARENTS

# PROFITABILITY OF SHRIMP FARMING: A STUDY IN SOME SELECTED AREAS OF BANGLADESH

## ABSTRACT

The study was conducted to examine the profitability of shrimp farming in Bagerhat and Khulna district of Bangladesh. Besides, attempt had given to examine the factors influencing the shrimp cultivation and toidentify the constraints faced by smallholder cultivators in the study area. Bagerhat and Khulna districts were selected purposively for the study on the basis of extensive shrimp cultivation. A total of 120 shrimp cultivators were randomly selected to conducting farm level survey with pre-tested questionnaire.Data were collected during 1$^{st}$November to 31$^{st}$ December, 2017. After analysing the data, per hectare gross return, net return and gross margin were found to be Tk. 300900, Tk. 231468 and Tk. 273269, respectively. Total cost of shrimp production was calculated at Tk. 154608 per hectare. Benefit Cost Ratio (BCR) was found 2.497 for shrimp farming. Thus, it was found that shrimp farming was highly profitable. Production function analysis suggested that, among the variables included in the model, cost of human labour, cost of fingerling and cost of feed had a positive and significant effect on gross return of shrimp production. On the other hand, cost of lime had a positive and insignificant effect on gross return of shrimp production and cost of urea and cost of TSP had a negative and insignificant effect on gross return of shrimp production.Problems faced by the farmers were ranked on the basis of corresponding means. Most of the farmers were reported that lack of capital was the main constraint for their shrimp production.

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## ABBREVIATIONS

| | |
|---|---|
| MOFL | Ministry of Fisheries and Livestock |
| EJF | Environmental Justice Foundation |
| DoF | Department of Fisheries |
| FRSS | Fisheries Resources Survey System |
| GDP | Gross Domestic Product |
| MT | Metric Tons |
| BER | Bangladesh Economic Review |
| FAO | Food and Agricultural Organization |
| DDP | Delta Development Project |
| FFP | Fan Fiction Project |
| MV | Modern Varieties |
| UFO | Upazila Fisheries Officer |
| BBS | Bangladesh Bureau of Statistics |
| BB | Bangladesh Bank |
| SPSS | Statistical Package For Social Sciences |
| BCR | Benefit Cost Ratio |
| CFI | Constraint Faced Index |
| NGOs | Non-Governmental Organizations |
| BRAC | Bangladesh Rural Advancement Committee |
| ASA | Adaptive Server Anywhere |
| CARE | Cooperative for Assistance and Relief Everywhere |
| IOC | Interest on Operating Capital |
| GR | Gross Returns |
| TVC | Total Variable Costs |
| GOs | Government Organizations |
| EPB | Export Promotion Bureau |

# CHAPTER I
# INTRODUCTION

## 1.1 Background of the Study

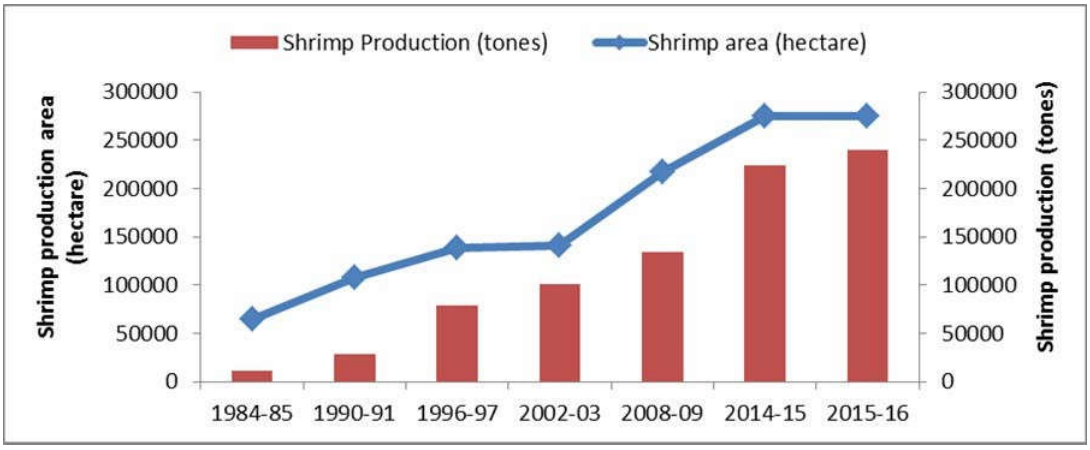
Bangladesh has diversified farming and fisheries sub-sector is one of the major and important components in agriculture sector. This sub-sector plays an important role in nutrition, employment and foreign exchange earnings. It employs about 1.4 million directly engaged in fishing and about 11 million people indirectly retain their livelihoods. Fisheries activities have opened a new avenue of employment for the landless rural people particularly for the women in shrimp industry in Khulna, Shatkhira, Bagerhat and Cox's Bazer districts. (MOFL, 2002) estimated that more than 600000 people are directly engaged in shrimp production and processing activities. There are 37,397 and 105 Bagda and Golda farm respectively and for processing shrimp. Bangladesh has 127 processing plants of which 38 plants are in Khulna.

Thus, this sub-sector has a very significant role to play in Bangladesh. There is high demand for shrimp of Bangladesh in the world market. Bangladesh has stepped in to a new era of industrial processing development. There are indications that the children and women workers are engaged in these shrimp processing activities (Rahman F, 2001 and Asma Alam, 2002). But the work environment is not conductive and favorable for their health. They are often unwary are of the opportunities they have to improve their conditions. Regarding the establishment of the processing plants, many other actors are playing vital role for supplying the raw materials such as raw shrimp, ice transports, bamboo basket, packages and cartons etc. There are many other intermediaries such as faria, depots agents etc. who are actively involved in shrimp related activities. But information is scantly on livelihoods of these actors, their linkages and how much they are benefited from their profession.

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; EJF, 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).

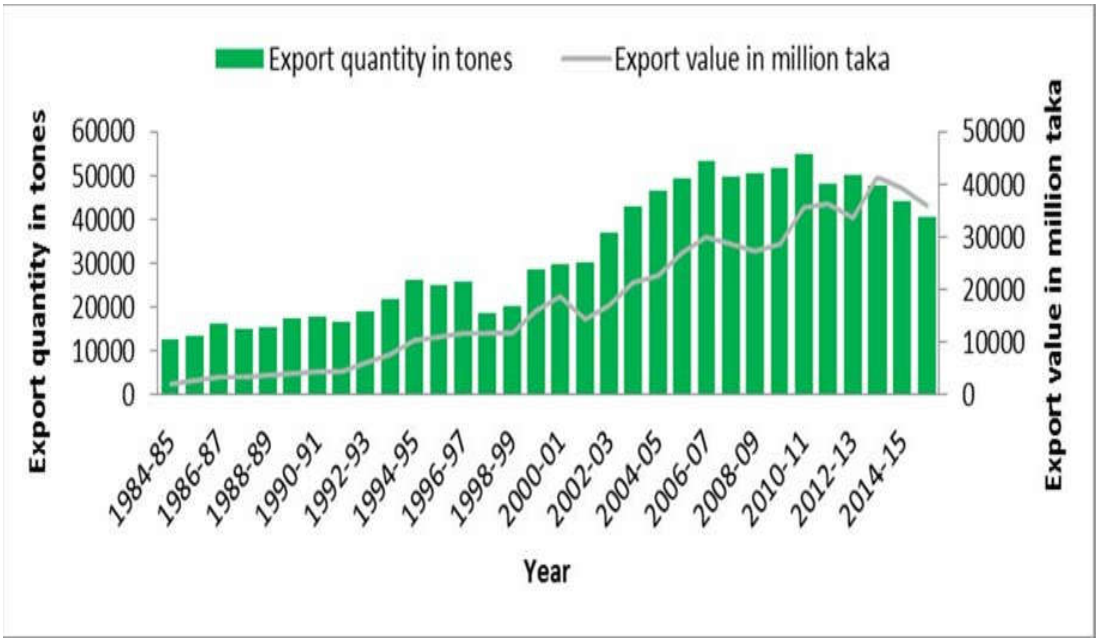
During the last three decades not only shrimp farming area but also production has tremendously increased (Figure 1). In the year 2015–16, total production of shrimp was 239798 tons from 275509 hectares of water bodies (DoF, 2015–16). Shrimp production expanded rapidly in this area because of higher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




**Source: DoF, 2015–16**

**Figure 1.1 : Trends of shrimp production and area**

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 1.2: 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 Tisdel, 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 sub-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.

Being one of the leading fish producing countries of the world Bangladesh had produced a total of 41.34 lakh metric tons (MT) of fish in the year of 2016-17 which contributed 3.61 percent to the GDP and 24.43 percent to the country's total agricultural productions (BER, 2018). Nevertheless, Bangladesh has ranked fourth in the world in terms of inland fish production in 2018 only after China and India (FAO, 2018). Fisheries in Bangladesh are diverse, there are about 795 native species of fish and shrimp in the fresh and marine waters of Bangladesh and 12 exotic species that have been introduced (FAO, 2008).

Shrimp farming is one of the fastest growing economic activities in coastal areas of the Asia-Pacific regions, contributing more than 85% of world's farmed shrimp, where Bangladesh is the fifth largest producer in the world (FAO, 2014). It is blessing with an advantageous natural setting for shrimp farming and contributes the national economy of Bangladesh since mid-1980s (Islam and Bhuiyan, 2016). Shrimp production in a controlled and enclosed water body is described as shrimp farming. Both saline and freshwater can be used for these practices. Shrimps are the swimming crustaceans that inhabit the warm marine waters of the tropics and subtropics. Due to the favorable climate and availability of space, shrimp farm has been developed mainly in tropical and subtropical coastal lowlands (Anwar, 2003). The southwestern coastal region of Bangladesh is one of the most promising areas for shrimp farming for two major reasons; first, its fresh and saline water resources are abundant in almost all seasons; second, the presence of world's largest mangrove forest, the Sundarbans, provides a food source and nursery for the off shore fisheries (MOFL, 1997). Production of farmed shrimp has been growing at the phenomenal annual rate

of 20%- 30% since 1990 (Primavera, 1997). In Bangladesh, shrimp farming has significant benefits in socioeconomic sector, and its potential of generation of foreign exchange has provided major driving forces in the expansion of this industry (Hossain *et al.,* 2013). According to the statistics from the Department of Fisheries of Bangladesh (FRSS, 2012), the exported amount of frozen shrimp was 15,023 tons in 1988, which was three times higher (47,879.91 tons) in 2011. Shrimp sector plays important role in the national economy of Bangladesh.

**1.2 Importance of Shrimp Cultivation**

Commercial shrimp culture has been dramatically expanded over the last three decades in the coastal zone of Bangladesh (Islam and Tabeta, 2016). In FY 2016-17, the total amount of production from shrimp farm including secondary crop fish and crab was 246406 MT in Bangladesh with a significant growth rate of 2.76% (DoF, 2017). Shrimp is the second most important export items in Bangladesh. The major shrimp-producing districts are Bagerhat, Satkhira, Pirojpur, Khulna, Cox's Bazar and Chittagong. Among them, Chittagong, Cox's Bazar, Khulna, Bagerhat and Satkhira districts are the main centers of shrimp culture (Belton, 2011). Although several species are available in the coastal regions, *Penaeusmonodon* (locally known as bagdachingri) is the preferred species for cultivation as very high price in international markets. In Bangladesh, *P. monodon* comprises 60 % of farmed shrimp production, followed by the giant freshwater prawn, *Macrobra chiumrosenbergii* (galdachingri), which accounts for 25 % of production (Rosenberry 1995; Ahmed 2003). Thus,of the fishery commodities exporting shrimps like Black Tiger (*Penaeus Monodon*) and fresh water scampi (*Macrobrachium Rosenbergii*) bring the most of foreign currency in this sector. Traditional 'Gher' (shrimp farming ponds which are converted from rice field) aquaculture had been practiced in the coastal region of Bangladesh to grow shrimp and other fishes long before the introduction of current shrimp farming practices (DDP, 1985).

In the Second Five-Year Plan (1980-1985), the government of Bangladesh acknowledged shrimp farming as an industry and adopted measures essential for increased shrimp production (Haque, 1994). After that the production grew exponentially and the area covered by production was 22,000 ha in 1980 that increased to almost double (276,000 ha) in 2013 (FRSS, 2012; Kabir, 2013). Total

shrimp production takes place from three sources, namely inland capture, inland culture and marine fisheries. In 1990–1991, total shrimp production was 80,384 tons in which cultured shrimp contributed 24%. But, in 2010–2011, the total shrimp production increased to 306,168 tons of which cultured shrimp contributed 47.71 %. That means the shrimp production share from the culture sources increased by 23.47 % as compared to 1990–1991 (Islam and Bhuiyan, 2016).The economic incentives encourage farmers to bring thousands of acres of lands under shrimp farms (Rahman *et al.,* 2013).

**1.3 Rationale of the Study**

There were few researches and studies in Bangladesh conducted to elicit the colossal effects of shrimp production at different times that did not particularize its focus on proposing an ecological design of shrimp production but no significant research has found which had been taken to assess the impacts of shrimp cultivation on the cultivator's livelihood. Therefore, the present study has been taken to delineate the socio-economic profile of shrimp cultivators and to examine the impacts of shrimp culture on smallholder cultivator's livelihoods in Bagerhat and Khulna district of Bangladesh. This study will also identify the constraints faced by smallholder shrimp cultivators as well as recommend policy guidelines to overcome the problems.

**1.4 Key research questions**

a) What are the demographic characteristics of the shrimp cultivators?
b) What are the socio-economic status of shrimp cultivators?
c) How much cost arises in the time of shrimp culture?
d) How much gross margin received by shrimp culture?
e) What is the profit margin of shrimp culture?
f) Where remain the efficiency of resources used for shrimp culture?
g) What are the constraints faced by the cultivators during shrimp culture?
h) Which problems suffered them mostly in the time of cultivation and marketing?
i) What was the extent of impact of shrimp cultivation on cultivator's livelihood?
j) What are the impacts of shrimp culture on the cultivator's food habit?
k) What are the impacts of shrimp culture on the cultivator's children's schooling

### 1.5 Justification of the Study

The outcomes of this research will be helpful to the planners, policy makers and extension workers for better understanding the current scenario and for taking strategies to accelerate regional development programs specifically in rural agricultural sector. Understanding the limiting factors of smallholder cultivators in technology adoption will help development workers to ascertain the type of strategy needed to encourage technology uptake and sustain their livelihood. This study will also be helpful to the academicians and researchers for further conceptualization.

### 1.6 Objectives

1. To delineate the socio-economic profile of shrimp cultivators in the study area;
2. To examine the factors influencing the shrimp cultivation in the study area; and
3. To identify the constraints faced by smallholder cultivators in the time of shrimp cultivation and to recommend some policy guidelines.

### 1.7 Outline of the Study

This thesis contains a total of eight chapters which have been organized in the following sequence. Chapter 1 includes introduction. The review of literature is presented in Chapter 2. Methodology of the relevant study is discussed in Chapter 3. Chapter 4 contains the socio- demographic profile of the shrimp producing farmers. Chapter 5 deals with profitability of shrimp farming. Chapter 6 describes the factors affecting returns of shrimp farming. Chapter 7 presents problems and constraints of shrimp farming. Finally, Chapter 8 represents the summary, conclusion and policy recommendations to increase shrimp production.

# CHAPTER II
# REVIEW OF LITERATURE

## 2.1 Introduction

This chapter presents the review of relevant literature with a view to understand the method and cause-effect relationship of past and present research work on shrimp farming. This would help in narrowing down the problem correctly and in selecting the most appropriate technique of analysis. A large number of studies were conducted on production and marketing of shrimp in Bangladesh. But review of literature was not only limited to works done in Bangladesh but also was extended to other countries for having a broader view.

## 2.2 Shrimp Farming Related Studies

Biswas (1993) conducted research on "A comparative economic study on the production of transplanted aman with shrimp and without shrimp in Rampal thana under Bagerhat district". It was found from the study that the yield and net return of T. aman with shrimp was significantly lower than that of T. aman without shrimp. The yield of T. aman with shrimp was low mainly due to excessive intake of saline water into the field for shrimp cultivation. Besides, the ownership pattern also affected the yield of aman paddy. The study also found that the paddy farmers were not so much benefited if they would cultivate shrimp in their fields. But they were far away from the ability to produce the shrimp that involved high cost.

Das (1993) studied shrimp farmers by tenurial groups such as owner operator, owner-cum-tenant and tenant farmer from the district of Khulna and Bagerhat of Bangladesh to examine the socioeconomic characteristics, production profitability and problems of the selected farmers. He found that the highest production was obtained by owner operator (196 kg/ha) and the lowest production was obtained by owner-cum-tenant (151 kg/ha). He further showed that benefit cost ratio was the highest for owner operator (2.53). Functional analysis showed that application of more inputs would increase the farm income.

Uddin (1995) conducted "An economic study on shrimp farming in some selected areas of Khulna and Satkhira district". He found that most of the farmers in Satkhira

district followed improved traditional method in shrimp farming which resulted in higher yield. Per hectare total cost of shrimp farming was Tk. 62613.26 in Satkhira district while it was Tk. 41815.69 in Khulna district. He also found that per hectare net income in Satkhira District was Tk. 78374.60 and in Khulna district it was Tk. 32447.49 which means that net income in Satkhira district was 2.41 times higher than that of Khulna district. In all respect shrimp farming in Satkhira district was more profitable compared to Khulna district.

Liao (1996) examined "The production economics of freshwater shrimp farming in southern Taiwan". Based on survey data, large farms were more profitable than small farms. It was found to be associated with lower production cost per hectare for large farms. A Cobb-Douglas production function was fitted to analyze the survey data. Farm size, capital and management were significant factors affecting production of freshwater shrimp. The adoption of improved practices resulted in higher yields. The estimated production function provides estimates of marginal value products for farm size, labor, capital and management.

Miah (2001) reported that per hectare production of shrimp (245 kg) was higher under alternative shrimp salt farming compared to the production of shrimp (207 kg) under alternate shrimp rice farming. He found that combined gross returns from producing shrimp and salt was Tk. 247165.00 substantially higher than that of combined returns from shrimp and rice production was Tk. 107235.00 under alternate shrimp rice farming system. In respect of socioeconomic consequences of shrimp farming, it was reported that about 90 percent farmers and other related people were economically and socially benefited due to shrimp farming. He also found that new employment opportunity had been created for both men and women. However, it was found from the study that shrimp farming had some negative effects on environment and agro-ecosystem, which had changed the biodiversity in the areas.

Parvin (2001) conducted a study on "Shrimp processing industry in Bangladesh: A market structure analysis". She stated that processed shrimps were distributed through two channels. There was no significant evidence of product differentiation in the industry but shortage of raw shrimps and lack of capital were the main barriers to entry for new firms. He also found the shortage of raw shrimps (100 percent), lack of

institutional support (100 percent), lack of shipment facilities (45 percent), strike and political unrest (88 percent) and price instability (83 percent) were the important problems of shrimp processing firms.

Shah and Karim (2001) studied on Shrimp culture and changes of land use pattern in coastal belt of Bangladesh: A spatio-temporal analysis. They identified the causes and extent of changes of physical, socioeconomic and ecological pattern. A total of 3932 households were included covering ten thana of Khulna district in the survey. They showed that shrimp culture has created negative impacts on the physical, socioeconomic and environment of the areas as a whole. Some necessary guidelines had been provided for sustainable shrimp culture activities in the areas.

Miah *et al*. (2002) stated that shrimp farming and related activities helped the concerned people, directly and indirectly, to increase their household income which enables them to have more savings and investment, resulting in better livelihoods and socio-economic conditions. Shrimp industry was found to have the potential for absorbing the surplus labor force of the coastal areas. The study also revealed that existing unplanned shrimp culture had adversely affected the production of cereal crops and vegetables, trees and plantation, poultry and livestock, environment and agro-ecosystem, which had moderately changed biodiversity.

FFP (2003) study showed that untrained farmers, when they used inputs, generally used them in an undiscriminating wasteful manner. Following this findings, one of the Fourth Fisheries Project key messages to the farmers was that it was more effective and cheaper to use smaller quantities and balances between different types of inputs (e.g., using lime, urea or cattle manure, because acidity discourages growth of phytoplankton even when nutrients are abundant).

Rahman (2003) conducted "An economic study of Galda shrimp farming in some selected areas of Jessore district". He found that under year-round galda shrimp farming, per hectare production was 550 kg, which was higher compared to the production of shrimp (440 kg) under alternate galda shrimp rice farming. The combined gross return Tk. 202500.00 from producing galda shrimp and finfish was substantially higher than that of combined returns Tk. 159800.00 from galda shrimp

and rice production under alternate galdashrimp rice farming. He clearly indicated that year-round galda shrimp farming was highly profitable because farmers had to incur small amount of cost for producing galda. He also found that per hectare total cost was Tk. 78728.00 for producing galda and net return was Tk. 123772.00.

Islam et al. (2003) stated that the government of Bangladesh was concerned about the impact of shrimp farming. The government provided crucial support in the sector through accessing of land, leasing of 'khas' land to shrimp farmers and providing financial support in production and marketing of shrimp. Regarding negative impacts of shrimp culture, the government subsequently introduced some regulatory measures to mitigate some of the negative impacts. However, those measures were alleged to be inadequate and even not implemented to protect the negative socio-economic and environmental consequences.

Barmon and Osanami (2004) conducted a study on "Problems and prospects of shrimp and rice-prawn gher farming system in Bangladesh". The findings indicated that the shrimp-gher farming system had a negative impact on the environment, ecology, land degradation, livestock, and water quality; whereas the rice-prawn gher farming system was found to be friendlier to environment, ecology, and water quality and helpful to alleviate poverty. The rice-prawn gher farming system had significant impacts on land for modern varieties (MV) paddy production. The yield of modern varieties paddy production under rice-prawn gher farming system was almost the same as the yield in other parts of Bangladesh where the farmers usually produce only year-round MV paddy. The rice-prawn gher farming system was found to provide a sufficient amount of rice, fish and vegetables to small, marginal and landless farmers that would not be possible under shrimp gher farming. Case studies and secondary data were used in the study. Primary data was not used for the study. So, in this regard the present study will provide better analysis for shrimp farming in Bangladesh.

Ito (2004) examined that changing agrarian institutions in southwestern Bangladesh where a large number of farmer, small and large, had switched from rice farming to export-oriented freshwater prawn farming within the last decade. The local economy boomed until ecological and managerial problems began to threaten the sustainability

of the farming activities. At the same time, the impact of global competition was forcing the industry to adopt so-called global standards concerning food safety and sanitary conditions. These demand restructuring of the local supply chain at the bottom of which a significant number of small farmers were struggling to survive. It was argued that this restructuring was leading to small farmer's reduced access to financial capital and possible to changes in ownership pattern of freshwater prawn farms.

Nuruzzaman (2006) conducted a study on "The present status of shrimp at the stage of production and marketing: a study in Khulna district of Bangladesh". He found that the marine water shrimp and freshwater prawn was commercially cultured in Khulna district of Bangladesh. Thousands of farmers in this area had converted their paddy fields to shrimp and prawn farms to accommodate a profitable shrimp culture practice. However, now the production of shrimp and prawn are turn over all around the year. The shrimp/prawns supply chain from farmers to the international markets always pass through a number of middlemen: faria (field workers), prawn traders, agents and companies. He mainly used paired t-test for two sample mean and linear regression analysis for examining the relationship between production of shrimp and its stages of marketing. His study focused on marketing chain of shrimp farming but not on the other side like its profitability, socio-economic condition of the farmers and the impacts of shrimp cultivation on the income of the farmers. So, in that case this study will provide a clear picture for the policy makers of the country for improving the livelihood of coastal people.

Reddy (2006) conducted a study on "Resource use efficiency of shrimp farming in India". This study was conducted to analyze resource use efficiency and resource productivity of shrimp farming for long-term sustainability. The medium farmers followed by large farmers emerged as the technologically advanced group, who meticulously adopted scientific culture management practices. The revival phase of shrimp culture from the recent setback was observed in the study. The resources that were efficiently utilized by the farmers include lime, organic manures and pond area. However, the material inputs, viz., feeds, stocking material, and fuel and electricity were excessively used. It was suggested that need-based training programmes and

demonstrations should be conducted among farmers to encourage them to follow the recommended package of practices.

Islam et al. (2007) made an attempt to determine the gender role and empowerment of stakeholders involved in shrimp industry. They noted that after development of shrimp industry, involvement of women in income generating activities had increased but still male participation and involvement were dominant compared to women. There was significant difference of wage rate or salary between male and female in different sectors of shrimp industry where both male and female laborers were employed. For most of these cases, women workers had no bargaining power and the job market was controlled by the male character.

Uddin (2008) conducted a study on "safety standards in shrimp export from Bangladesh to the world's market". This study aimd to sketch out various activities of different stakeholders in the value chain from the production level to export market conformity with the food safety standards. The result revealed that shrimp farming found to be very much profitable and work environment was being improved. They were found to be trying to practice traceability. Some international organizations are working as third party certification agency. However, it was recommended to ensure traceability from the farm level to shipment as well. It is also recommended to recover the illegally occupied government land and distribute those to the real shrimp farmers and processor to augment its production and export volume.

Rahman and Hossian (2013) conducted a study on "Present Status and Potentiality of Shrimp in Bangladesh". He found that Shrimp and prawn together represent the second largest exportable items contributing to foreign exchange earnings of Bangladesh. Shrimp farming was found to have significant impact on environment and economy. The productivity of shrimp was very low compare to the other shrimp producing countries of the world. One of the major causes of poor productivity was the extensive or traditional method of farming, whereas developed countries brought their farms under intensive or semi-intensive methods of farming. The farmers of the study area practiced galda-cum-rice pattern. The productivity of galda and T. Aman rice was found 505 kg/ha and 3497 kg/ha, respectively. About 72 percent famers of the study area were choose galda farming as the main occupation and shared 83.4

percent of their annual income whereas, rice shared 8.88 percent only. So, galda had significant importance to the socioeconomic and livelihood status of the farmers. Data on shrimp farm management practices were mainly analyzed using descriptive statistics such as mean, median and percent. Activity budget was used to analyze the profitability of shrimp/prawn farming. This study was not used the Cobb-Douglas production function model which provides a clear explanation of the relationship between the input and output of shrimp farming. So, in this perspective this study will provide a clear explanation of the relationship between the input and output of shrimp farming based on the Cobb-Douglas production function.

Rasha (2013) conducted a study on "Profitability and resources use efficiency of shrimp farming in some selected areas of Bagherhat district in Bangladesh" and it was found that per hectare gross return, net return and gross margin were found to be Tk. 364222.00, Tk. 215931.00 and Tk. 260095.00 respectively. Total cost of shrimp production was calculated at Tk. 148291.00 per hectare. Benefit Cost Ratio (BCR) was found 2.46 for shrimp farming. Thus, it was found that shrimp farming was highly profitable. Production function analysis suggested that, among the variables included in the model, cost of shrimp fry, cost of feed, cost of fertilizer, cost of human labor and cost of water management had a positive and significant effect on gross return of shrimp production. On the other hand, cost of lime had a negative.

Various studies have also been conducted by different researcher to explore different aspects of this shrimp cultivation. Among them Islam and Tabeta (2016) studied the impacts of shrimp farming on local environments and livelihoods in Bangladesh.

Islam (2003) studied the rapid horizontal expansion of this sector. Kabir and Eva (2014) studied the environmental impact of shrimp aquaculture of Chandipur village at Debhata upazila of Satkhira district of Bangladesh and reported salinity intrusion due to shrimp farming.

Rahman *et al.* (2013) studied the shrimp cultivation with water salinity in Bangladesh and reported its impacts on ecological and other factors. Anwar (2003) studied the effect of shrimp culture on ecology in the coastal areas of Bangladesh.

Haque (2006) studied the salinity problems and crop production in coastal regions of Bangladesh. Begum and Alam (2002) studied the social and economic impacts of shrimp disease among small-scale, coastal farmers and communities in Bangladesh. Islam *et al*. (1998) studied the impact of shrimp farming on soil and water quality of some selected areas in the greater Khulna district of Bangladesh.

Ghafur *et al.* (1999) studied the socio-economic and environmental impact of shrimp culture in south-western Bangladesh. Saha (2017) studied socio-economic and environmental impacts of shrimp farming in the south-western coastal region of Bangladesh.

Karim and Mustari (2015) studied the shrimp cultivation and coastal livelihood. Hossain *et al.* (2013) studied the impacts of shrimp farming on the coastal environment of Bangladesh.

### 2.3 Concluding Remarks

The above mentioned discussion and review indicate that most of the studies dealt with cost, return, profitability and productivity of shrimp. Some studies also determine the factors affecting the profitability. Maximum studies examined parameters, which influence production, more than a decade ago. Within this period changes might have taken place in production process, and owing to these changes, the validity of those factors needs to be looked into again. Side by side the influence of other factors identified by the researchers of other countries is needed to study studied in the context of Bangladesh. Therefore, this study is expected to be conducted taking into account those aspects. The review of literature was helpful to re-design methodological aspects with a view to overcome the limitations of previous studies. From the above studies the researcher felt the need of conducting and analyzing the productivity of shrimp farming in Bangladesh within the current development context, which will help the policy makers to understand the current situation and take programmes to increase shrimp production and improving the livelihood of coastal people in Bangladesh. On the other hand, researcher believed that the findings of this study would provide useful updated information, which would help the policy makers and researcher for further investigations.

# CHAPTER III
# METHODOLOGY

## 3.1 Introduction

This chapter presents a detailed sequential steps of research work for instance, selection of study areas, selection of study period, sources of data, processing of data and analytical techniques.

## 3.2 Study area

The study was conducted in some selected upazila namely, Bagerhat sadar and Rampal upazila of Bagerhat district and Paikgacha Upazila and Dumuria Upazila of Khulna district of Bangladesh.

## 3.3 Population size

A list was prepared comprising the farmers who cultivate shrimp in Bagerhat and Khulna district with the help of upazila fisheries officer (UFO) and local farmers. This list will be the population of the study.

## 3.4 Sample and sampling procedure

A total number of 120 shrimp cultivators, 30 from each upazila were randomly selected from the population. The selected farmers were interviewed to gather the required information for the study.

**Table - 3.1: Population and sample of the study area**

| Name of the district | Name of the upazila | Sample size |
|---|---|---|
| Bagerhat | Bagerhat Sadar | 30 |
| | Rampal | 30 |
| Khulna | Paikgacha Upazila | 30 |
| | Dumuria Upazila | 30 |
| Total | | 120 |


**Figure 3.1: A map of Khulna district showing the stuty area**

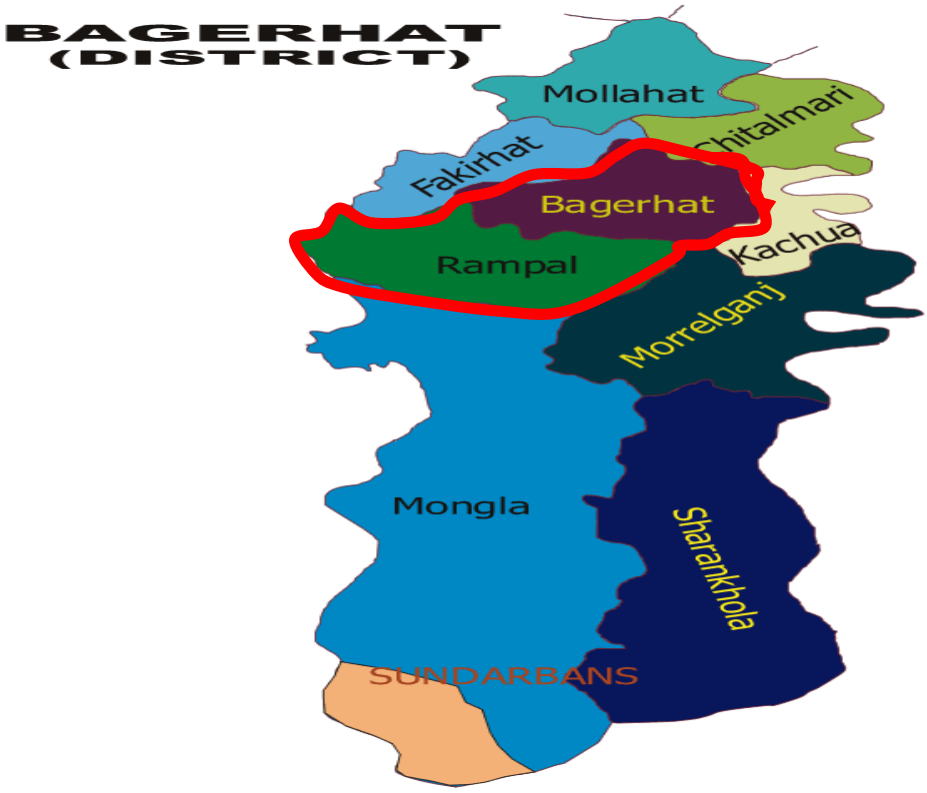



**Figure 3.2: A map of Bagherhat district showing the stuty area**

### 3.5 Methods of Data Collection and Data Collecting Instruments

Both technical and socio-economic data were needed for this research. The researcher himself was collected the data by interviewing the selected respondents.

The measures taken were:

- Built-in-check in the interview schedule;
- Field checking and
- Independent re-interviewing of the respondents.

### 3.6 Preparation of the Survey Schedule

Preparation of survey schedules is of crucial importance in this study. A comprehensive survey schedule was prepared to collect necessary information from the concerned respondent in such a way that all relevant information needed for shrimp farming could be easily obtained within the shortest possible time. The interview schedule was pretested for judging their suitability. After pre testing, the schedule was finalized.

### 3.7 Collection of Data

To satisfy the objectives of the study, necessary data were collected by visiting each farm personally and by interviewing them with the help of a pretested interview schedule. Usually most of the respondent does not keep records of their activities. Hence it is very difficult to collect actual data and the researcher has to rely on the memory of the respondent. Before going to an actual interview, a brief introduction of the aims and objectives of the study was given to each respondent. The question was asked systematically in a very simple manner and the information was recorded on the interview schedule. When each interview was over the interview schedule was checked and verified to be sure that information to each of the items had been properly recorded. In order to minimize errors, data were collected in local units. These were subsequently converted into appropriate standard unit.

Data collection period was 1$^{st}$ November to 31$^{st}$ December, 2017. In order to obtain reliable data the researcher initially visited for several times to introduces himself with the people of the study areas during the season. Secondary data were collected through literature and different publications from BBS, BER, DoF and Bangladesh Bank (BB) etc.

### 3.8 Editing and Tabulation of Data

After collection of primary data, the filled schedules were edited for analysis. These data were verified to eliminate possible errors and inconsistencies. All the collected data were summarized and scrutinized carefully. For data entry and data analysis, the Microsoft Excel programs and SPSS programs were used. It might be observed here that information was collected initially in local units and after checking the collected data, it was converted into standard units. Finally, a few relevant tables were prepared according to necessity of analysis to meet the objectives of the study.

### 3.9 Analytical Techniques

Data were analyzed with the purpose of fulfilling the objectives of the study. Both descriptive and statistical analysis was used for analyzing the data.

#### 3.9.1 Descriptive Analysis

Tabular technique of analysis was generally used to find out the socio-demographic profile of the respondent, to determine the cost, returns and profitability of shrimp farm enterprises. It is simple in calculation, widely used and easy to understand. It was used to get the simple measures like average, percentage etc.

#### 3.9.2 Production Function Analysis

The production function represents the technological relationship between output and factor inputs. To estimate the production function, one requires development of its properties leading to specification of an explicit functional form.

One of the most widely used production function for empirical estimation is the Cobb Douglas production. This function was originally used by C.W. Cobb and P.H. Douglas in twenties to estimate the marginal productivities of labor and capital in American manufacturing industries. Their main purpose was to estimate the shares of labor and capital in total product; hence they used this function with the constraint that the sum of elasticity's or regression coefficients should total one. Later on, they relaxed this restraint. Cobb and Douglas originally fitted the function to time series 1930s and 1940s; the same form was used for cross section of industries. This form of the function was subsequently used in many production function studies for technical units (crops, livestock) and farm-firms in agricultures. The popularity of this function is because of the following characteristics of the function:

i. It directly provides the elasticity's of production with respect to inputs;
ii. It allows more degrees of freedom than other algebraic forms (like quadratic function) which allow increasing or decreasing marginal productivities and
iii. It simplifies the calculations by reducing the number of regression to be handled in regression analysis.

The original form used by Cobb and Douglas was

$$Q = aL^{\alpha}K^{1-\beta}U$$

This forces sum of elasticity's to one. Their later modification was

$$Q = aL^{\alpha}K^{\beta}U$$

Where, $\boldsymbol{\alpha} + \boldsymbol{\beta}$ need not equal one.

In agriculture, this form of function has not been used in its original form. Neither the sum of elasticity's is kept equal to one nor is the number of variables limited to two. Even then as the basic idea of functional form was provided by Cobb and Douglas, various forms of this function have continued to be called as Cobb-Douglas production function.

The Cobb–Douglas production function, in its stochastic form, may be expressed as

$$Y_i = \beta_1 \ X_{2i}^{\beta_2} X_{3i}^{\beta_3} e^{u_i} \qquad \text{…….. (3.1)}$$

Where, $Y$ = output

$X_2$= labor input

$X_3$= capital input

u = stochastic disturbance term, e = base of natural logarithm.

From Eq. (3.1) it is clear that the relationship between output and the two inputs are nonlinear. However, if we log-transform this model, we obtain:

$$\ln Y_i = \ln\beta_1 + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + u_i$$

$$= \beta_0 + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + u_i \qquad \text{….. (3.2)}$$

Where $\beta_0 = \ln\beta_1$.

Thus written, the model is linear in the parameters β0, β2, and β3 and is therefore a linear regression model. Notice, though, it is nonlinear in the variables *Y* and *X* but linear in the logs of these variables. In short, (3.2) is a log-log, double-log, or log-linear model, the multiple regression counter part of the two-variable log-linear model.

The properties of the Cobb–Douglas production function are quite well known:

1. $\beta_2$ is the (partial) elasticity of output with respect to the labor input, that is, it measures the percentage change in output for, say, a 1 percent change in the labor input, holding the capital input constant.
2. Likewise, $\beta_3$ is the (partial) elasticity of output with respect to the capital input, holding the labor input constant.
3. The sum ($\beta_2$+ $\beta_3$) gives information about the returns to scale, that is, the response of output to a proportionate change in the inputs. If this sum is 1, then there are constant returns to scale, that is, doubling the inputs will double the output, tripling the inputs will triple the output, and so on. If the sum is less than 1, there are decreasing returns to scale—doubling the inputs will less than double the output. Finally, if the sum is greater than 1, there are increasing returns to scale— doubling the inputs will more than double the output.

Before proceeding further, note that whenever they have a log–linear regression model involving any number of variables the coefficient of each of the X variables measures the (partial) elasticity of the dependent variable Y with respect to that variable. Thus, if they have a k-variable log-linear model:

$$\ln Y_i = \beta_0 + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \ldots\ldots + \beta_k \ln X_{ki} + u_i \qquad \ldots\ldots\ldots\ldots (3.3)$$

Each of the (partial) regression coefficients, $\beta_2$ through $\beta_k$, is the (partial) elasticity of Y with respect to variables $X_2$ through $X_k$. Assuming that the model (3.2) satisfies the assumptions of the classical linear regression model; we obtained the regression by the OLS. (Acharaya, 1988).

### 3.9.3 Specification of the Cobb-Douglas Production Function

The input-output relationships in shrimp farming were analyzed with the help of Cobb-Douglas production function approach. To determine the contribution of the most important variables in the production process of shrimp farming, the following specification of the model was used.

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} e^{ui} \quad \text{…….. (3.4).}$$

The Cobb-Douglas production function was transformed into following logarithmic form so that it could be solved by ordinary least squares (OLS) method.

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + \text{.....(3.5)}$$

Where, Y= Gross income from year round shrimp (Tk/ha);

$X_1$= Cost of labour (Tk./ha);

$X_2$= Cost of fingerling (Tk/ha);

$X_3$= Cost of lime (Tk/ha);

$X_4$= Cost of fertilizer & manure (Tk/ha);

$X_5$= Cost of human labor (Tk/ha);

$X_6$= Cost of water management (Tk/ha);

a= Intercept;

$b_1$…..$b_6$= Coefficient of the respective variable;

$U_i$= Error Term;

i= 1, 2,…….6.

### 3.10 Profitability Analysis

Cost and return analysis is the most common method of determining and comparing the profitability of different farm household. In the present study, the profitability of shrimp farming is calculated by the following way-

### 3.10.1 Calculation of Gross Return

Per hectare gross return was calculated by multiplying the total amount of product and by-product by their respective per unit prices.

Gross Return= Quantity of the product * Average price of the product + Value of by-product.

### 3.10.2 Calculation of Gross Margin

Gross margin is defined as the difference between gross return and variable costs. Generally, farmers want maximum return over variable cost of production. The argument for using the gross margin analysis is that the farmers are interested to get returns over variable cost. Gross margin was calculated on TVC basis. Per hectare gross margin was obtained by subtracting variable costs from gross return. That is, Gross margin = Gross return – Variable cost.

### 3.10.3 Calculation of Net Return

Net return or profit was calculated by deducting the total production cost from the total return or gross return. That is,

Net return = Total return – Total production cost.

The following conventional profit equation was applied to examine farmer's profitability level of the shrimp producing farms in the study areas.

$$\text{Net profit, } \pi = \Sigma P_m Q_m + \Sigma P_f Q_f - \Sigma (P_{xi} X_i) - TFC.$$

Where, $\pi$ = Net profit/Net return from shrimp farming (Tk/ha);

$P_m$ = Per unit price of shrimp (Tk/kg);

$Q_m$ = Total quantity of the shrimp production (kg/ha);

$P_f$ = Per unit price of other relevant fish (Tk/kg);

$Q_f$ = Total quantity of other relevant fish (kg/ha);

$P_{xi}$ = Per unit price of i-th inputs (Tk);

$X_i$ = Quantity of the i-th inputs (kg/ha);

TFC = Total fixed cost (Tk) and

i = 1, 2, 3,....., n ( number of inputs).

### 3.10.4 Undiscounted Benefit Cost Ratio (BCR)

Average return to each taka spent on production is an important criterion for measuring profitability. Undiscounted BCR was estimated as the ratio of total return to total cost per hectare.

$$BCR = \frac{\text{Total Return}}{\text{Total Cost}}$$

### 3.11 Problem Faced in Collecting Data

During the period of data collection, the researcher faced the following problems.

3.11.1 Most of the farmers felt disturbed to answer questions since they thought that the researcher might use the information against their interest. To earn the confidence of the farmers a great deal of time was spent.

3.11.2 The farmers do not keep records of their activities and day to day expenses. Therefore the author had to depend upon their memory.

3.11.3 The farmers were usually busy with their field works. So, the researcher sometimes also had to pay extra visits to meet the farmer.

### 3.12 Constraint Faced Index (CFI)

Constraint Faced Index (CFI) used to explore and rank the problem faced by cultivators.CFI was computed for each confronted constraints. The formula is follows:

$$CFI = f_{vh} \times 4 + f_h \times 3 + f_m \times 2 + f_l \times 1 + f_n \times 0 \quad \text{..... (3.6)}$$

Where:

CFI = Constraint Faced Index,

$f_{vh}$= No. of respondents faced very high constraint,

$f_h$= No. of respondents faced high constraint,

$f_m$= No. of respondents faced medium constraint,

$f_l$= No. of respondents faced low constraint,

$f_n$= No. of respondents faced no constraint.

Ten problems were selected and validated by experts to measure the extent of problem faced by the farmers in practicing rice yield gap minimizing strategies. Five (5) point rating scale was used for each problem. Five alternative responses were not at all, low, medium, high and very high problem. The weights were assigned to these responses as 0, 1, 2, 3 and 4 respectively. Extent of problem faced score of the respondents was measured by summing up all the responses to all the problems. The extent of problem faced score could range from 0 - 40 where '0' indicating no problem and '40' indicating very high problem.

After calculating constraints score for all the problems it can be ranked based on its ascribed CFI score.

# CHAPTER IV
# SOCIO-DEMOGRAPHIC PROFILE OF SHRIMP PRODUCING FARMERS

## 4.1 Introduction

This chapter deals with the socioeconomic characteristics of the farmers. Socioeconomic characteristics of the farmers are important in profitability of shrimp cultivation. People differ from one another in many respects. Behavior of an individual is largely determined by his/her characteristics. There are numerous interrelated and constituent attributes that characterize an individual and profoundly influence development of his/her behavior and personality. It was, therefore, assumed that enterprise combination, consumption pattern, purchase pattern and employment patterns of different farm household would be influenced by their various characteristics.

### 4.1.1 Age

Age of the farmers ranged from 18 to 68 years, the average being 41.39 years and the standard deviation, 11.83. On the basis of age, the farmers were classified into three categories: up to 18-30 years, 31-45 years and above 45 years. The distribution of the shrimp's farmer according to their age is shown in Table 4.1.

**Table 4.1 Distribution of the farmers according to their age**

| Age category | No. | Percent (%) |
|---|---|---|
| **18-30 years** | 24 | 20.00 |
| **31-45 years** | 58 | 48.3 |
| **Above 45 years** | 38 | 31.7 |
| **Total** | 120 | 100.00 |

**Source: Field survey, 2017.**

Table 4.1 showed that the highest proportion 48.3 percent of the farmers fell in the age group of 31-45 years, while 20 percent of them fell in the age group of 18-30 years and 31.7 percent in the age group of above 45 years.

### 4.1.2 Education

The education scores of the farmers ranged from 0 to 16. The average was 7.41 and the standard deviation was 3.87. On the basis of their educational scores, the farmers were classified into four groups, namely "illiterate (0-0.5), primary (1-5), secondary (6-10) and above secondary (above 10). The distribution of the farmers according to their education is shown in Table 4.2.

**Table 4.2 Distribution of the farmers according to their education**

| Level of education | No. | Percent (%) |
|---|---|---|
| Illiterate/can sign only( 0 ) | 12 | 10 |
| Primary level( 1-5 ) | 32 | 26.7 |
| Secondary level( 6-10 ) | 49 | 40.8 |
| Above secondary level( >10 ) | 27 | 22.5 |
| **Total** | 120 | 100.00 |

**Source: Field survey, 2017.**

Table 4.2 indicated that the majority (40.8 percent) of the farmers had secondary education compared to 26.7 percent of them having primary level of education. About 10 percent of the farmers were illiterate while 22.5 percent had above secondary level of education.

### 4.1.3 Family size

Family size of the farmers ranged from 2 to 9 years, the average being 4.34 and the standard deviation, 1.38. On the basis of family member, the farmers were classified into three categories: small family up to 2-3 members, medium family 4-6 members and large family above 6. The distribution of the shrimp's farmer according to their family member is shown in Table 4.3.

**Table 4.3 Distribution of the farmers according to their family size**

| Family member category | No. | Percent (%) |
|---|---|---|
| **Small (2-3)** | 32 | 26.7 |
| **Medium (4-6)** | 81 | 67.5 |
| **Large (above 6)** | 7 | 5.8 |
| **Total** | 120 | 100.00 |

Table 4.3 showed that the highest proportion 67.5 percent of the farmers fell in the medium family of 4-6 members, while 26.7 percent of them fell in the small family size of 2-3 members and 5.8 percent fell in the large family size of above 6 members.

### 4.1.4 Sources of Credit

Available amount of funding is an important factor for any kind of farming. The sources of credit facilities for the shrimp producing farmers include Banks, NGOs, Relatives and also their own funding. In the study area different NGOs such as BRAC, ASA, CARE etc are operating their services for providing loan to the poor farmers so they can use this fund in the shrimp farming business. About 2.5 percent farmers were taken loan from Banks, 20 percent farmers were taken credit from NGOs 77.5 percent farmers were used their own funding (Table 4.4).

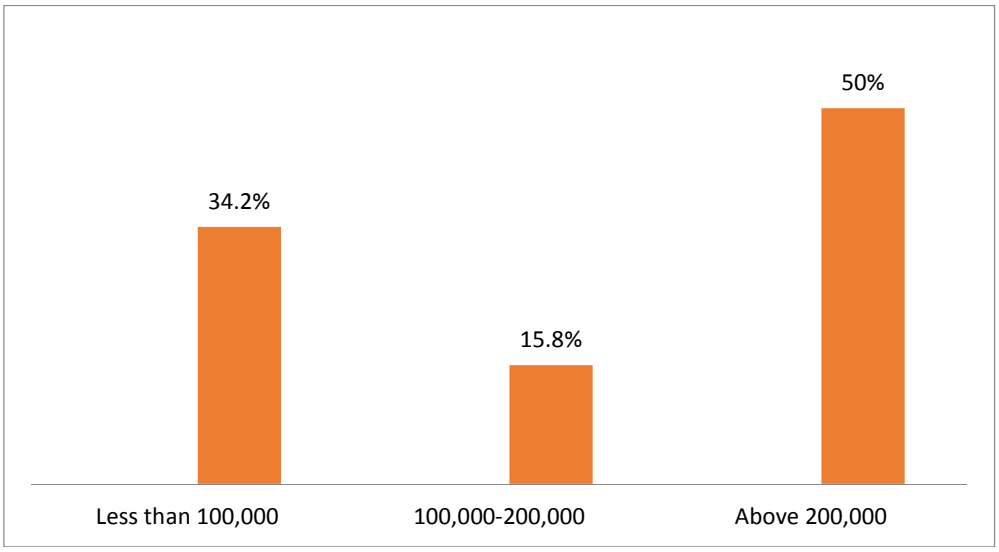
**Table 4.4 Sources of credit facilities of the sample farmers**

| Items | No. | Percent (%) |
|---|---|---|
| Banks | 3 | 2.5 |
| NGOs | 24 | 20 |
| Relatives | 0 | 0 |
| Own funding | 93 | 77.5 |
| Total | 120 | 100 |

**Source: Field survey, 2017**

### 4.1.5 Income

The yearly income of shrimp farmers differs from one another. In the present study, the incomes of shrimp farmers were categorized as follows: less than Tk. 100,000, from Tk. 100,000 to Tk. 200,000 and Tk. 200,000. It is evident from the figure 5.5 that most of the farmer's yearly income belonged to the category of Tk. 100,000 to Tk. 200,000. About 50 percent of the shrimp producing farmers were earned Tk. 100,000 to Tk. 200,000 per year, 15.8 percent of the farmers were earned less than Tk. 100,000 per year and 34.2 percent farmers were earned above Tk. 200,000 per year.




**Source: Field survey, 2017.**

**Figure 4.1: Distribution of the respondent according to their income**

### 4.1.6 Experience in shrimp cultivation

The experience score of the respondents ranged from 3 to 35 years. The mean score was 14.71 with the standard deviation 7.56. On the basis of experience, the respondents were classified into three categories namely, low experience, medium experience and high experience as shown in Table 4.5.

**Table 4.5 Distribution of the farmers according to their experience**

| Category (years) | No. | Percent (%) |
|---|---|---|
| **Low experience (3-7)** | 24 | 20.00 |
| **Medium experience (8-21)** | 77 | 64.2 |
| **High experience (above 21)** | 19 | 15.8 |
| **Total** | 120 | 100.00 |

**Source: Field survey, 2017.**

Data contained in the Table 4.5 revealed that the majority (64.2%) of the farmers had medium experience as compared to (15.8%) and (20%) having high and low experience respectively.

### 4.1.7 Adopter

The adopter score of the respondents ranged from 1 to 2. On the basis of adopter, the respondents were classified into two categories namely, adopter and non-adopter, as shown in Table 4.6.

**Table 4.6 Distribution of the farmers according to their adopter**

| Category | No. | Percent (%) |
|---|---|---|
| Adopter (1) | 81 | **67.5** |
| Non-adopter (2) | **39** | 32.5 |
| Total | **120** | **100.00** |

**Source: Field survey, 2017.**

Data contained in the Table 4.6 revealed that the majority (67.5%) of the farmers had adopter and (32.5%) had non-adopter respectively.

### 4.1.8 Training on shrimp cultivation

Training on shrimp cultivation score of the respondents were found to be varying from 0 to 25 days with an average of 2.34 and standard deviation of 3.71. Based on their score, the farmers were classified into three categories as shown in Table 4.8.

**Table 4.7 Distribution of the shrimp farmers according to their training**

| Category (Days) | No. | Percent (%) |
|---|---|---|
| No training (0) | 44 | **36.7** |
| Low training (1-5) | 64 | **53.3** |
| Medium training (6-10) | 5 | **4.2** |
| High training (above 10) | 7 | **5.8** |
| Total | **120** | **100.00** |

**Source: Field survey, 2017.**

Table 4.7 indicate that the majority (53.3%) of the farmers had low training on shrimp cultivation that comprised by 36.7 percent and 4.2 percent farmers have low training and medium training on shrimp cultivation. Only 5.8% of the respondents had high training on shrimp cultivation.

### 4.1.9 Land under shrimp cultivation

In the present study the land under shrimp cultivation of the farmers were classified into different categories. Land under shrimp cultivation of the farmers was in as reported by the sample farmers. It is evident from the Table 4.9 that 73.3 percent, 25.9 percent and 0.8 percent of the farmers were small land, medium land and high land respectively.

**Table 4.8 Distribution of the farmers according to their land under shrimp cultivation**

| Types of land (Ha) | No. | Percent (%) of land |
|---|---|---|
| **Small (0.13-1 ha)** | 88 | **73.3** |
| **Medium (1.01-3 ha)** | 31 | **25.9** |
| **Large land (above 3 ha)** | 1 | **0.8** |
| **Total** | **120** | **100.00** |

**Source: Field survey, 2017.**

### 4.1.10 Organizational participation

Organizational participation score of the respondents were found to be varying from 0 to 144 with an average of 20.50 and standard deviation of 30.28. Based on their score, the farmers were classified into four categories as shown in Table 5.9.

**Table 4.9 Distribution of the shrimp farmers according to their organizational participation**

| Organizational participation category | No. | Percent (%) |
|---|---|---|
| No participation (0) | 61 | **50.8** |
| participation (1) | 59 | **49.2** |
| Total | **120** | **100.00** |

**Source: Field survey, 2017.**

Table 4.9 indicates that the majority (50.8%) of the farmers had no organizational participation and 49.2 percent farmers have organizational participation.

## 4.2 Concluding Remarks

This chapter analyzed the socioeconomic characteristics of the sample farmers. The findings of analysis clearly indicate the socioeconomic characteristics from each other in respect of age distribution, education, family size, sources of credit, income, experience in shrimp cultivation, adopter, training on shrimp cultivation, land under shrimp cultivation and organizational participation etc.

# CHAPTER V
# PROFITABILITY OF SHRIMP FARMING

## 5.1 Introduction

This chapter mainly deals with the estimation and analysis of costs of shrimp production. The costs were classified into variable costs and fixed costs. Most of the inputs were valued at the current market price and sometimes governments' price in the study area during the survey period and also the prices at which farmers bought the inputs. But, for some unpaid inputs such as family labor, non-cash price was actually paid and pricing was very difficult in such cases. In these cases, the rule of opportunity cost was followed.

In this chapter, in terms of shrimp farming per hectare yield, gross return, gross margin, net return and undiscounted benefit-cost ratio are discussed. Therefore, a financial return of producing shrimp was calculated from the standpoint of farmers. All the returns were accounted for the study period. A brief account showing how the individual costs and returns were estimated in the present study is presented below. For analytical advantages, the cost items were classified under the following heads:

i. Human labor
ii. Fingerling
iii. Lime
iv. Fertilizer
v. Manure
vi. Feed
vii. Water management
viii. Land use
ix. Construction of guard shed, office and other housing
x. Miscellaneous
xi. Ponds repairing

## 5.2 Variable Costs

### 5.2.1 Human Labor Cost

Human labor is one of the most important variable inputs in the production process. Human labor is required for various activities and management of the selected farms such as- farm preparation, raising dyke, weeding, sorting, grading, harvesting etc. Human labor was classified into: (a) hired labor and (b) family labor. It is easy to calculate hired labor costs. To determine the cost of family labor, the opportunity cost concept was used.

In this study, the opportunity cost of family labor was assumed to be as wage rate per man i.e., the wage rate, which the farmers actually paid to the hired labor for working a man-day. The labor of women and children was converted into man-equivalent day by presenting a ratio of 2 children day = 1.5 women days = 1 man equivalent day (Miah, 1987). In this study a man-day was considered to be 8 hours of work. For avoiding complexity, average rate has been taken into account. Labor wage rate varies with respect to different seasons. In the study area it varied from 200 to 300 Tk. per man-days. Thus the computed average rate was Tk. 250 per man-days for shrimp farming.

Use of human labor and its relevant cost incurred were shown in Table 5.1. The per hectare labor cost was Tk. 34000 which constituted 30.14 percent of total variable cost.

### 5.2.2 Fingerling

Fingerling is a major input of shrimp farming in the study area. The farmers used purchased fingerling from fry collectors and hatchery. There was a variation in the per unit price of fingerling from location to location and time to time. But cost was calculated on the basis of actual price paid by the farmers. The average price of shrimp fingerling was Tk. 0.68 per piece. Per hectare average costs of shrimp fingerling were estimated at Tk. 22085 which constituted 19.58 percent of total variable cost (Table 5.1).

### 5.2.3 Cost of Lime

Lime is an important factor to the shrimp farming which prolongs healthy and productive environment for shrimp in the farm. It was used to neutralize acidity in the soil and pond water and it prevents diseases of shrimp. Lime assists in the release of nutrients from the soil and promotes bacterial breakdown of organic material including green manure. Cost of lime was charged at the price actually paid by the farmers. The average price of lime was estimated to be Tk. 18 per kg during the study period. There is a required dose for lime application, but the shrimp farmers in the study area used 125 kg/ha for shrimp production. Average per hectare costs of lime was calculated at Tk. 2250 which constituted 1.99 percent of total variable cost (Table 5.1).

### 5.2.4 Cost of Fertilizer

Fertilizer is an important input for shrimp farming. Shrimp farmers applied two kinds of fertilizer such as Urea and TSP. Uses of these fertilizers influence in increasing the growth of shrimp. The purpose of using fertilizer in the farm is to create a condition which facilitates to increase in production of good quality natural feeds, thereby increasing shrimp production. The cost of fertilizer was estimated by using the prevailing market rate which was actually paid by the farmers. The prices of these fertilizers were assumed to be same in all categories of farms. The average prices of Urea and TSP were Tk. 17 per kg and Tk. 26 per kg respectively in the study area.

The estimated costs of fertilizer are shown in Table 5.1. It was observed that shrimp farmers incurred cost of Tk. 1479 for Urea and Tk. 1612 for TSP on an average which constituted 1.31 percent and 1.43 percent of total variable cost respectively.

### 5.2.5 Cost of Manure

Manure (cowdung) was commonly used as organic fertilizer for producing shrimp. There was no fixed rate for buying manure in the study area. Farmers used purchased manure. Cost of manure was computed at the prevailing market price, which was estimated to be Tk. 3 per kg during the study period.

Per hectare cost of using manure was calculated at Tk. 963 for practicing shrimp farming which accounted for 0.85 percent of total variable cost (Table 5.1).

### 5.2.6 Cost of Feed

Supply of artificial supplementary feeds, which can complement nutritional deficiency, is important to increase shrimp production. In the study area shrimp farmers used rice bran, wheat bran, pulse bran and different types of oil cake, as supplementary feed for shrimp growth. Cost of feeds was estimated at the prevailing market price. The average cost of ready feed was calculated at Tk. 45 per kg during the study period. Per hectare average costs of feed were calculated at Tk. 32040 which was found to be 28.40 percent of total variable cost (Table 5.1).

### 5.2.7 Cost of Water Management

Brackish water shrimp culture is mainly based on saline water supply. Water is needed at the appropriate time for the proper growth of shrimp and its survival. Without saline water shrimp cannot be cultivated. In the study area farmers used motor for saline water uplifting and supplying it to the canal. So, cost of diesel was computed on the basis of prevailing market rate. The cost of diesel was calculated at Tk.70 per liter during the study period. Average per hectare costs of saline water uplifting were calculated at Tk. 11690 which was 10.36 percent of total variable cost (Table 5.1).

### 5.2.8 Miscellaneous Cost

Shrimp farmers had to bear some miscellaneous cost for purchasing different material, such as rope, light, umbrella, bamboo, boat, transportation, netting, commission for caretaker, rent of motor etc. It also included the payment of some charges and donation of different religious and social institutions. These miscellaneous costs were calculated on the basis of actual price paid by the farmers. In the study area, per hectare average miscellaneous costs for shrimp farming was found to be Tk. 1345 which constituted 1.19 percent of total variable cost (Table 5.1).

### 5.2.9 Ponds repairing cost

Ponds repairing cost was determined on the basis of cost that spent on ponds repairing. The Ponds repairing cost was estimated at Tk. 5343 constituted 4.74 percent share of total variable cost (Table 5.1).

**Table 5.1 Per Hectare Variable Costs of Shrimp Farming**

| Variable cost items | Units | Quantity (Unit/ha) | Price (Tk./Unit) | Cost (Tk.) | Percent of total variable cost (%) |
|---|---|---|---|---|---|
| Human labor | Man- days | 136 | 250 | 34000 | 30.14 |
| Fingerling | No. | 32478 | 0.68 | 22085 | 19.58 |
| Lime | Kg | 125 | 18 | 2250 | 1.99 |
| Urea | Kg | 87 | 17 | 1479 | 1.31 |
| TSP | Kg | 62 | 26 | 1612 | 1.43 |
| Manure | Kg | 321 | 3 | 963 | 0.85 |
| Feed cost | Kg | 712 | 45 | 32040 | 28.40 |
| Water management cost | Diesel in liter | 167 | 70 | 11690 | 10.36 |
| Miscellaneous cost | - | - | - | 1345 | 1.19 |
| Ponds repairing | - | - | - | 5343 | 4.74 |
| Total variable cost | - | - | - | 112807 | 100 |

**Source: Field survey, 2017.**

### 5.2.10 Total Variable Cost

In the study area, the total variable costs varied from year to year. It was observed that the total per hectare variable cost for shrimp farming was Tk. 112807 which comprised of 72.96 percent of total cost (Table 5.3).

## 5.3 Fixed Costs

### 5.3.1 Lease value

The farmers used the land as per conditions of leasing arrangement. The term leasing cost means the cost which was required for shrimp farmers to take land lease which would be used for shrimp production to a particular period of time. Leasing cost varies from one place to another depending on the location, soil fertility, topography of the soil and distance from the sources of water etc. Leasing cost was the single highest cost item in the study areas. The value of own land was calculated as opportunity cost concept. Land use cost for shrimp farming was estimated at the prevailing rental value per hectare in the

study area. The rental value of per hectare land was estimated at Tk. 29750 which occupied 71.17 percent of total fixed cost (Table 5.2).

### 5.3.2 Construction of water supplying canal and housing cost and guard shed

Guard shed was constructed to protect shrimp from thieves and dacoits. Cost for constructing construction of water supplying canal and housing cost and guard shed were taken one third of the average of this cost. The per hectare average construction of water supplying canal and housing cost and guard shed were calculated at Tk. 5356 for shrimp farming which shared 12.81 percent of total fixed cost (Table 5.2).

### 5.3. 3 Canal digging and dyke reconstruction

In the study area, it was estimated that per hectare canal digging and dyke reconstruction for year round shrimp farming was Tk. 2030 which comprised of 4.87 percent of total fixed cost (Table 5.2).

### 5.3.4 Interest on Operating Capital

Interest on operating capital was determined on the basis of opportunity cost principle. The operating capital actually represented the investment on different farm operation over the period because all the cost was not incurred at the beginning or at any single point of time. The cost was incurred throughout the whole production period; hence, at the rate of 9 percent per annum interest on operating capital for six months was computed for shrimp production (Interest rate was taken according to the bank rate prevailing in the market during the study period). Interest on operating capital was calculated by using the following standard formula (Miah, 1992).

Interest on Operating Capital (IOC) = Alit Where,

Al= Total investment /2,

t = Total time period of a cycle

i= interest rate which was 9 percent per year during the study period. The interest on operating capital was estimated at Tk. 4665 constituted 11.16 percent share of total fixed cost (Table 5.2).

**Table 5.2 Per Hectare Fixed Costs of Shrimp Farming**

| Fixed cost items | Cost (Tk./ha) | Percent of total fixed cost (%) |
|---|---|---|
| Land use cost | 29750 | 71.17 |
| Construction of water supplying canal and housing cost and guard shed | 5356 | 12.81 |
| Canal digging and dyke reconstruction cost | 2030 | 4.87 |
| Interest on operating capital | 4665 | 11.16 |
| Total fixed costs | 41801 | 100 |

**Source: Field survey, 2017.**

### 5.3.5 Total Fixed Cost

In the study area, it was estimated that per hectare total fixed cost for year round shrimp farming was Tk. 41801 which comprised of 27.04 percent of total cost (Table 5.3).

## 5.4 Total Cost

The total costs were calculated by adding up total variable cost and total fixed cost. In the study per hectare total cost of shrimp farming was calculated at Tk. 154608 (Table 5.3).

**Table 5.3 Per Hectare Total Cost of Shrimp Farming**

| Cost items | Cost (Tk./ha) |
|---|---|
| a. Total variable cost | 112807 |
| b. Total fixed cost | 41801 |
| Total cost (a+b) | 154608 |

**Source: Field survey, 2017.**

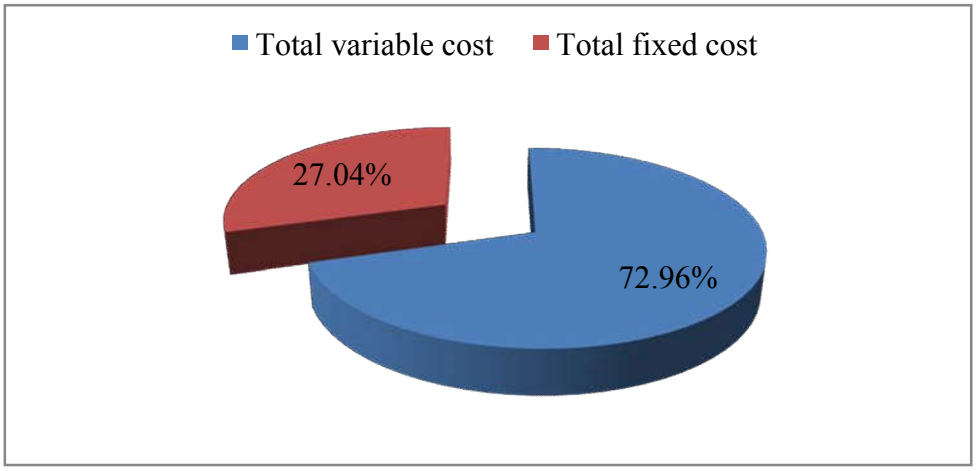



**Figure 5.1: Percentages of Per Hectare Total Variable Cost and Total Fixed Cost of Shrimp Farming**

## 5.5 Returns of Shrimp Farming

### 5.5.1 Gross Return

Gross return is the pecuniary value of total product. Per hectare gross return were calculated by multiplying the total amount of production by their respective market prices. In the study area, per hectare average yield of shrimp was 543 kg and its monetary value was Tk. 300900. Shrimp has a different grading system. Most shrimp are graded on the basis of size (weight). Here the grading was done on the basis of number of pieces forming one kg as reported by the farmer. For, calculation, three types of grading system was followed.

- A-grade: 12-15 numbers of shrimp is required to make 1kg weight.
- B-grade: 20-28 numbers of shrimp is required to make 1kg weight.
- C-grade: 30+ numbers of shrimp is required to make 1 kg weight.

Apart from these, few species of shrimps and fishes were also grown in shrimp farms. They are known as fin fish included pershey, tilapia, vetki, horina, chaka, & tangra etc. Per hectare average yield of fin fish was 546 kg and its monetary value was Tk. 85176.Therefore, the gross return for one year shrimp farming was accounted for Tk. 386076 (Table 5.4).

### 5.5.2 Net Return

In general net return is termed as entrepreneur's income. To evaluate the profitability of shrimp production, net return is an important aspect. Net return is the difference between gross return and total costs. Per hectare net return was estimated at Tk. 231468 which indicates that shrimp production is profitable business for the shrimp farmers (Table 5.5).

### 5.5.3 Gross Margin

Farmers usually want to gain maximum return over variable cost of production. The probable reason is that estimation of fixed cost of production is difficult to determine. Thus the gross margin analysis has been taken into account to calculate the relative profitability of shrimp farming. The gross margin of shrimp farming was estimated at Tk. 273269 (Table 5.5).

**Table 5.4 Per Hectare Return of Shrimp Farming**

| Items | Yield(kg/ha) | Price (Tk. /kg) | Gross income (Tk./hectare) | Percent of gross income (%) |
|---|---|---|---|---|
| (a) Shrimp | | | | |
| A-grade | 216 | 700 | 151200.00 | 39.16 |
| B-grade | 189 | 500 | 94500.00 | 24.48 |
| C-grade | 138 | 400 | 55200.00 | 14.29 |
| Subtotal | 543 | - | 300900.00 | 77.94 |
| (b) Fin fish | 546 | 156 | 85176.00 | 22.06 |
| Gross return from shrimp and fin fish (a+b) | - | - | 386076.00 | 100 |

**Source: Field survey, 2017.**

**Table 5.5 Gross Margin and Benefit Cost Ratio (Undiscounted) of Shrimp Farming**

| Sl. No. | Items | Amount (Tk. hectare) |
|---|---|---|
| **A.** | Gross return (GR) | 386076.00 |
| **B.** | Total variable costs (TVC) | 112807.00 |
| **C.** | Total costs (TVC+TFC) | 154608.00 |
| **D.** | Net return (GR-TC) | 231468.00 |
| **E.** | Gross margin (GR-TVC) | 273269.00 |
| **F.** | Benefit-cost ratio (BCR) = GR/TC | 2.497 |

**Source: Field survey, 2017.**

### 5.5.4 Benefit Cost Ratio (Undiscounted)

Benefit cost ratio was calculated by dividing gross return by gross cost or total cost. It implies return per taka invested. It helps to analyze financial efficiency of the farm. It was evident from the study that the benefit cost ratio of shrimp farming was accounted for 2.497 implying that Tk. 2.497 would be earned by investing Tk. 1.00 for shrimp production. So, the shrimp farming was found to be profitable for farmers (Table 5.5).

## 5.6 Concluding Remarks

It was evident from the results that per hectare total variable cost for shrimp farming were more than per hectare total fixed costs for shrimp farming. Shrimp farming provides higher returns to the farmers. Shrimp cultivation is gaining popularity in the country gradually due to its high yield potentiality and high demand in the international market. Sample farmers showed their opinion that higher yield and income encouraged them to continue shrimp production.

# CHAPTER VI
# FACTORS AFFECTING PROFITABILITY OF SHRIMP FARMING

## 6.1 Introduction

An attempt has been made this chapter to identify and measure the effects of the major variables on shrimp production. Cobb-Douglas production function was chosen to estimate the contribution of key variables on the production process of shrimp farming. The estimated values of the model are presented in Table 6.1.

## 6.2 Functional Analysis for Measuring Production Efficiency

Production function is a relation or a mathematical function specifying the maximum output that can be produced with given inputs for a given level of technology. Keeping in mind the objectives of the study and considering the effect of explanatory variables on output of shrimp farming, six explanatory variables were chosen to estimate the quantitative effect of inputs on output.

Management factor was not included in the model because specification and measurement of management factor is almost impossible particularly in the present study, where a farm operator is both a labor and manager. Other independent variables like water quality, soil condition, time etc. which might have affected production of farm enterprises, were excluded from the model on the basis of some preliminary estimation. A brief description is presented here about the explanatory variables included in the model.

## 6.3 Estimated Values of the Production Function Analysis

6.3.1 F-value was used to measure the goodness of fit for different types of inputs.

6.3.2 The coefficient of multiple determinations ($R^2$) indicates the total variations of output explained by the independent variables included in the model.

6.3.3 Coefficients having sufficient degrees of freedom were tested for significance level at 1 percent, 5 percent and 10 percent levels of significant.

6.3.4 Stage of production was estimated by returns to scale which was the summation of

all the production elasticity of various inputs.

The estimated coefficients and related statistics of the Cobb-Douglas production function for shrimp production are shown in Table 6.1.

**Table 6.1 Estimated Values of Coefficients and Related Statistics of Cobb- Douglas Production Function**

| Explanatory variables | Coefficient | Standard error | p- value |
|---|---|---|---|
| Intercept | 0.20 | 0.88 | 0.82 |
| Cost of human labor ($X_1$) | 0.42 | 0.02 | 0.00*** |
| Cost of fingerling ($X_2$) | 0.38 | 0.02 | 0.00*** |
| Cost of lime ($X_3$) | 0.01 | 0.06 | 0.86 |
| Cost of urea ($X_4$) | -0.02 | 0.08 | 0.79 |
| Cost of TSP ($X_5$) | -0.01 | 0.09 | 0.90 |
| Cost of feed ($X_6$) | 0.36 | 0.03 | 0.00*** |
| R2 | 0.89 | | |
| Adjusted $R^2$ | 0. 88 | | |
| Return to scale | 1.20 | | |
| F-value | 162.8005*** | | |

Source: Field survey, 2017.

Note: *** Significant at 1 percent level and NS: Not Significant

### 6.4 Interpretations of Results

**Cost of human labor ($X_1$):** Estimated coefficients of human labor were significant for shrimp farming. It implies that 1 percent increase in the cost of labor as additional expenditure, remaining other factors constant, would increase gross returns by 0.42 percent (Table 6.1).

**Cost of fingerling ($X_2$):** The estimated coefficient of shrimp fry was 0.38 and significant at 1 percent level for shrimp farming. It implies that 1 percent increase in the cost of shrimp fingerling, keeping other factors constant, would increase gross returns by 0.38 percent (Table 6.1).

**Cost of lime ($X_3$):** The regression coefficient of lime cost 0.01 was insignificant for shrimp farming. It implies that 1 percent increase in the cost of lime, keeping other factors constant, would increase gross returns by only 0.01 percent (Table 6.1).

**Cost of urea ($X_4$):** The urea used for shrimp farming. The regression coefficient of fertilizer cost was -0.02 and insignificant for shrimp farming. It indicates that 1 percent increase in cost of urea, remaining other factors constant, would decrease gross returns by 0.02 percent (Table 6.1).

**Cost of TSP ($X_5$):** The estimated coefficient of TSP for shrimp farming was -0.01 and insignificant. It indicates that 1 percent increase in the cost of TSP for shrimp farming, remaining other factors constant, would decrease gross returns by 0.01 percent (Table 6.1).

**Cost of feed ($X_6$):** The estimated coefficient of feed cost was 0.36 which was positive and significant at 1 percent level for shrimp farming. It indicates that 1 percent increase in the feed cost, keeping other factors constant, would increase gross returns by 0.36 percent (Table 6.1).

### 6.5 Coefficient of multiple determinations ($R^2$)

The values of the coefficient of multiple determination of shrimp farming was found to be 0.89 Which implied that about 89 percent of the total variation in the gross return could be explained by the included explanatory variables of the model. So we can say the goodness of fit of this regression model is better since $R^2$ indicates the goodness of fit of the regression model (Table 6.1).

### 6.6 Adjusted $R^2$

Here the term adjusted means adjusted for the degrees of freedom. The adjusted $R^2$ for shrimp farming was found to be 0.88 which indicated that about 88 percent of the variations of the output were explained by the explanatory variables included in the model (Table 6.1).

### 6.7 Returns to Scale in Shrimp Production

The summation of all the production coefficients of shrimp farming is equal to 1.20. This means that production function for shrimp farming exhibits increasing returns to scale. This means that, if all the variables specified in the model were increased by 1 percent, gross return would also be increased by 1.20 percent (Table 6.1).

### 6.8 F-value

The F-statistic was computed to denote the overall goodness of fit of any fitted model. The F-value for the shrimp farming was estimated at 162.8005 which were highly significant at 1 percent level. It means that the explanatory variables included in the model were important for explaining the variation in gross return of shrimp production (Table 6.1).

# CHAPTER VII
# CONSTRAINTS OF SHRIMP FARMING

## 7.1 Problem faced by the farmers in shrimp farming

Shrimp farmers were asked whether they faced any problem in shrimp farming. It was observed that the shrimp farmers faced a number of problems, which might have hindered rapid adoption of shrimp farming practices. An attempt has been made in this chapter to identify the major problems faced by the farmers in running the business of shrimp farming. Several rounds of discussion with the pond owners helped to identify the major problems facing the farmers for shrimp farming. These problems and constraints are broadly classified under four categories such as economic, marketing, technical and social. The specific problems which pervaded behind shrimp farming, arc discussed below:

### 7.1.1 Economic constraints

Economic problems of the farmers were related to financial difficulties such as lack of sufficient funds, complexity of credit system, high input price etc. problems aid constraints relating to economic aspects arc presented in Table 7.1.

#### 7.1.1.1 Lack of sufficient fund and complexity of credit system

Data presented in the Table 7.1 revealed that problems i.e. lack of capital ranked 1st with the mean of 4.0 and SD of 0. Regarding problems and constraints relating to economic aspects, respondents faced financial difficulties due to lack of sufficient fund for excavations of their ponds. Complexity of loan ranked 10th the mean of 0 and SD of 0 because farmers of the study area had very few knowledge on shrimp farming. On the other hand, shrimp farmers reported that they did not have adequate fund either to purchase various inputs (such as fingerlings, fish feed, fertilizer etc.) or for excavation of the pond. Shrimp farmers further reported that they were not interested to get loan from GOs and NGOs due to complex credit procedures. Lack of capital and complexity of loan the acute problem in shrimp farming, which was ranked as the $l^{st}$ and $10^{th}$ problem

respectively. To overcome this problem, simplification of credit system and availability of credit at lower interest rates are suggested.

**Table 7.1 Problems faced by the respondents according to their shrimp farming**

| Problems | Mean | SD | Rank |
|---|---|---|---|
| **Economic constraints** | | | |
| Lack of capital | 4.0 | 0 | 1 |
| High input price | 3.93 | 0.254 | 2 |
| Complexity of loan | 0 | 0 | 10 |
| **Marketing constraints** | | | |
| Lack of transportation | 1.36 | 0.842 | 7 |
| Price fluctuation | 3.89 | 0.312 | 3 |
| **Technical constraints** | | | |
| Lack of fingerlings | 3.64 | 0.541 | 4 |
| Diseases | 3.49 | 0.502 | 5 |
| Dry seasons | 3.2 | 0.423 | 6 |
| **Social constraints** | | | |
| Theft | 1.13 | 1.04 | 8 |
| Interference | 1.12 | 0.978 | 9 |

#### 7.1.1.2 High price of various inputs

High price of input ranked 2nd with the mean of 3.93 and SD of 0.254. Price of various inputs like price of rice bran, oil cake, urea, TSP and lime are important factors in production practices. If prices of these inputs remain reasonable than shrimp farmers can make use of these inputs properly, in the study area, farmers faced the problem, which was ranked as the 2nd mentioned high price of inputs as a major problem. The government should take measures for ensuring easy availability of inputs at reasonable prices.

### 7.1.2 Marketing constraints

Price fluctuation ranked 3rd with the mean of 3.89 and SD of 0.312. The prices of fishes fluctuate rapidly in the local market. Instability in prices was discoursing for the shrimp farmers as they were not getting fair prices due to instability in prices at local market. Shrimp farmers reported that instability of fish prices is one of the problems to them which was ranked as the 3rd problem (Table 7.1).

Lack of transportation ranked 7th with the mean of 1.36 and SD of 0.842. As shrimp is a perishable commodity, its marketing at proper time is very important. After harvests quick step should be taken to marketing shrimp. Shrimp farmers reported that they often were not able to market in a non-availability of easy transportation, which was ranked as the 7th (Table 7.1). Again to overcome these constraints, facilities such as storage and transportation should be developed in the areas so that the farmers can get fair prices of their product round the year.

### 7.1.3 Technical constraints

The important technical constraints faced by the farmers are non-availability of desired fingerlings at proper time, sudden outbreak of fish parasites or diseases and insufficient water in dry seasons.

#### 7.1.3.1 Non-availability of desired fingerlings at proper time

Lack of fingerlings ranked 4th with the mean of 3.64 and SD of 0.541. Fingerlings are one of the most important inputs. Shrimp production depends largely upon timely availability of desired good and healthy fingerlings. In the study area, shrimp farmers opined that they did not get sufficient desired healthy fingerlings at proper time which was ranked as the 4th problem (Table 7.1). To overcome this problem, farmers should contact with nearby seed multiplication farmers and it is better not to purchase fingerlings from local vendors.

#### 7.1.3.2 Sudden outbreak of diseases and fish parasites

Diseases ranked 5th with the mean of 3.49 and SD of 0.502.During the sudden outbreak of diseases and shrimp parasites, farmers could not contact the respective fisheries officer or even extension worker to check morality immediately. Lack of knowledge to identify shrimp diseases and its control or prevent its rapid spread was thus a problem for the farmers. Shrimp farmers faced sudden attack of fish parasites or diseases causing shrimp death in the pond as one of the major problem. To overcome the problem insurance policy for pond fish culture should be provided to the farmers. On the other hand, samples of disease attacked fishes should be provided to the prefect authority or upazila fishery officer so that they could give proper suggestions to prevent further attack of such diseases and parasites.

#### 7.1.3.3 Insufficient water in drv seasons

Dry seasons ranked 6th with the mean of 3.2 and SD of 0.423. Insufficient water in the dry seasons (December to March) is a serious problem, which can damage the total production if the pond water goes below its minimum level. In the study areas this problem which was ranked as the 6th indicate that insufficient water in dry seasons hampered their shrimp production (Table 7.1). Supplementary water supply from the external source is the best solution, but it is not possible for all farmers due to fund shortage or lack of its available sources. It is therefore suggested to use organic fertilizer in pond bottom after drying the pond and that will improve water quality.

### 7.1.4 Social constraints

The related social problems were the theft of shrimp from the ponds and social interference.

#### 7.1.4.1 Theft of shrimp from ponds

Theft of shrimp from ponds ranked 8th with the mean of 1.13 and SD of 1.04. Theft of shrimp from the pond was considered as one of the important constraint of shrimp farming. During the present investigation this problem which was ranked 8$^{th}$ farmers

(Table 7.1). This problem can be minimized by educating the local people about social consciousness and implementing strictly social and the relevant government laws.

#### 7.1.4.2 Interference by influential persons

Interference by influential persons ranked 9th with the mean of 1.12 and SD of 0.978. This type of people always likes to catch shrimp from the pond without payment. To overcome this problem shrimp farming may be undertaken on a cooperative basis to strengthen unity among the farmers.

### 7.2 Suggestion to overcome the shrimp production problems

The farmers were asked to comment on the solutions of the problem they faced. The sample farmers suggested some solutions to minimize the above mentioned problems. They furnished their opinion, which was accumulated below by the researcher (Table 7.2) according to their rank order.

**Table 7.2 Distribution of the suggestion given by the respondents according to their rank order**

| Suggestion | Mean | Rank |
|---|---|---|
| Arrange spot training | 1.17 | 5 |
| Adequate loan supply | 1.43 | 1 |
| Provide more technical support | 1.24 | 3 |
| Inputs availability | 1.21 | 4 |
| Support them for marketing their fish | 1.00 | 7 |
| Deliver loan at proper time | 1.09 | 6 |
| Deliver loan as inputs | 1.26 | 2 |

**Source: Field survey, 2017.**

Table 7.2 indicates that adequate loan supply and deliver loan as inputs was the first and second suggestion in case of shrimp cultivation. GOs and NGOs should help them to provide technical support was suggested as the 3rd and 4th measures for shrimp farmers, respectively. Inputs availability was suggested as the 4th for shrimp farmers.

### 7.3 Concluding Remarks

The above mentioned problems and constraints, of course, are interrelated with one another and hence, need to be removed comprehensively through an integrated programme for the overall development of shrimp farming. Problems faced by the farmers were ranked on the basis of corresponding percentages. Most of the farmers were reported that lack of capital was the main constraint for their shrimp production. And this problem occupies first position according to its ranking. But there was some inconsistency of their answer. Hence researcher opined that attack of shrimp diseases and the insufficient water in the dry season were the main constraints hampering shrimp production. Government is already given subsidy on these inputs. So, price of input was not a severe problem for the farmers.

# CHAPTER VIII
# SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

## 8.1 Summary

The study was mainly based on primary data, which were collected by the researcher himself through interviewing the sample farmers. A total of 120 year round shrimp farmers were selected from four upazila namely, Bagerhat Sadar, and Rampal upazila of Bagerhat district and Paikgacha Upazila, Dumuria Upazila of Khulna district. Survey method was followed to collect production related data while, simple random sampling technique was used to select the shrimp farmers. Tabular as well as statistical technique was followed to fulfil the objectives of the study. Considering the present study, following specific objectives were formulated:

1. To delineate the socio-economic profile of shrimp cultivators in the study area;
2. To examine the factors influencing the shrimp cultivation in the study area; and
3. To identify the constraints faced by smallholder cultivators in the time of shrimp cultivation and to recommend some policy guidelines.

With respect to socioeconomic features of the sample farmers, the findings revealed that none of the farmers had the age below 15 years. The shrimp producing farmers were classified into three age groups: up to 20-30 years, 31-45 years and above 45. Out of the total sample farmers 20 percent belonged to the age group of 20-30 years, 48.3 percent belonged to the age group of 31-45 years and 31.7 percent fell into the age group of above 45. Out of 120 sample farmers, 10 percent farmers had illiterate, 26.7 percent farmers had completed primary education, 40.8 percent farmers had completed secondary level education, and 22.5 percent farmers had completed their above secondary level education. Data showed that the highest proportion 67.5 percent of the farmers fell in the medium family of 4-6 members, while 26.7 percent of them fell in the small family size of 2-3 members and 5.8 percent fell in the large family size of above 6 members. About 2.5 percent farmers were taken loan from Banks, 20 percent farmers were taken credit from NGOs as reported by the sample farmers, 77.5 percent farmers were used their own

funding. About 50 percent of the shrimp producing farmers were earned Tk. 100,000 to 200,000 per year, 15.8 percent of the farmers were earned Tk. less than 100,000 per year and 34.2 percent farmers were earned Tk. above 200,000 per year. Data revealed that the majority (60.2%) of the farmers had medium experience as compared to (15.8%) and (20.8%) having high and low experience respectively. Data revealed that the majority (67.5%) of the farmers had adopter and (32.5%) had non-adopter respectively. Data indicated that the majority (53.3%) of the farmers had low training on shrimp cultivation that comprised by 36.7 percent and 4.2 percent farmers have low training and medium training on shrimp cultivation. Only (5.8%) of the respondents had high training on shrimp cultivation. Data revealed that 73.3 percent, 25.9 percent and 0.8 percent of the farmers were small land, medium land and high land respectively. The data indicated that the majority (50.8%) of the farmers had no organizational participation and 49.2 percent farmers have organizational participation.

Per hectare human labour cost in shrimp farm was Tk. 34000. Per hectare cost of fingerling was Tk. 22085. In the study area, it was observed that the cost of lime, Urea, and TSP were Tk. 2250, Tk.1479 and Tk.1612, respectively. In shrimp farming, manure per hectare used was calculated at Tk. 963. Per hectare feed cost was Tk. 32040. Average per hectare costs of saline water uplifting were calculated at Tk. 11690. The Ponds repairing cost was estimated at Tk. 5343 per hectare. Per hectare Land use cost amounted to Tk.38361. The per hectare average construction of water supplying canal and housing cost and guard shed were calculated at Tk. 6578 Interest on operating capital amounted to Tk. 4665, total gross return from shrimp production was Tk. 386076. Per hectare return from shrimp farming was Tk. 231468. Per hectare gross margin of shrimp farming were Tk. 273269. Benefit cost ratio of shrimp farming were 2.497 in full cost basis (including all variable and fixed cost basis). Benefit cost ratio were 2.497 in cash cost basis (including only variable cost).

In this study, Cobb-Douglas production function model was used to determine the effects of key variable inputs. The most important six explanatory variables were included in the model to explain the gross income or return of shrimp farming. Most of the variables in the production function were significant in explaining the gross return except the negative

and insignificant effect of urea and TSP. The coefficient with expected sign indicates the selected inputs contributed positively to the gross return. The values of the coefficient of multiple determination of shrimp farming was 0.88 which implied that about 88 percent of the total variation in the gross return could be explained by the included explanatory variables of the model. Production function for shrimp farming exhibits increasing returns to scale (1.20). This means that, if all the variables specified in the model were increased by 1 percent, gross return would also increase by 1.20 percent. The F-value for the shrimp farming was 162.8005 which were highly significant at 1 percent level.

Four categories of problems and constraints in economic, marketing, technical and social constraints have been identified in the study area. The economic problems lack of capital, high price of input etc. Marketing constraints included price fluctuation and lack of transportation. Technical constraints were related to production techniques and technologies, such as lack of fingerlings, diseases etc. Some social problems related to fish production also emerged such as theft and Interface by others.

**8.2 Conclusions**

i. Near about 36.7% farmers were illiterate to primary level of education in this study area. In shrimp farming farmer with more education increased the capabilities to reduce different problems about shrimp farming. Education enhances the ability of the farmers to face the problems in shrimp farming and reduce it at short time than others.

ii. The results indicate that more than half (53.3 percent) of the respondents had medium training in shrimp farming. The results might be no good scenario to taking shrimp farming. However, still there is a need to take initiative to improve the training facilities of the farmers with various organization. Training received helps the respondents in different farming activities. Therefore, it can be concluded that more the training on farming by the respondents, higher would be shrimp farming.

iii. Organizational participation can play a vital role on shrimp farming. Organizational participation helps the respondents in different farming activities.

Therefore, it can be concluded that more the organizational participation on farming by the respondents, higher would be shrimp farming.

iv. Scientific method of cultivation should be introduced to increase production. The farmers should be provided with training, adequate services, information and necessary facilities to cope with new and changed situation.

v. Though the government is already given subsidy on fertilizer like urea and other inputs required for shrimp farming but fair prices of inputs should be ensured so that the farmers can get the inputs at a reasonable price.

vi. Availability of saline water is an important factor for shrimp production. Government can solve this problem by keeping the diesel price at a reasonable level so that farmers can supply sufficient water in the shrimp farm in dry season.

vii. Physiological and soil related research should be conducted to identify the real causes of shrimp viral diseases and its outbreak. To overcome this problem, scientific use of chemicals should be ensured and supplementary supply of artificial irrigation should be arranged in dry season.

viii. Bank loan and institutional credit should be made available on easy term and conditions to the shrimp farmers.

ix. Application of feed and fertilizer in relation to stocking density needed to increase the production of shrimp. Fair prices of outputs should be ensured.

x. Attention should be given to improve transportation and marketing facilities of the study area.

xi. Law and order enforcing agencies should be vigilant in the study area to minimize the social tension and improve the situation of shrimp farming areas.

### 8.3 Recommendations

The following recommendations are presented for successful shrimp farming development in the study area.

- Bangladesh government through Bureau of Non-formal Education (BNFE) and NGOs can take necessary steps to increase farmers' primary level of education through non-formal education (adult education) and regular farmers' training, workshop; rally needs to be organized to broaden their knowledge.

- The study indicated that training on shrimp farming can play a vital role. So extension agencies should arrange more training to utilize farm properly.
- The study indicated that majority (50.8 percent) of the farmers had no organizational participation. So in order to increase organizational participation of farmers, different cultural and others organization should be setup.
- Majority of the respondents of the study area mentioned about a problem of having lack of capital. In fact, it was the most prevalent problem. Respective authority may take necessary steps to supply capital through disbursement of loan.
- Higher input price was also mentioned as a problem by a significant portion of the respondent. Respective authority may take initiatives to ensure the supply of inputs in a lower price.
- Respondent also mentioned about price fluctuation of the shrimp. Respective authority may also take some corrective measures to overcome those problems.
- Lack of fingerling was also significant problems which have to be addressed by the authority to overcome the situations and further improvement.
- Prevalence of disease was also a major problem. So corrective actions should be taken to ensure the supply of disease free fingerlings. Preventive measure should also be taken.
- Extensive training is a must for addressing these problems.

### 8.4 Limitations of the Study

It is very common that there is no study without some limitations. The study I have made is of great importance and require me huge work and time. During preparing this paper, I have tried my best. But while conducting this study I had to face a number of problems. The problems were-

- Most of the data collected through interview of the farmers so sometimes they were not well-cooperated with the interviewer.
- The information was collected mostly through the memories of the respondents which were not always correct.
- Lack of experience and time hampered the in-depth of the study.

- Secondary data are extremely difficult to collect and may be contradictory. All the information is not based on valid data.

### 8.5 Avenues for Further Research

The limitation of study indicated some new avenues of research which might be undertaken in the context of Bangladesh. These are discusses below.

- Similar study considering a large number of samples could be taken.
- As the present study covered only four upazila of Bagerhat and Khulna district, a similar study could be conducted covering various geographical regions of the country and made a cross country comparisons of shrimp farming.

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