PROFITABILITY ANALYSIS OF TILAPIA FISH FARMERS IN SOME SELECTED AREAS OF CUMILLA DISTRICT IN BANGLADESH

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This is to certify that the research work entitled, **'PROFITABILITY ANALYSIS OF TILAPIA FISH FARMERS IN SOME SELECTED AREAS OF CUMILLA DISTRICT IN BANGLADESH'** conducted by **NARGIS AKTER MUKTA**, Registration No. **11-04562 (July-December/2018)** under my supervision and guidance in the partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (M.S.) IN DEVELOPMENT AND POVERTY STUDIES** in the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka 1207, Bangladesh. No part of this thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information received during this study has been dully acknowledged by her.

Dated: December, 2018

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TO

MY BELOVED PARENTS

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-The Author

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ABSTRACT

This study was conducted to find out the socio-economic status and the financial profitability of Tilapia farming of Bangladesh in Cumilla, district in 2019 following stratified random sampling technique. Data were collected from a total of 75 samples of Tilapia farmers. Simple profitability analysis of aquaculture production was measured in terms of gross return, gross margin, net return and BCR. Total variable cost was average variable cost for Tilapia fish farm was Tk 2,347,514.30 per hectare for tilapia fish farm where average water cleaning cost, fingerling cost, feed cost, temporary human labour cost, and miscellaneous cost were included. Again total fixed cost was 304,102.35 Tk/hectare for Tilapia fish farm where average land use cost, cost of equipment, permanent labour cost were included. Considering all the sample farmers, per hectare gross return of Tilapia Tk. 1,777,204.70. Per hectare net return was estimated at Tk. 329,618.29. Here, BCR was calculated at 1.2434 for Tilapia farm considering all the sample farmers. Tilapia fish farming is a profitable as for higher productivity. The farmers need to be very conscious about the inputs application, and this has to be made in the light of the inputs prices paid as well as the price of Tilapia received by the farmers.

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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Bangladesh is considered one of the most suitable regions for fisheries in the world, with the world's largest flooded wetland and the third largest aquatic biodiversity in Asia after China and India (Shamsuzzaman *et al*., 2017). Aquaculture is the farming of aquatic animals or plants, including breeding, raising and harvesting in all types of water environments in controlled conditions. It is used to produce food and chemical products, restore and create healthier habitats and rebuild threatened or endangered species populations.

Bangladesh is considered one of the most suitable countries in the world for small-scale fresh water rural aquaculture, because of its agro climatic conditions. Development of aquaculture has generated considerable animal protein supply, food sufficiency, creating employment opportunity, foreign exchange earnings, improvement of standard of living, and finally reducing poverty in Bangladesh through the production and marketing of fish and associated activities. Fish farming has been proved a profitable and attractive business comparing to the other agricultural cultivations. Therefore, many rice farmers are converting their fields into fish culture ponds (Islam *et al*., 2002; Islam *et al*., 2017).

At present the majority of the world’s aquaculture fish are produced in Asian countries which represent about half of worlds exports of fish and fishery products by value and about 60% in terms of quantity (FAO, 2012). The top 25 aquaculture producing countries accounted for about 96% of total world production in 2014, of which the first major 5 producers were Asian countries namely: China, Indonesia, India, Viet Nam and Bangladesh. Bangladesh is now ranked 5th in world aquaculture production (FAOSTAT, 2016). Aquaculture practice has the potentiality to achieve self-sufficiency in the food sector and to reduce poverty in Bangladesh (Al-Amin *et al*., 2012).

The fisheries production in the world has increased has outpaced the protein demand of increasing population. The share of world fish production utilized for direct human consumption has increased significantly in recent decades, up from 67% in the 1960s to 87% in 2014, 46% (67 million tons) of the fish for direct human consumption was in the form of live, fresh and chilled fish. The rest of the production for edible purposes was in different purposes was in different processed forms, with about 12% (17 million tons) in dried, salted, smoked or other cured forms, 13% (19 million tons) in prepared and preserved forms, and 30% (about 44 million tons) in frozen form. Apart from human consumption, about 57 million people were engaged in the fisheries sector (FAO, 2016). Moreover, the international trade of fish contributes to employment generation, food supply, income economic growth and development.

Amongst the world, China is the main fish producer and largest exporter of fish and fishery products. Fishery production contributed significantly to China's dietary animal protein (FAO, 2013). Norway, the second major exporter, posted record export values in 2015. Bangladesh is blessed with huge inland water bodies like pond, haor, baor and lakes (baors) are 5,488 ha (DoF, 2015). Among various segments of the fisheries sub-sector, the inland fisheries has experienced the fastest growth, with the establishment of new technologies, species, and intensification and improvement of farming. Bangladesh is one of the world's leading fish producing countries with a total production of 41.34 lakh MT, where aquaculture contributes 56.44% to total production (DoF, 2018). During last 10 years average growth performance of this sector is almost 5.43%. Government is trying to sustain this growth performance, which eventually ensures to achieve the projected production target of 4.55 million MT by 2020-21. Bangladesh is ranked 5th in world fish production, where the growth performance is of 8.2%. Aquaculture and fisheries together contribute about 25.30% of agricultural GDP and 3.57% to the national GDP (FAO, 2016). More than 11% of total population of Bangladesh are engaged with this sector on full time and part time basis for their livelihoods (DoF, 2018).

1.2 Importance of Fisheries Sector in the Bangladesh Economy

Bangladesh is one of the world's leading fish producing countries with a total production of 42.77 lakh MT in FY 2017-18, where aquaculture production contributes 56.24 percent of the total fish production. This sector is contributing significantly in food security through providing safe and quality animal protein. More than 11% of the total population of Bangladesh is engaged with this sector in full time and part time basis for their livelihoods. Bangladesh is blessed with huge open water resources with a wide range of aquatic diversity. Biodiversity is also enriched, comprising almost 260 freshwater fish species (DoF, 2018). Average growth performance of this sector is 5.26 percent for last 10 years. National fish hilsa as a single species has been making the highest contribution (around 12 percent) to the country's total fish production. Aquaculture shows a sturdy and consistent growth, average growth rate is almost 10 percent during the same timeframe. It is believed that if the increasing trend of fish production continues, it will be possible to achieve the projected production target of 45.52 lakh MT by 2021 in conformity with the targets of Vision-2021 of the present Government.

After 46 years of independence, Bangladesh becomes a self-sufficient country in fish production, with a per capita fish consumption of 62.58 g/day against set target of 60 g/day (DoF, 2018). This sector is contributing significantly in food and nutrition security through consistently providing safer and good quality animal protein, almost 60 percent of total animal protein supply (DoF, 2018). Bangladesh earns a considerable amount of foreign currencies by exporting fish, shrimps and other fishery products. In comparison to 2008-09 FY production (10.63 lakh MT), the aquaculture production became more than double in 2017-18 FY. Bangladesh earns a considerable amount of foreign currencies by exporting fish, shrimps and other fishery products. This sector also has high potential for the perspective of economic development of the country. In 2017-18, the country earns BDT 430,994.00 lakh by exporting almost 68.94 thousand MT of fish and fishery products (DoF, 2018).

Table 1.1 Sector Wise Annual Fish Production in Inland Marine Fisheries, 2017-2018

Sector of Fisheries	Water Area (Hectare)	Production (Metric Ton)
Inland Fisheries		
Inland Open Water (Capture)		
1. River and Estuary	853,863	320,598
2. Sundarbans	177,700	18,225
3. Beel	114,161	99,197
4. Kaptai Lake	68,800	10,152
5. Flood Plain	2,712,618	768,367
Inland Closed Water (Culture)		
6. Pond	391,753	1,900,298
7. Seasonal Cultured Water Body	1,366,622	216,353
8. Baor	5,488	8,072
9. Shrimp/Prawn Farm	258,681	254,367
10. Crab*	9,854	11,787
11. Pen Culture	5,294	11,015
12. Cage Culture**	1.29 lakh cu. meter	3,523
13. Industrial (Trawl)	--	120,087
14. Artisanal	--	534,600

Source: Fisheries Statistical Yearbook, 2017-2018

* Crab area is included with Shrimp far area.

** Cage culture area is 128,945 cubic meter (12.89 ha). This area is included with River and Estuary area.

1.3 Fisheries Sub-sector

Fisheries are two types.

a) Inland fisheries

b) Marine fisheries

Fisheries sector are mainly divided into two sub sectors. Which are-

a) Capture fisheries

b) Culture fisheries

Besides this culture fisheries includes

a) Fresh water aquaculture

b) Coastal aquaculture

Bangladesh, with its rich inland waters and river systems, has significant capture fishery and aquaculture potential. The favorable geographic position of Bangladesh comes with a large number of aquatic species and provides plenty of resources to support fisheries potential. Fish is a popular complement to rice in the national diet, giving rise to the adage Maache-Bhate Bangali ("a Bengali is made of fish and rice") (Ghose, 2014). According to the report from aquaculture industry, Bangladesh, located in south Asia, has hundreds of crisscross river system, spreading all over the rivers, canal, depression, pond and lake, owing inland water source up to 4.7 million hectare. Its unique climate can provide condition that is abound in gifts of nature for aquaculture and fishing industry resource administration.

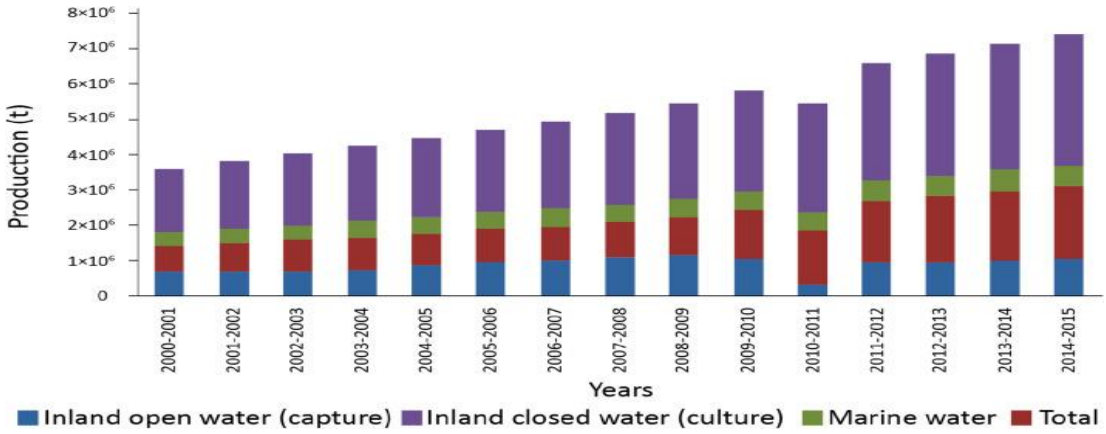

Figure 1.1 Trends of Sector-wise Fish Production Scenario in Bangladesh

Figure 1.1 showed that, production of fish production is increasing over the year in Bangladesh (Fisheries Statistical Yearbook, 2017-2018). While production of marine and capture has stagnated. Inland open waters (capture) was higher than other two sectors. But with the changes of time, the fish productivity turn into a linearly higher increasing trend than marine and inland capture.

1.4 Fish as Human Food

Fish is a high quality food item and about 80 percent of rural people of Bangladesh suffer from malnutrition and low protein intake. Fish alone shares about 60 percent of per capita protein intake (DoF, 2018) and contributes about 74 percent of animal protein (Haque, 2000). Fish muscle contains almost all the essential nutrients required for human health. Water is the major constituent of fish which varies between 60-90%. Also fish contains proteins (7%), lipid (2-65%), ash (4-2%), vitamins (both fat and water soluble), and considerable amount of carbohydrates and non-protein nitrogenous compounds (free amino acids, nucleotides, peptides etc.) (Akhter, 2009). Fish is considered as one of the most delicious food over the world. Besides protein, human body need various essential nutrition for growth and good living. Omega-3 fatty acids is responsible for brain development, control some arthritis, diabetics etc. Night blindness can be prevented by vitamin-A. So, fish can play an important role as good source of high quality protein and thus can make an outstanding contribution to the nutritional contribution in Bangladesh (Rahman, 2009).

Aquaculture is also considered to have the potential of food security in Bangladesh (Jahan *et al*., 2010). In inland aquaculture, particularly of Tilapia aquaculture in Bangladesh, as there is no any legal aquaculture legislation in place for land use, consequences could be the same as the of shrimp farming in coastal areas. Therefore, the overall environmental impact for Tilapia farming became an important issue deserves to be addressed thoroughly. Fish play an important role in the Bangladeshi diet, contributing 60% of national animal protein, representing a crucial source of micro-nutrients (Bolton *et al*., 2011).

1.5 Economic Importance

Bangladesh is a densely populated country in the world and it is very difficult to meet the food requirement of its population. The fisheries sector has significant contribution in the economy of Bangladesh. Mostly, people in the country have fish with rice for most of their meal and fish ranks as the second staple in their diet. In other words, agriculture sector plays a vital role in economic development of the country where socio-cultural and economic life is largely influenced by fisheries sector.

1.6 Access to Finance

Although aquaculture in Bangladesh has grown significantly as an industry over the years, its full potential is yet to be recognized with proper attention. Access to institutional finance remains a major challenge for many of the fish farmers, especially the small-scale farmers. Lack of convenient loan schemes and limited availability of information about those are hindering a smooth development of culture fisheries in the country. Besides, financial institutions and banks are often unaware of the sector specific needs of the rural aquaculture value chain actors and relevant SMEs to offer their best.

1.7 Importance in Employment Generation

Aquaculture contributes to the livelihoods and employment of millions of rural and urban poor in Bangladesh. Employment creation have been estimated that about 12 million rural people are involved in subsistence farming of fish. As an economic activity, fisheries ranks second to agriculture in terms of providing livelihood to an estimated 1.3 million of Bangladeshi population in full time and substantial livelihood support to 12 million part time fisherman (Akhter, 2009).

Women in Bangladesh showed numerous examples of being competent in adopting aquaculture technologies, despite the fact that their contribution and skills in fish culture were not adequately recognized and remained poorly addressed. The partaking of women in different aspects of household activities as well as aquaculture practices is strongly affected by social, cultural and

religious norms such as seclusion, isolation and the veiling of women in public. These restrictions and the gender division of labor created the custom of a segregated and restricted role for women, and forced women's mobility and participation in the activities related to aquaculture. The present study revealed the similar situation, where female involvement in the culture practices of Tilapia was limited. In the field survey, it was found that around one fourth of the farmers engage their female family members in cultivation. However, most of the women who are engaged in fish farming are not paid for their work since it is regarded as a household work.

1.8 Tilapia Fish Culture in Bangladesh

With increasing popularity among consumers, tilapia has become the world's second most important cultured fish after carp (ADB, 2005). There is a long history of tilapia farming in Bangladesh. At first the Mozambique tilapia (*Oreochromis mossambicus*) was introduced to Bangladesh from Thailand in 1954 (Rahman, 1985). However, this species was not widely accepted for aquaculture because of its early maturation and prolific breeding leading to overcrowded ponds. To overcome this problem the Chitralada strain of Nile tilapia (*O. niloticus*) was introduced to Bangladesh from Thailand by UNICEF in 1974 (ADB, 2005).

Nevertheless, Nile tilapia farming was slow to develop as most farmers remained more interested in carp. Gradually, the red tilapia (hybrid of *O. mossambicus* × *O. niloticus*) was imported to Bangladesh from Thailand. The Bangladesh Fisheries Research Institute (BFRI) reintroduced Nile tilapia and Red tilapia from Thailand in 1987 and 1988, respectively (Gupta *et al*., 1992). Thereafter, Genetically Improved Farmed Tilapia (GIFT) was introduced to Bangladesh by ICLARM (International Centre for Living Aquatic Resources Management, now known as the World Fish Centre) and BFRI in 1994. The performance of the GIFT strain was found to be significantly superior to that of other tilapia in many respects (Hussain, 2009).

Technology was developed to produce sex reversed male tilapia (i.e. monosex tilapia), to avoid the unwanted reproduction and benefit from the faster growth rate of males compared to females. Since 2000, interest in tilapia farming has grown because of its observed success in other Asian producers and increasing consumer acceptance both within Bangladesh and internationally (Ahmed, 2009).

In recent years, the culture of tilapia has been progressing well because of consumer acceptance as tilapia is often treated as 'aquatic chicken' in Asia. In respect to different tilapia species, the following sections describe tilapia (*Oreochromi*s sp) culture with its production, distribution and marketing activities. Tilapia generally grows in rivers, haor, baor, beels and flood plains with natural care and culture of Tilapia would be successful and profitable in Bangladesh due to its fast growth, wider tolerance in water quality fluctuation, disease resistance as well as high demand. Currently Bangladesh ranks 4th in tilapia production in the world and 3rd in Asia (DoF, 2018).

Table 1.2 Tilapia (Species/Group wise) Annual Fish Production in Inland and Marine Fisheries, 2017-18 (Unit: Metric Ton)

SL No.	Species/Group	Inland Fisheries	Marine Fisheries	Total	Percentage (%)
1.	Tilapia	381,215	0	381,215	8.91%
Total		381,215	0	381,215	8.91%

Source: Fisheries Statistical Yearbook, 2017-2018

Table 1.2 indicated that the total contribution of Tilapia fish in the overall inland production of fishes. Total inland Tilapia fish production is about 381,215 metric ton estimated by Directorate of fisheries (DoF) in FY 2017-2018. That species grow at 8.91% in FY 2017-2018. The Table 1.3 explains the comparative production practices of Tilapia fish in pond fish production is 316,283 metric ton calculated by Directorate of Fisheries for FY 2017-2018. The Table 1.3 shows the total contribution of the selected study area production of Tilapia fish per year and pond fish production was maximum comparative to other levels of fish production which is 213,664 metric ton for the FY 2017-2018.

Table 1.3 Tilapia (Species/Group wise) Annual Fish Production in Inland Water, 2017-2018 (Unit: Metric Ton)

Sl No.	Speies	River	Sundabun	Beel	Kaptai Lake	Flood plain	Pond	Seasonal cultured water body	Baor/ Prawn farm	Shrimp/Prawn farm	Pen culture	Case culture	Total	%
1.	Tilapia	0	0	1479	10	0	316,283	21,986	312	38,465	2,680	3523	384,737	10.62

Source: Fisheries Statistical Yearbook, 2017-2018

Table 1.4 District Wise (Cumilla) Annual Fish Production in Inland Water, 2017-2018 (Unit: Metric Ton)

District	River	Sundarban	Beel	Kaptai Lake	Flood Plain	Pond	Seasonal cultured Water Body	Baor/Prawn farm	Shrimp	Pen Culture	Cage Culture	Total
Cumilla	961	0	274	0	70,699	108,262	32,993	0	173	59.7	242	213,664

Source: Fisheries Statistical Yearbook, 2017-2018

1.9 Justification of the Study

Fish production of Bangladesh can help to meet the increased domestic demand in Bangladesh for food and nutrition. In order to meet the shortage of fish the department of fisheries (DoF) and some non-government organizations (NGOs) are encouraging people to increase fish production in their surrounding and nearby water areas. Profitable pond fish production depends on the application of its input management and technologies. Now a days, fish producers of our country understood the positive effect of scientific aquaculture and they had already adopted a number of improved technologies for increasing fish production through pond fish culture.

During this rapid growth of Tilapia fish has been occurred due to its popularity to the pond farmers for possessing hardy characteristics, higher survival rates, fast growth, and ability to survive at high stocking densities. The species has also proven popular among consumers due to its low market value, making it one of the most important cultured species, particularly among the poor in urban areas (World Fish Center, 2011). It is therefore an important issue of addressing Tilapia as single species aquaculture being recognized as “Tilapia aquaculture” in Bangladesh and here its culture, production, distribution and marketing activities are discussed.

Cumilla is one of the main tilapia producing area of Bangladesh due to the climatic and edaphic condition. Production of tilapia is increasing rapidly because of commercial tilapia farming. Commercial farming mostly depends on inputs application. Feed is the main input of aquaculture farming but the price of feed is increasing sharply. Increasing price may affect the profitability of tilapia farming. In addition, productivity of tilapia may be affected by inputs used in production and socio-economic characteristics of farmers. Moreover, tilapia farmers are facing different constraints in the study area. Therefore, this study will help to increase tilapia productivity and profitability of farmers in Cumilla district of Bangladesh.

1.10 Objectives of the Study

The study consists of the culture of high value fish species of Tilapia fish with the following objectives:

(i) To assess the socio-economic characteristics of Tilapia fish farmers in the study area.

(ii) To find out the profitability of total production of tilapia fish farmers in the study area.

(iii) To identify the problems of Tilapia fish farmers in the study area.

1.11 Outline of the Study

This study is organized into seven chapters. It starts by looking at the objective of the study. **Chapter-1** deals with a brief introduction of fisheries sector and Tilapia fish farming; **Chapter 2** represents the literature review; **Chapter 3** discussed the methodology of the study; **Chapter 4** presented the socio-economic character of sample farmers; in **Chapter 5** profitability of Tilapia fish culture are presented; **Chapter 6** stated the problem facing in Tilapia fish farming; and in **Chapter 7** summary, conclusion, policy recommendation are presented in.

Chapter 2
Review of Literature

CHAPTER 2

REVIEW OF LITERATURE

Review of literature gives the clear and concise direction of the researcher for conducting the experiment. In this chapter, review of literatures relevant to the objectives of this study was presented. This was mainly concerned with 'adoption of modern technology'. There was serious dearth of literature with respect to research studies on this aspect. So the directly related literatures were not readily available for this study. Although a large number of researchers have been done in the fishery sector, it was found that only a few limited number of works conducted in Bangladesh related to this research work undertaken. However, the most common and relevant studies conducted related to profitability analysis in the recent past are reviewed in this chapter are presented below-

Ferdoushi *et al*. (2019) conducted an experiment to assess the cost and return from tilapia fish farming from the selected farmers of Dinajpur districts. The results from the survey revealed that both the tilapia monoculture and polyculture farming were profitable. However, the average total cost per hectare per production period was found higher (Tk. 332,712.08) in tilapia monoculture than tilapia culture with carps (Tk. 241,722.34). Moreover, the net margin was also found higher in tilapia monoculture with benefit cost ratio 1.51, whereas, the benefit cost ratio in polyculture farming was 1.34.

Ebukiba *et al*. (2019) carried out an experiment to study evaluates economic analysis of cat Fish Production in Karu local government area of Nasarawa State, Nigeria. The result showed that (35%) of the sampled fish farmers fall within the age bracket of 21-30 years, and 31- 40 years, respectively and the average age of the sampled farmers was 41 years; The average farming experience of the sampled farmers was 8 years. Also 55% percent of the respondents depend on borehole for source of water while (5%) depend directly

on either stream or river as their major source of water. In terms of holding/rearing structure, 45% percent of the sampled respondents used concrete pond only, while (30%) of the respondents used both concrete and earthen ponds, 25% percent of the respondents used earthen pond only. The result of the profitability analysis shows that a total average cost (TAC) of N 919,667.6 was incurred by the sampled fish farmers per cropping season while the total revenue (TR) of N 1,296,894.00 was realized with a returning gross margin (GM) of N 309,909.3 in the study area and the rate of return on investment realized was 31% which shows that for every N 1.00 invested, 31 kobo is gained on investment by the respondents. This indicates that fish farming is a profitable venture in the study area. Despite the profitability of fish production in the study area farmers encountered production constraints such as preservation/storage and processing facilities, inadequate motivation from extension officers lack of capital, lack and high cost of feeds, market fluctuation, source of water, fingerlings and technical know-how were identified as major constraint of fish production in the study area. The study recommends that provision should be made for trained extension agents to create awareness about fish production, capital, and source of water, fingerlings and subsidized fish feed.

Shawon *et al.* (2018) conducted a study on the socio-economic status and financial profitability of small-scale shrimp farming in selected area of Khulna district coastal areas of Bangladesh. The findings of the study revealed that small scale shrimp farming was commercially profitable but it could be more profitable if they got proper facilities like large farmer. Therefore, it can be concluded that for the enhancing of shrimp export, emphasis should be given on small scale shrimp farming. In economic analysis they found benefit cost ratio and net profit margin were more than one and this indicated that small scale shrimp farming was commercially profitable.

Busari (2018) carried out an economic analysis of homestead aquaculture in Olorunda local government area, Osun State, Nigeria. The results of descriptive

analysis showed that the aquaculture farmers were middle-aged, small holder catfish farmers, married males, with tertiary education. The indicators used to measure the economic performance were gross margin (GM) net farm income (NFI), rate of return on investment (RRI) and operating profit margin ratio (OPMR). The result revealed that GM and NFI were N 475,342.51 and N 468,451.18 respectively. The rate of return on investment was 71.02% showing that homestead fish farming is a profitable venture in the study area. Results of regression analysis showed that the cost of fingerlings and pond maintenance were significant determinants of gross margin from homestead aquaculture production in the study area. The study concluded that although homestead aquaculture is a profitable venture in the study area, there is still the need for the farmers to increase their scale of production in order to maximize their gross margin.

Sharma *et al*. (2018) conducted an experiment to analyze the economics of fish production at Chitwan District of Nepal. Three study sites: East, West and South part of Chitwan were selected purposively. Descriptive statistics and extended Cobb Douglas production function was used to accomplish the study objectives for which MS-Excel and SPSS 16 were used. The B/C ratio is obtained dividing the gross return by total variable cost incurred. The total cost of production per ha of the pond area was Rs. 743,798 per year with 79 and 21 percent variable and fixed cost components, respectively. Feed cost (28%) was largest cost item followed by cost for labour (25%), fingerlings (10%), maintenance (6%), manure cum fertilizers (5%), fuel cum energy (3%) and limestone and others (2%). The average gross return and net profit realized per ha were Rs. 1,223,934 and Rs. 480,135 respectively. The cost, return and profit were calculated to be highest for east Chitwan with highest B/C ratio followed by west Chitwan and south Chitwan. The B/C ratio for the district was found to be 1.63. The return to scale was found to be decreasing with value of 0.654 indicating that 1 percent increment in all the inputs included in the function will increase income by 0.654 percent. Production function analysis, including five variables, showed

significant effect of human labor, fingerlings and fuel cum energy cost but feed and manure cum fertilizers cost were insignificant.

Sarker *et al.* (2016) carried out a study to investigate the effects of feed types on Thai koi productivity in Mymensingh district of Bangladesh. The performance of different feed types on productivity was investigated using the Cobb-Doughlas production function and propensity score matching (PSM) methods and reported that floating feed led to the highest net returns. They also reported that Thai koi farmers are advised to use floating feed to reap higher production and returns on investment.

Sharmin (2016) investigated the potentiality of pangas fish export from Bangladesh. The survey was conducted in 7 districts namely Mymensingh, Bogura, Chittagonj, Comilla, Khulna, Barisal and Bhola. To assess the export potentiality, farm level production cost and benefits analysis of pangas and it's comparison with Vietnamese cost-benefits were performed. Various protection coefficients such as NPCO, NPCL, EPC, and PCR were measured. Findings revealed that pangas fish farming was profitable in Bangladesh as per the opinion of the Pangas fish farmers. In export markets, pangas is great but many challenges remain ahead because of increasing requirements of quality, food hygiene and development of technological and trade barriers in large pangas markets in USA and EU countries.

Akenbor and Ake (2015) conducted an experiment to study the technical efficiency (TE) of fish farming in Edo State, Nigeria. The result showed that the TE of the farmers ranged from 0.46 to 0.99, with a mean of 0.95 at which 77% of them were operating. The efficiency was significantly influenced positively by stocking rate and negatively by the farmers' age, educational level as well as poor access to extension services. Serious constraints that affected optimum production include high cost of feed, limited capital, poor power supply, high cost of pond construction, disposal of effluents, increased fish price created by middleman and inadequate water supply.

Tunde *et al*. (2015) examined the economic analysis of fish farming in Saki-East Local Government Area (LGA) of Oyo State, Nigeria. The results of a Cost and Return Analysis of the fish farming in the study area showed that the total revenues was N 244,364.30 k per cycle, whereas total cost was N 129,379.52 k per cycle. This implies that fish farming was profitable and is expected to continue to operate. In addition, Benefit Cost Ratio (BCR) was 1.9, the fish farming is therefore considered to be profitable. The rate of Return on Investment was 0.8887, meaning, for every N 1 invested; there will be a return of 88.8 k.

Ahmed and Toufique (2015) studied the blue revolution of small-scale fresh water aquaculture in Mymensingh, Bangladesh. Rapid development of small scale freshwater aquaculture in the Mymensingh district of north-central Bangladesh has been linked to a 'blue revolution'. Mymensingh is ranked first among districts of pond fish production in Bangladesh. However, a number of challenges, particularly social, economic and environmental issues, will need to be overcome to translate its benefits effectively. They propose a conceptual framework for greening the blue revolution of aquaculture, which links social, economic and ecological aspects for promoting the importance of socio-ecological, ecological-economic and socio-economic interactions. They conclude that active community participation, institutional collaboration and policy support are needed for greening the blue revolution of aquaculture in Mymensingh.

Devi *et al*. (2014) carried out an experiment in Manipur state to study the cost and returns of fish production under different farm categories and to find out the constraints of fish production. The study revealed that overall the average cost of fish production per hectare was Rs 99,107.9. Comparatively higher per hectare cost was observed in category I, Rs 109,902.32 followed by category II, Rs 93,036.04. .The total fixed investments per hectare have been highest on category II (small farms), followed by category I (large farms). On an overall

average, Net Income per hectare was observed as Rs 27,940.77. Comparatively, higher per hectare Net Income was observed in category II Rs 36,963.96 followed by category I Rs 18,917.58. The Benefit-Cost ratio has been found profitable in both the farm categories, it being higher in category II (1.4) than category I (1.17). The lack of training facilities relating to new technology, non-availability of good quality fingerlings, lack of storage facilities, financial problems and price fluctuation are some of the major constraints faced by the fish farmers.

Mahmood *et al.* (2014) carried out a study on the analyze the relationship between farm size and productivity and its various correlates like total and partial factor productivity, cropping intensity, gross margin, on and off farm incomes, credit availability with reference to different farm sizes in the irrigated perennial areas of district Gujrat and MandiBahauddin. To achieve the objectives, 213 respondents were randomly selected and interviewed. Cobb-Douglas production function was employed to observe the productivity trends using various exogenous farm inputs while monetary values of output has been used as endogenous variable in the model. The cropping intensity and study specific total and partial factor productivities were also calculated. Results confirmed the inverse relationship between farm size and productivity, however, this relationship was found weak. Furthermore, cropping intensity, yield and gross margins per hector were found higher at small farms as compared to larger ones.

Itam *et al*. (2014) studied on stochastic production frontier model to analyze the resource use efficiency among small scale fish farms in cross river state Nigeria. The mean efficiency of 0.89 was obtained indicating room for farm efficiency improvement by 11% quantity of feed, farm size (pond size), labor, capital had significant influence on fish production in the study area, with positive coefficient of feed quantity and farm size while that of labor and capital were negative. The return to scale was 1.055 indicating increasing return to scale,

which implied that farmers may need to increase the use of productive resources. High cost of feed, unavailable credit, lack of capital, and unfavorable price of fish were among the major constraints to fish production in the area. There existed some inefficiency among the sampled farmers. The major contributing factors to efficiency were gender, family size, family experiences and education.

Penda *et al.* (2014) carried out a study on Benue State, Nigeria, made use of both primary and secondary data. Descriptive analysis showed that 62% of the fish farmers fall into the economically active age groups of 20-50 years and 50.8% of the respondents had tertiary education. Most of the respondents (93%) were part time fish farmers and financed their fish production through personal savings. Equally evident from the results is that an average total cost of N 302,614.25 was incurred per annum, by the respondents while a mean gross revenue of N 466,610.84 was realized thereby returning an average gross margin of N 284,800.00 and a profit of N 163,995.59. The rate of return on investment of 0.65 implied that for every one naira invested in fish production in concrete ponds by the farmers, a return of N1.65 and a profit of N 0.65 were obtained. Stochastic frontier production function results also revealed that the mean technical efficiency was 0.619. This implies that on the average the fish farmers were able to obtained 61.9% potential output for a given mix of production inputs. The study concluded that fish production under concrete pond system in the study area is economically rewarding and capable of creating employment, augmenting income and improving the standard of living of the people.

Ele *et al*. (2013) carried out an experiment to study the economic analysis of fish farming in Calabar, Cross River State, Nigeria. The study revealed that the major constraints affecting increased level of output in the study area were high cost of inputs, lack of adequate finance, access to credit facilities, security and farm labour problems. It was also discovered that the amount spent on stocking accounted for 37.27% of the running cost, followed by amount spent on water (30.21%), feeding (16.51%) and labour (14.84%). Cob-Douglas equation was

chosen to be the lead equation because of statistical significance of the coefficient and high R^2 value of 0.94. The result indicated that feed (kg), years of farming experience and stocking density have significant effect on output levels. The study recommends among others, that fish hatcheries and feed mill should be established in the study area.

Rahman *et al.* (2011) conducted a study on impact of fish farming on household income. The study provides enough evidence that fish farming in Bangladesh is very productive and brings increased income among the fish farmers. Results of the study revealed that respondent's farmers are earning a significant income from fish farming. It was also observed by the researchers that due to having better communication facilities in the study areas, fish farmers can easily send their harvested fish to the capital city, thus the respondents fish farmers are enjoying a better income security. The earnings from fish farming is also contributing significantly to their household income which is ultimately improving the lives of the poor fish farmers.

Akhter (2009) conducted a study to assess the costs, returns and profitability of pond fish farmers were selected randomly from two villages namely Boiler and Dhanikhola at Trishalupazila under Mymensingh district. Both tabular and statistical analysis were done to address the objectives of the study. It was estimated that per hectare gross cost of pond fish production was Tk. 176,759.88 while gross return and net return were Tk. 315,361.2 and 138,601.32 per hectare respectively. The findings of the study shows that pond fish production was profitable in the study area. Cobb-Douglas production function was also applied to realize the specific effects of the factors on pond fish production. It was observed that most of the included variables had significant impact on pond fish production.

Clausen (2009) conducted a study on the profitability ratio analysis of income statement and balance sheet ratio. In this study analysis of the income statement and balance sheet were used to measure company profit performance. The

income statement and balance sheet are two important reports that showed the profit and net worth of the company. Study also found that how the well the company was performing in terms of profits compared to sales and how well the assets were performing in terms of generating revenue. From the study, it found the income statement that showed the net profit of the company by subtracting expenses from gross profit (sales – cost of goods sold). Furthermore, the balance sheet lists the value of the assets, as well as liabilities. In simple terms, the main function of the balance sheet was to show the company's net worth by subtracting liabilities from assets. Study found that there was an important relationship between assets and profit. The business owner normally had a lot of investment in the company's assets.

Ahmed (2009) conducted a study on the sustainable livelihoods approach to the development of fish farming in rural Bangladesh. The study shows that all farmers made a profit from fish production. The gross revenue, net return and BCR for the different farming systems are relatively sound from an economic perspective. The study confirmed that most farmers have improved their socio-economic conditions through fish production which plays an important role in increasing income, food production, and employment opportunities.

El-Naggar *et al*. (2008) conducted economic analysis of fish farming in Behera Governorate of Egypt. The study result revealed that the average age of fish operators was 43 years, majority are married (62.5%), fairly level of education (80%) and majority with rented land ownership (93.3%) and tilapia represented over 85% of total fish harvested. High prices of fish feed; declining fish prices and lack of finance were found out to be the top ranking serious constraints facing fish farmers in that area. Feed costs per kg of fish were LE 3.87, representing 58.9% of the production costs. The break-even analysis showed average production costs of LE 6.57 per kilogram of fish while the sales price is LE 7.5/kg. The analysis of the rate of returns on operational costs revealed an average of 19% in the production season. Correlation matrix showed that there is

high positive relationship between the level of income generated and feed costs, quantity of fish seeds, cost of fuel, cost of extra labor, permanent staff salary and cost of transportation except cost of fertilizer.

Islam *et al*. (2008) conducted a research on "Carp Culture: Cost-Return and Profit Analysis in Rajshahi District". The result shows a clear relation between the total investment cost and total returns. Maximum cost was found to be involved in nursery pond (Tk. 7,858 per hectare) and minimum cost in beel (Tk. 3,417 per hectare). Similarly, the total return has come from nursery pond culture system (Tk. 4,755 per hectare) and return from beel (Tk. 4,030 per hectare) respectively.

Ali *et al.* (2008) conducted a study to assess the livelihood status of the fish farmers in Hamirkustsha and Kamarbari Unions of Bagmaraupazilla under Rajshahi district. They found average pond size was 0.13 ha with single (64%) and multiple ownerships (36%). Average annual incomes of majority of fish farmers were above Tk. 75,000 per annum and 62% of the farmers used semi-*pucca* sanitary. About 62% of the farmers had electricity facilities while 38% did not have and 88% of the farmers used own tube-well, while 12% of the farmers used neighbor's tube-well. Lack of scientific knowledge, multiple ownerships and lack of capital for fish culture were the major constraints.

Tanjeena *et al.* (2007) conducted a study in Mohanpur Upazila, Rajshahi to determine the pond fishery resources and the livelihood status of fish farmers. Pond sizes of the area were varied from 15 to above 180 decimal of which maximum ponds (57.8%) were operated by single owner. Field observation revealed that 65.5% ponds were used for fish culture, whereas 28.5% and 6% ponds were culturable and derelict, respectively. Among the fish farmers 23.3% were illiterate, while 14.4, 8.9 and 6.7% were educated up to primary, secondary, and higher secondary or above level, respectively. Agriculture (51.1%) was the principle occupation of the pond owners followed by aquaculture (18.9%). Thirty three percent of the fish farmers earned Tk. 25,000 -

Tk. 50,000/year, 32% earned Tk. 50,000-Tk.100,000 and the rest 25% earned above Tk. 1,25,000 annually.

Kaliba *et al*. (2006) conducted an experiment in Tanzania, Nile tilapia culture is a promising aquaculture enterprise. Information on production costs could assist fish farmers in economic and financial planning. Economic profitability of small- scale Nile tilapia production in Tanzania is analyzed using a model that simulates individual fish growth and takes into account fish population dynamics in the pond. The results suggest that the current practiced mixed- sex tilapia culture without predation is not economically sustainable. Extension efforts should be geared toward developing a Nile tilapia production system that is based on a hand- sexed all- male tilapia. Meanwhile catfish can be introduced in ponds to control overcrowding in mixed- sex tilapia culture without predation. Studies to determine optimal pond sizes, availability of feed, and a quality fingerling supply chain are also fundamental for developing a sustainable Nile tilapia production system in Tanzania. Under improved Nile tilapia production systems, returns are high enough to justify investment through borrowed capital from formal institutions.

Alam (2005) conducted a study to measure the productivity, profitability, and efficiency of producing fish in Bangladesh. Two regions, Mymensingh and Rangpur were selected purposively. From each of the selected regions 60 farmers and 90 retailers were randomly selected for the study. Farmer of Mymensingh region produced significantly higher output (17,942.41 kg) per hectare than those of Rangpur region (2,005.5 kg). Net returns (full cost basis) per hectare for producing fish in Mymensingh and Rangpur region were Tk. 232,281.50 and 13,635, respectively. The benefit cost ratios showed that production of fish was profitable for both regions with BCR being 1.39 and 1.17 in Mymensingh and Rangpur, respectively.

Paul (2005) conducted a study to determine the cost, return and relative profitability of rearing fingerlings and pond fish production. It was estimated

that per hectare gross cost of rearing fingerling was Tk. 142,827 while gross return and net return were Tk. 275,123 and 132,295 per hectare respectively. On the other hand, per hectare gross cost of pond fish production was Tk. 109,489 while gross return and net return were Tk. 173,098 and 63,609 per hectare, respectively. The findings of this study showed that both rearing fingerlings in the nursery pond and pond fish production was profitable but fingerlings production was more profitable than pond fish production in the study areas.

Tektas and Gunay (2005) found that maximizing profit, lowering and controlling various risks are obligatory for assets and liability management of a bank. They mentioned risk management as an integral and important part of overall manager for profit seeking organizations.

Parul (2005) carried out a study to determine the economic performance of carp poly culture practiced by the pond fish farmers under DSAP supported NGOs namely GRAMAUS, ORD and SATU in Bangladesh. The findings of the study clearly indicates that carp polyculture under the management of SATU was profitable and net return was also higher compared to GRAMAUS and ORD. For all sample farmers, per hectare yield was 3,319 kg. Total costs, gross income and net returns of carp polyculture were Tk. 89,879, 17,440 and 84,462, respectively.

Ahmed (2003) carried out a research on "An economic study of yield gap, production losses and profitability of pond fish culture under different types of management in some selected areas of Netrokona district". He found that the overall per hectare gaps was 1528 kg/ha. In this study total cost, gross return and net return were Tk. 72,383, Tk. 220,350 and Tk. 147,967 respectively.

Faruk (2003) carried out a study 'A comparative economic analysis of Carp and Pangus culture in some selected areas of Mymensingh district' and found that average per hectare total cost of carp culture for all farms was Tk. 95,908 while gross income and net return per hectare were Tk. 281,215 and Tk. 185,307 respectively. It was observed that Pangus culture was highly profitable and its net return was about two times higher compared to Carp culture.

Roy (2003) conducted a study to understand the dynamics on pond fishery and to determine the cost and return of pond fish production and explore the backward and forward linkages of pond fish culture in two upazilas (Mymensingh sadar and Trishal) of Mymensingh district. The study showed that the pond fish and hatchery production were highly profitable business.

Akter (2001) conducted an experiment to study the economic analysis of pond pangus fish production at Trishal upazila of Mymensingh district. She observed that per hectare total cost of production was Tk. 286,953 while gross margin and net return were Tk. 300,533 and 59,520, respectively. The findings revealed that pangus fish production was a profitable enterprise.

Kausari (2001) carried out a study in Mymensingh and Jamalpur district on pangus fish culture. The findings of the study revealed that average per hectare cost pangus production in Mymensingh district was Tk. 7,550,047 higher than that of the Jamalpur district Tk. (730,940). The gross return and net return per hectare were Tk. 1,667,200 and 912,153, respectively in Mymensingh district while they were Tk. 1,575,160 and 912,153, respectively in Jamalpur district. It was observed that pangus fish production in Mymensingh district was more profitable compared to Jamalpur district.

Biswas (2001) conducted a study on ‘An economic analysis of pond fish culture of BRAC in some selected areas of Mymensingh district’. This study revealed that ha^{-1} $year^{-1}$ total cost of pond fish production was TK. 59,814 where artificial feed cost was largest cost and it contributed 30.44% of total cost and it contributed 30.44% of total cost. Net return was observed as TK. 855,110 for all location.

Alam and Thomson (2001) examined the current status of fisheries in Bangladesh, for each of the major subsectors, namely inland open waters, inland closed waters (aquaculture) and marine fisheries. They explained that production increased for all types of fisheries. But the productivity of rivers and estuaries is variable. There are many constraints of expansion, and it is difficult to identify significant achievement from government policy efforts. A host of factors are

responsible for the underutilization of fishing areas, including resources limitations, poor implementation of fisheries laws, the limited spread of fish farming technology, low financial capacities and ineffective production practices.

Masud (2000) conducted a study on economic analysis of fish culture in indicated water bodies under the supervision of SAPAP in Kishorgonj district. The results of the study showed that fish culture in inundated water was profitable business. Per hectare total cost of fish production was TK. 10,642 while gross return and net return were Tk. 23,742 and 13,100, respectively. The BCR and net returns were invested TK.2.23 and TK.1.23, respectively.

Haque (2000) carried out a study which showed that per hectare gross cost of production of pond fish was TK. 65,917.52, while gross return and net return were TK. 91,705.61 and 25,789.09 respectively, per hectare gross cost of production of nursery fish was TK. 87,488.94 while gross return and net return were TK. 139,272.2 and 51,783.26 respectively. He observed that variation in gross return was largely influenced by, the fry and fingerlings, human labour and material inputs.

The above cited review indicated that most of the studies were conducted with various diversified aspects of aquaculture in Bangladesh. It revealed that there was no specific study were not conducted on the economic analysis on Tilapia fish farming in the area under present study. The present study is an attempt to determine the economic analysis of Tilapia fish farming. The study is different from other studies because no such studies were undertaken yet on this issue in the selected areas of Cumilla District of Chattagram division. Policy makers will get information on the profitability and ultimate production capacity of Tilapia fish on the selected study area. The study which was undertaken that may bring socio-economic benefits to individual's farmers and entrepreneurs. Thus, the findings of this research are likely to provide useful information which will help farmers and researchers and also in further research in many ways.

Chapter 3
Materials and Methods

CHAPTER 3

MATERIALS AND METHODS

Chapter deals with the procedures for the collection of valid information as well as procedure of data coding and also data analysis. For conduction a research work smoothly proper methodology is an obligatory one and it is very difficult to address the study objectives with a scientific manner without a define methodology. An appropriate methodology is an essential part for conducting scientific research. It enables researcher to achieve the objectives and so reveals the strongest or weakness of the research. A farm business study usually involves collection of data from individual farm producers; collection of data for farm business analysis involves judgment of the analyst in the selection of data collection methods within the limits imposed by the resources available for the work (Dillon and Hardaker, 1993). In this regard, this work presents the socio-economic condition of the Tilapia fish farming, the production cost, return and profitability analysis of Tilapia fish culture and the real culture system that practiced in the study area.

This study is based on field survey where primary data were collected from individual farmers who practiced Tilapia fish culture in the pond. The method of collecting data depends upon the nature, aims and objectives of the study undertaken. There are several methods of collecting necessary data and information. Selection of a particular method depends on many considerations such as the nature of the research problem, time constraints, availability of funds etc. Considering the context and situation the survey method of data collection was followed for this study. The word survey refers to a method of study in which an overall picture is obtained by a systematic data collection of all available sources of data on the specific subjects. A sequential description of the methodologies that was followed in conducting this research work has been presented in this chapter under the following headings-

3.1 Selection of the Study Area

Selection of the study area is an important step for this study on Tilapia fish culture. The area is selected to collect information for Tilapia fish culture is to serve the purpose set for the study. Cumilla is located along the Dhaka-Chattogram highways of Bangladesh located in Chattogram Division. A large number of private fish seed hatcheries and aqua feed industries have developed in Cumilla, making it a suitable location for fish farming. Commercial Tilapia farming is the most important type of aquaculture that practiced in this locality. Tilapia fish farming has been evolved to a shape of commercial enterprise over the last two decades in Bangladesh, particularly in the area of Cumilla, Mymensingh, Bogura, Khulna and many other areas. This study was conducted using multiple methodological tools including participatory rural appraisal (PRA) tools and mainly questionnaire based farm survey to assess the profitability analysis of Tilapia fish farming.

The purpose would be better served in an area where availability of data on Tilapia fish culture would be ensured. With this end in view, a sample of 75 Tilapia fish producers was selected from Homna, Muradnagar and Chandina Upazila of Cumilla district under Chattogram division considering the following reasons.

a) Availability of ponds and Tilapia fish farmers.

b) There was a huge number of typical Tilapia fish farms.

c) There are a number of potential private fish farm (commercial Tilapia fish farming) which are operated in systematic way.

d) Easy accessibility and good communication system existed in the selected villages.

e) Co-operation from the respondents were expected to be high since the researcher was familiar with the local dialect, living experience, beliefs and other socio-economic characteristics of the area and

f. This type was not conducted in this area in the recent previous year.

Figure 3.1 Map of Bangladesh Showing the Study Area Cumilla District

3.2 Sampling Technique

In selecting samples for a study two factors need to be taken into consideration. The sample size should be as large as to allow for adequate degrees of freedom in the statistical analysis. On the other hand, administration of field research, processing and analysis of data should be manageable within the limitation imposed by physical, human and financial resources (Shawon *et al*., 2018). However, because of diversity in the technical and human environment, it is necessary to sample several numbers of the population before any conclusion can be drawn. Therefore, the purpose of sampling is to select a sub-set of the population that is representative of the population (Rahman, 1998).

It was not possible to include all the farmers in the area studied due to limitation of time, money and personnel. A simple random sampling technique was followed in the present study for minimizing cost, time and to achieve the ultimate objectives of the study. Homna, Muradnagar and Chandina upazila of Cumilla district were selected purposively as the study area. As the population is not so large and considering the limited time, efforts and fund, a sample of 25 Tilapia fish farmers were randomly selected from each upazila. Thus, a total of 75 Tilapia fish farmers constituted the population of the study. Thus the selected farmers were interviewed to achieve the ultimate objectives of the study.

3.3 The Research Instrument

A well-structured interview schedule was developed for primary data collection from Tilapia fish farmers based on objectives of the study for collecting information with containing direct and simple questions in open form and close form. Appropriate scales were developed to measure both independent and dependent variables.

The questionnaire was pre-tested with ten Tilapia fish farmers out of sample in the study area to finalize it for collection of research data. Necessary corrections, additions, alternations and adjustments were made in the interview schedule based on pretest experience.

3.4 Period of the Survey

Data collection survey of Tilapia fish farming was conducted during March to June 2019. Besides these, secondary data were collected from different published and un-published sources to fulfill of the objectives of the study.

3.5 Collection of Data

Technical and socio-economic data are needed in this research and the data were collected by interviewing of the selected respondents. It was very difficult to collect accurate data since farmers did not keep any written records on pond fish culture and different farm activities which they provided were mostly from their memory. To overcome this problem, all possible efforts were made by the researcher to ensure the collection of reasonably accurate information from the field. Firstly, the objectives of the present study were explained to the Tilapia fish farmers and were requested to provide correct information so far as they could remember. The researcher herself collected the data from the sample respondents through personal contact with the help a pre-tested interview schedule. Whenever, any respondent faced difficulty in understanding questions, more attention was taken to explain the same with a view to enabling the respondent's Tilapia fish farmers to answer properly. No serious problem was faced by the investigator during data collection but obtained cooperation from the respondents.

3.6 Accuracy of the Data

Adequate measures were taken during the period of data collection to minimize the possible errors. The measures taken were:

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

In case of any inconsistency and lapse, the neighboring farmers were asked for necessary verification and data were checked and corrected through repeated visits. For ensuring consistency and reliability of the parameters being generated out of the data, follow up visits were also made to the field to obtain supplementary data. Data were collected at respondent's house as well as in the field.

3.7 Processing of Data

The collected data were manually edited and coded. Then all the collected data were summarized and scrutinized carefully. Data were processed to transfer to master sheets to facilitating tabulation in order to meet the objectives. Moreover, data entry was made in computer and analyses were done using Microsoft Excel and Statistical Package for Social Science (SPSS). It may be noted here that data were collected initially in local units. After necessary checking it was converted into standard international units such as hectare, metric ton, etc.

3.8 Data Analysis

Recorded and processed data were analyzed for achieving the objectives of the study. A number of tables were prepared for keeping in view the aims and objectives of the study. In this study, statistical analysis and tabular technique were used. The gross return, gross margin, net return were the simple statistical measures employed to show the profitability of Tilapia fish production.

3.9 Analytical Techniques

Analytical techniques enable researcher to examine complex relationships between different concerned variables. Mainly two techniques i.e. Tabular and Functional analysis of data analysis were used in the study:

3.9.1 Tabular Analysis

Tabular method was used for a substantial part of data analysis. This technique is intensively used for its inherent quality of purporting the true picture of the farm economy in the simplest form. Percentage and arithmetic mean or average were employed to analyze data and to describe socio-economic characteristics of Tilapia fish farmers, input use, costs and returns of Tilapia fish production.

3.9.2 Functional Analysis

Functional analysis was used to reveal the quantitative relationships between dependent a set of independent variables (Prodhan and Khan, 2018). This section presents a quantitative relationship between some key inputs and outputs of Tilapia fish production through production function analysis.

Some statistical measures like average, percentage and ratios were calculated in tabular form for measuring socio-economic characteristics and financial

profitability (Shawon *et al*., 2018). Farmer's financial profitability were calculated in different ways such as gross margin (GM), net return (NR), benefit-cost ratio (BCR), gross profit margin (GPM) and net profit margin (NPM). Total cost (TC) of Tilapia fish farming was divided into variable cost (VC) and fixed cost (FC). In this study, variable cost includes labor, fingerling, feed, fertilizer, manure and other miscellaneous cost. Fixed cost were land use cost, construction of water supply and housing, canal digging and dyke re-construction and interest on operating capital. Total cost is the summation of variable and fixed costs.

Total Cost

The formula for calculating total cost was given below:

$$TC = \sum_{i=1}^{N} X_i . W_i + \sum_{i=1}^{N} TFC \quad \text{.....} \quad (1)$$

Where,

X_i is quantity (kg/hectare) of the i^{th} variable input and

W_i is per unit price (Tk/kg) of the i^{th} variable input.

Gross return (GR)

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

$$GR = \sum_{i=1}^{N} Q_{ai} . P_{ai} + \sum_{1i}^{N} Q_{bi} . P_{bi} \quad \text{.....} \quad (2)$$

Where,

Q_{ai} is the quantity of the Tilapia fish (kg hectare^{-1})

P_{ai} indicates per unit price (Tk/kg) of Tilapia

Q_{bi} is quantity of fin-fish or other fish (kg/hectare), and P_{bi} is per unit price (Tk/kg) of fin-fish.

Gross margin (GM)

Gross margin (GM) is the difference between gross return and total variable cost.

The formula was given as:

$$GR = \sum_{i=1}^{N} Q_{ai} . P_{ai} + \sum_{i=1}^{N} Q_{bi} . P_{bi} - \sum_{i=1}^{N} X_i . W_i \quad \text{.....} \quad (3)$$

Net return (NR)

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

$$\pi = \sum_{i=1}^{N} Q_{i}.P_i + \sum_{i=1}^{N}(W_{xi}.X_i) - \text{TFC} \qquad (4)$$

Benefit-cost ratio (BCR), gross profit margin (GPM) and net profit margin (NPM) were indicators whether the farm is financially profitable or not. Higher ratio means the farm is higher profitable.

Benefit-cost ratio

The benefit-cost ratio (BCR) is a relative measure, which is used to compare benefit per unit of cost. The BCR estimated as a ratio of gross returns and gross costs. The formula of calculated BCR (undiscounted) was as follows:

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

Gross profit margin

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

Here's the formula of gross profit margin was given as:

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

Net profit margin

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

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

Chapter 4

Socio-Demographic Profile of Tilapia Fish Farmers

CHAPTER 4

SOCIO-DEMOGRAPHIC PROFILE OF TILAPIA FISH FARMERS

Socio-economic characteristics mainly demonstrate the wide ranges of interrelated social characteristics of the respondents' which largely influence their economic activities, living conditions and decision making process. To get a more positive complete picture of the profitability analysis of Tilapia fish culture, it is necessary to know the socio-economic characteristics of the growers. The socio-economic characteristics of the selected respondents' were not identical rather there was a wide variation in their socio-economic position which affect their economy and production plan. Therefore, it is necessary to identify different common socio-economic aspects of the respondents' for understanding profitability analysis of Tilapia fish culture. The recorded observations of the study were presented and probable discussion was made with probable justifiable and relevant interpretation in this chapter.

For assess the socio-economic characteristics of Tilapia fish farmers and various interrelated characteristics were collected under the present study. However, the 8 selected salient features of the Tilapia fish farmers such as age, level of education, family size, farm size, farming experiences, annual income, organizational participation and training exposure that might be greatly influences the profitability analysis of Tilapia fish production are presented below-

4.1 Age

The age of the Tilapia fish farmers have been varied from 22 to 57 years with a mean and standard deviation of 36.97 and 11.14, respectively. Considering the recorded information of age Tilapia fish farmers were classified into three categories namely 'young', 'middle' and 'old' aged following methods that was developed by Sarker *et al.* (2016). The distribution of the Tilapia fish farmers in accordance of their age are presented in Table 4.1.

Table 4.1 Distribution of the Respondents' Tilapia Fish Farmers According to their Age

Categories	Range (Years)		Respondents'		Mean	Standard deviation
	Score	Observed	Number	Percent		
Young aged	Upto 35	22-57	26	34.67	36.97	11.14
Middle aged	36-50		43	57.33		
Old aged	Above 50		6	8.00		
Total			75	100		

From Table 4.1 it was revealed that the middle aged Tilapia fish farmers comprised the highest proportion (57.33 percent) followed by young aged category (34.67 percent) and the lowest proportion were made by the old aged category (8.00 percent). Data also indicates that the middle and young aged respondents constitute almost 92 percent of total respondents. So from the findings it may be concluded that young and middle aged respondents were generally more involved in Tilapia fish cultivation than the older because of they having ability to undertake technical enterprises like fish farming and other enterprises with better management. Different age groups of farmers impart differential impact on the livelihood strategy of the household (Hossain, 2009). Generally in this stage, farmers are more efficient and active. They are more acquainted with production practices and more able to manage their inputs in the more efficient way and they are more risk averter than their younger counterparts.

4.2 Level of Education

The level of educational scores of the Tilapia fish farmers of the study areas ranged from 0 to 14 with a mean and standard deviation of 6.79 and 3.81, respectively. Based on the educational scores, the respondents were classified into five categories such as 'can't read of sign' (0), 'can sign only' (0.5), 'primary education' (1 to 5), 'secondary education' (6 to 10), above secondary (above 10). The distributions of the respondents Tilapia fish farmers according to their level of education are presented in Table 4.2.

Table 4.2 Distribution of the Respondents' Tilapia Fish Farmers According to their Level of Education

Categories	Range (School years)		Respondents'		Mean	Standard deviation
	Score	Observed	Number	Percent		
Can't read and sign	0	0-14	3	4.00	6.79	3.81
Can sign only	0.5		11	14.67		
Primary education	1-5		19	25.33		
Secondary education	6-10		37	49.33		
Above secondary	Above 10		5	6.67		
Total			75	100		

Table 4.2 shows that respondent under secondary education category constitute the highest proportion (49.33 percent) followed by primary education (25.33 percent) and can sign only category (14.67 percent). On the other hand, the lowest 4.00 percent in can't read and sign category followed by above secondary category (6.67 percent). Education broadens the horizon of outlook of Tilapia fish farmers and expands their capability to analyze any situation related to fish production. It plays an important role in accelerating the pace of agricultural development and it greatly influences the new technology and scientific knowledge regarding farming. An educated Tilapia fish farmers is likely to be more responsive to the modern facts, ideas, technology and information. Literate farmers would be progressive minded to adopt as well as involve with modern technology of fish culture and supposed to have better access to the relevant information for improving the fish production and can make rational economic decision.

4.3 Family Size

Family size of the respondent Tilapia fish farmers ranged from 2 to 9 with the mean and standard deviation of 4.87 and 1.59, respectively. According to family size the respondents were classified into three categories viz. 'small', 'medium' and 'large' family. The distribution of the respondents according to their family size is presented in Table 4.3.

Table 4.3 Distribution of the Respondents' Tilapia Fish Farmers According to their Family Size

Categories	Range (Number)		Respondents'		Mean	Standard deviation
	Score	Observed	Number	Percent		
Small family	Upto 3	2-9	19	25.33	4.87	1.59
Medium family	4-6		41	54.67		
Large family	Above 6		15	20.00		
Total			75	100		

Data in Table 4.3 indicate that the medium size family constitute the highest proportion (54.67 percent) followed by the small size family (25.33 percent). Only 20.00 percent respondents had large family size. Such finding is quite normal as per the situation of Bangladesh. The findings from Table 4.3 indicated that average family size of the study area was around similar than the national average which is 4.85 (BBS, 2018).

4.4 Farm Size

The farm size of the respondent's Tilapia fish farmers ranged from 0.15 to 2.65 ha with a mean and standard deviation of 0.88 and 0.43, respectively. Based on their farm size, the respondents were classified into three categories following the categorization of DAE. These categories were marginal (upto 0.2 ha), small (0.201 to 1.0 ha) and medium farm holder (1.01 ha to 3.0 ha). The distribution of the Tilapia fish farmers according to their farm size is presented in Table 4.4.

Table 4.4 Distribution of the Respondents' Tilapia Fish Farmers According to their Farm Size

Categories	Range (Hectare-ha)		Respondents'		Mean	Standard deviation
	Score	Observed	Number	Percent		
Marginal	Upto 0.2 ha	0.15-2.65 ha	11	14.67	0.88	0.43
Small	0.201-1.0 ha		36	48.00		
Medium	1.01 to 3.0 ha		28	37.33		
Total			75	100		

Table 4.4 indicates that the small farm holder constitute the highest proportion (48.00 percent) followed by medium farm holder (37.33 percent), whereas the lowest 14.67 percent marginal farm holder. The findings of the study reveal that majority of the Tilapia fish farmers were small to medium sized farm holder. The average farm size of the farmers of the study area (0.88 ha) was higher than that of national average (0.60 ha) of Bangladesh (BBS, 2018). The farmer with marginal farm size has very little scope to experiment about new technologies as their earnings depend on mainly in agriculture.

4.5 Fish Farming Experiences

Experience of fish farming score of the respondent Tilapia fish farmers could range from 5 to 23 with mean and standard deviation of 12.47 and 3.78, respectively. On the basis of faming experiences scores, the respondents were classified into three categories namely, 'low, 'medium' and 'high' experience. The distribution of the respondents according to their farming experiences is given in Table 4.5.

Table 4.5 Distribution of the Respondents' Tilapia Fish Farmers According to their Farming Experiences

Categories	Range (Years)		Respondents'		Mean	Standard deviation
	Score	Observed	Number	Percent		
Low experience	Upto 10	5-23	7	9.33	12.47	3.78
Medium experience	11-35		47	62.67		
High experience	above 35		21	18.00		
Total			75	100		

Data of Table 4.5 reveals that the majority (62.67 percent) of the respondents fell in medium farming experience category, whereas only 9.33 percent in low experience category followed by 18.00 percent in high experience category. The findings of the present study reveal that around 91 percent of the respondent Tilapia fish farmers in the study area had low to medium farming experiences. Rahman *et al.* (2011) observed average experience years 3.52.

4.6 Annual Income

Annual income of the respondent Tilapia fish farmers ranged from 59 to 225 thousand taka with a mean and standard deviation of 117.25 and 18.93, respectively. On the basis of annual income, the respondents' were classified into three categories, viz. low, medium and high annual income. The distribution of the Tilapia fish farmers according to annual income are presented in Table 4.6.

Table 4.6 Distribution of the Respondents' Tilapia Fish Farmers According to their Annual Income

Categories	Range ('000 Taka)		Respondents'		Mean	Standard deviation
	Score	Observed	Number	Percent		
Low income	Upto 72	59-225	14	14.81	117.25	18.93
Medium income	73-146		39	69.44		
High income	Above 146		22	15.74		
Total			75	100		

Data revealed that the Tilapia fish farmers having medium annual income constitute the highest proportion (69.440 percent), while the lowest in low income was (14.81 percent) which was followed by high income (15.74 percent)

4.7 Organizational Participation

Organizational participation score of the Tilapia fish farmers ranged from 10 to 25 with a mean and standard deviation of 16.55 and 3.26, respectively. Based on their organizational participation score, the respondent were classified into three categories as low, medium and high participation and it is presented in Table 4.7.

Table 4.7 Distribution of the Respondents' Tilapia Fish Farmers According to their Organizational Participation

Categories	Range		Respondents'		Mean	Standard deviation
	Score	Observed	Number	Percent		
Low participation	Upto 13	10-25	25	33.33	16.55	3.26
Medium participation	14-20		33	44.00		
High participation	Above 20		17	22.67		
Total			75	100		

Data revealed that the highest proportion (44.00 percent) of the respondents had medium organizational participation, while 33.33 percent had low organizational participation and the lowest 22.67 percent had high organizational participation.

4.8 Training Exposure

Training exposure score of the respondent ranged from 0 to 22 with a mean and standard deviation of 11.13 and 4.07, respectively. Based on the training exposure score, the respondents were classified into three categories as 'no training', 'low', 'medium' and 'high' training exposure. The distribution of the Tilapia fish farmers according to their training exposure is presented in Table 4.8.

Table 4.8 Distribution of the Respondents' Tilapia Fish Farmers According to their Training Exposure

Categories	Range (days)		Respondents'		Mean	Standard deviation
	Score	Observed	Number	Percent		
No training	0	0-22	7	9.33	11.13	4.07
Low exposure	Upto 6		24	32.00		
Medium exposure	7-17		67	36.00		
High exposure	Above 17		19	22.67		
Total			75	100		

Table 4.8 indicates that the highest proportion (36.00 percent) of the respondents had medium training exposure compared to 32.00 percent in low training exposure and 22.67 percent in high training exposure category and the lowest proportion (9.33 percent) had no training. Training makes the farmers skilled and helps them to acquire deep knowledge about the respected aspects. Trained farmers can face any kind of challenges about the adverse situation in their fish farming. The trained farmers can effectively use inputs for any production process and can earn maximum yield as compared to non-trained farmers.

Chapter 5

Profitability of Tilapia Fish Culture

CHAPTER 5

PROFITABILITY OF TILAPIA FISH CULTURE

This Chapter includes per hectare production cost and return of Tilapia fish culture which were determined for the one year production period and assess the effects of some important variables of production on gross return for this fish culture in a specific area. This chapter present the spirit of the survey results on economic analysis including profitability of Tilapia fish culture in the selected study area of Cumilla district. Profitability is one of the major criteria for the determination of the acceptance of any farming business. Tilapia fish farmers in the study area did not maintain any written document of cost and returns of fish culture. However, it is presumed that they possess of the profitability analysis was done by using sharp memory of the respondents and can calculate everything in relation with their farm production of Tilapia fish. The specific objectives of this Chapter are the determination of costs, returns and profitability analysis of Tilapia fish culture in the study area.

5.1 Estimation of Costs and Returns

The calculation of cost, return and profitability items have been done in terms of per hectare for the Tilapia fish culture in considering different variables that involves in fish production process. Costs of the input were valued in consideration of the current market price that prevailed in the study areas during the study periods or the prices at which farmers bought the inputs and involved in production process. Costs and returns were considered from farmers' point of view, their responses and were valued at prevailing local market unit price and converted into suitable standard unit for easily understand. Costs of the Tilapia fish production are the expenses incurred in consideration of production process of Tilapia fish (Ferdoushi *et al.*, 2019). Following different procedures, production costs and returns were calculated from farmer's point of view and presented in Table 5.1.

Table 5.1 Financial Profitability Analysis of Tilapia Fish Farming

Cost, Production and Return	Quantification of Indicators (unit/ha)
Cost	
Total cost	Tk. 1,447,586.41
Variable cost	Tk. 1,143,484.06
Fixed cost	Tk. 304,102.35
Production	
Harvest from Tilapia	16,654.81 kg
Total Production	16,654.81 kg
Return	
Return from Tilapia	Tk. 1,777,204.70
Total return (TR)/Gross Return (GR)	Tk. 1,777,204.70
Gross margin (GM)	Tk. 633,720.64
Net Return (NR)	Tk. 329,618.29
Benefit Cost Ratio (BCR)	1.2434
Gross profit margin (GPM)	33.082%
Net profit margin (NPM)	18.474%

Gross margin from per hectare Tilapia fish farming was found Tk. 633,720.64 and benefit-cost ratio was 1.2434 (Table 5.1). It suggested that by investing Tk. 1, farmers earned Tk. 1.2434 indicated that the Tilapia fish farming was profitable in the study area. This findings also support by the findings of Rahman *et al*., (2011) and Kumar *et al*. (2016).

Study revealed that gross profit margin was 33.082% which indicates managing cost of sales and other expenses is 66.918%. In other words, about 33.082% of the revenue is available that earned from total sale in the farm after covering costs. Study also revealed that the net profit margin was 18.474%. It means, it managed to convert 18.474% of its sale into net income of Tilapia fish farming. Considering per hectare of production, gross return and per kg of it was revealed that small scale Tilapia farming was a profitable venture in the present study area.

5.2 Cost-Benefit Analysis

The main objective of producer is to maximize profit. Therefore financial profitability assessment is very much important for any farm business. In this section, financial profitability of Tilapia fish farm were estimated with different point of view. Initially, different cost items and its quantity per hectare were presented then profitability was estimated. Both purchased and home supplied inputs were used by Tilapia farmer in the study area.

Table 5.2 Per Hectare Cost of Tilapia Fish Farming

Cost item	Cost (Tk./hectare) (average)	% of total cost (average)
a. Variable cost		
Labor cost	476,449.20	16.94
Fingerling cost	79,614.53	2.83
Feed cost	378,493.15	13.46
Fertilizer cost	60,546.19	2.15
Cost of water	106,465.99	3.79
Total running cost farm	102,461.18	3.64
Total others variable cost	1,143,484.06	40.66
b. Fixed cost		
Land use cost	5,397.47	0.19
Permanent labor cost	155,586.67	5.53
Total fixed cost	304,102.35	10.81
Total cost (a+b)	2,812,600.79	100

Cost items of Tilapia fish farm were classified into two major categories as: variable cost and fixed cost. Labour cost, fingerling cost, feed cost, fertilizer cost and cost of water were considered as variable cost. On the other hand, fixed costs are those costs which are not varying with the volume of production. Land use cost, permanent labor cost and total fixed cost are considered as fixed cost for this study.

5.3 Variable Cost

A variable cost is a cost that varies in relation to either production volume or services provided. Variable costs are those which changes as the size of the operation change. If there is no production or no services are provided, then there should be no variable costs. To calculate total variable costs, the formula is:

Total quantity of units produced × Variable cost per unit = Total variable cost

Considering its importance, this investigation put emphasis on different related cost items. This investigation put emphasis on different related cost items. Table 5.2 shows different cost items of Tilapia fish farms. For analytical advantages following variable cost items and their estimation procedure has been discussed under the following heads:

i. Human labor cost
ii. Fingerling cost
iii. Feed cost

5.3.1 Human Labor Cost

Human labor was one of the most important input cost item of Tilapia fish farming. It was classified into two categories: Family labor and Hired labor. Family labor consists of the farm operator himself and other family members. The extent of labor use in production depends on how carefully and what operations have to be conducted during production. Both family and hired labor were used in the study area, the prevailing wage rate in the market for hired labor was considered as the opportunity cost of family supplied labor. The total cost of human labor was calculated by multiplying the total months by monthly market wage which was taken as the opportunity cost of family labor. Human labor is required for various activities and management such as: pond preparation, water cleaning, feeding, applying fertilizer. In this study, a man-day was considered to be 8 hours of work. It can be observed from the data collection that average wage rate was Tk. 340 per day/labour. For avoiding

complexity, average rate has been taken into account. Thus average temporary labor cost for Tilapia fish farm was Tk. 476,449.20 per hectare which was 16.94% of total cost (Table 5.2). Shawon *et al.* (2018) and Sharmin (2016) reported that human labor cost Tk. 248,717.00 for aquaculture production per hectare. The variation of the human labor cost can be changed with different areas, labor types, gender, ages, seasons etc.

5.3.2 Fingerling Cost

Fingerlings are one of the most important factors that have a direct effect on the quality of fish. Number of stocking materials (fish seed) varies with the intensity of fish culture operations. The stocking rate of fingerlings varies with the fertility of pond. Good quality fingerlings are needed to ensure the sustainability and success of Tilapia fish production. Average cost of fingerling was calculated based on existing price of fingerlings in the locality. The cost of fingerlings depends on its size, price and number of fingerlings stocked. Average fingerling cost for Tilapia fish farm was Tk. 79,614.53 per hectare representing 2.83% of total cost (Table 5.2). Shawon *et al.* (2018), Sharmin (2016) and Prodhan and Khan (2018) reported that were incurred fingerlings costs Tk. 119,148 per hectare. The cost of fingerling can be changed with species, area of pond and availability of water required etc. In this survey a large number of samples have been taken than the referred works, so it is simple that fingerling cost has varied from farm to farm and location to location.

5.3.3 Feed Cost

Feed is a crucial factor to increase Tilapia fish production and is important for the quality of the fish. Feed cost included both traditional feed and commercial feed cost .Traditional feed includes cow-dung, fish meal, meat bone, rice bran, wheat bran, boiled rice ,mustered oil cake and homemade mixer feed. Farmers also use different commercial feed of different company for high growth and survival of fish that likely to increase variability in the production process. In the study area, most of the farmers purchased feed from different company and some farmers made feed by own using purchased feed from different company

and some farmers made feed by own using purchased raw material. Rice bran, oil cake, wheat bran, maize, fish meal etc. were used for feeding. Supply of artificial supplementary feeds, which can complement the need like nutritional deficiency, was important to increase the total production. Different types of feed were used at different stage of growth of production. Farmers cost for Tilapia fish farm was Tk 378,493.15 per hectare and Tilapia fish farms feed cost was 13.46% of total cost (Table 5.2). Shawon *et al.* (2018), Sharmin (2016) and Prodhan and Khan (2018) have to bear feed costs were Tk. 1,727,785 per hectare.

5.3.4 Total Variable Cost

All these above cost are considered as variable cost for Tilapia fish farm. Again average variable cost for Tilapia fish farm was Tk. 2,347,514.3 per hectare and Total variable cost is 83.46% of total cost for Tilapia fish farm (Table 5.2).

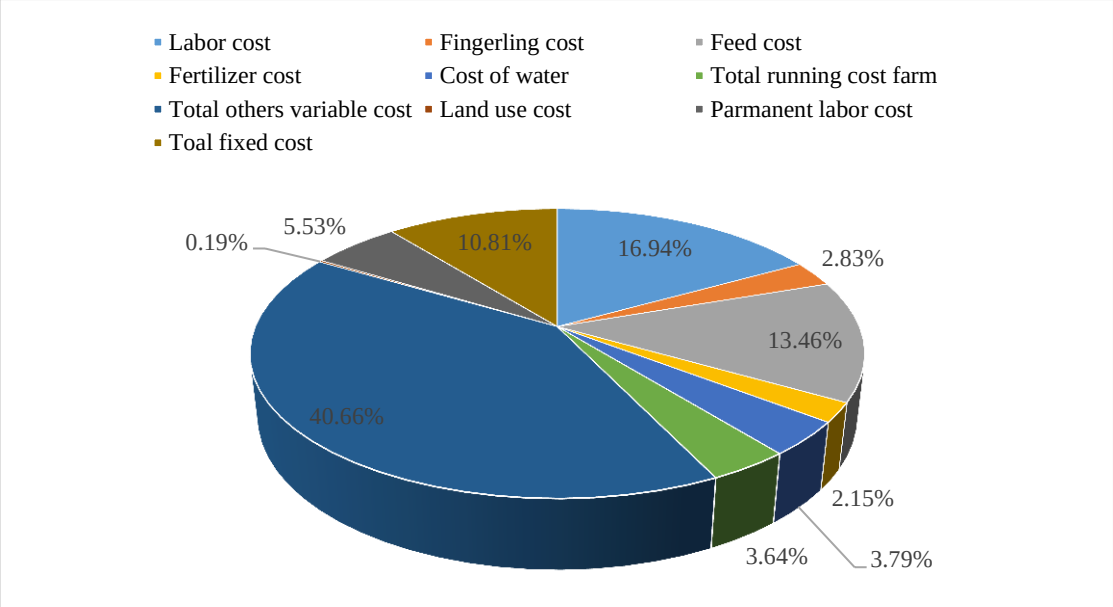

Figure 5.1. Percentage of Total Variable Cost

5.4 Fixed Cost

A fixed cost is an expense or cost that does not change with an increase or decrease in the number of goods or services produced or sold. Fixed costs are expenses that have to be paid by a farm or company, independent of any business activity. The total production costs consisted of both fixed and variable

costs. Fixed cost remains the same regardless of the volume of output change. Fixed cost is estimated on the basis of depreciation of each item. Fixed cost items and their estimation procedures have been discussed under the following heads:

i. Land use cost and
ii. Permanent labor use cost.

5.4.1 Land Use Cost

Land use cost depends on the location, soil fertility, soil texture etc. Two types of pond were found in the study area namely a) owned pond and b) leased in pond. Land use cost is calculated for twelve months (1 year). In the case of leased in pond, land use cost was calculated at the rate of prevailing cash rental value of per hectare pond land in the study area. Average land use cost was found Tk 5,397.47 per hectare for Tilapia fish farm which is 0.19% of total cost. In the survey of Sultana (2015) and Sharmin (2016) they found a fixed amount of land use costs are Tk. 75,446 and Tk. 29,750 per hectare respectively.

5.4.2 Permanent Labor Cost

Permanent labors are the labor that were involving permanently with the farms entire production period and get a fixed cost in a regular basis. Permanent labor can be family or hired. The table shows that the average permanent labor cost per hectare was Tk. 155,586.67 per hectare respectively and 5.53% in total cost. Sultana (2015) found permanent labor cost as a fixed cost Tk. 231,660 per hectare of Tilapia production in some selected area of Mymensingh which changed with farm to farm but fixed for a certain farm.

5.4.3 Total Fixed Cost

Sum of land use cost, cost of operating capital and permanent labor cost are total fixed cost. The average value of total fixed cost for Tilapia fish farm is 304,102.35 Tk/hectare which was 10.81% of total production cost.

5.5 Total Cost of Production

Total cost included all types of variable cost and fixed cost items of production. Total cost is the sum of total variable cost and total fixed cost. Total cost for

Tilapia fish farm was Tk. 2,812,600.79 per hectare. (Table 5.2). Prodhan and Khan (2018) also investigated that the total fixed cost and variable cost were Tk. 2,192,313 per hectare of commercial fish farms in selected areas of Bangladesh.

5.6 Gross Return

Gross return is the monetary value of fish production. It was calculated by multiplying the total amount of production by their respective market prices. Table 5.3 showed that productivity (kg hectare) for Tilapia was 16,654.81 kg. Gross return from per hectare of pond was Tk. 1,777,204.70 for Tilapia fish farm. Shawon *et al.* (2018) calculated gross return Tk. 250,500 per hectare for small scale shrimp farming in a coastal area of Bangladesh. At the same way, Prodhan and Khan (2018) investigated and found gross return Tk. 3,136,880 per hectare of commercial fish farms in selected areas of Bangladesh.

Table 5.3 Gross return from Tilapia fish farming (per hectare in a year)

Output	Production (kg/hectare)	Price (Tk./kg)	Gross Return (Tk./hectare)
Tilapia fish	16,654.81	106.708	Tk. 1,777,204.70

5.7 Financial Profitability Analysis for Tilapia Fish Farm

Financial profitability estimates the amount of profit the farm has earned per unit of invested capital. Different indicators are used to estimate financial profitability such as: gross margin, net return, BCR, gross profit margin, net profit margin and break-even analysis.

5.7.1 Gross Margin

Gross margin is the difference between the gross return and the total variable costs. Producer generally wants to gain maximum return over variable cost of production. Gross margin for Tilapia farming was found Tk. Tk. 1,777,204.70 per hectare (Table 5.1). Sultana (2015) calculated gross margin Tk. 400,082 for per hectare Tilapia production of Mymensingh. Prodhan and Khan (2018) got gross margin Tk. 944,567 per hectare of commercial fish farm in selected areas of Bangladesh.

5.7.2 Net Return

To estimate the net return from Tilapia fish production gross cost was deducted from gross return .Gross cost is the sum of the total variable cost and total fixed cost. It can be observed from Table 5.3 that net return for Tilapia fish farm was estimated at Tk. 329,618.29 per hectare (Table 5.1). Shawon *et al.* (2018) found net return was Tk. 105,904 per hectare in case of small scale shrimp farming.

5.7.3 Benefit Cost Ratio (BCR)

BCR is a relative measure which is used to compare benefits per unit of cost. An undiscounted benefit-cost ratio (BCR) is a relative measure used to know and make comparison about the benefit per unit of cost BCR for Tilapia fish farming was determined as a ratio of gross return to gross cost. Benefit-cost ratio for Tilapia fish farming was 1.2434.

5.7.4 Gross Profit Margin

Gross profit margin is a percentage which indicates real measure of profitability. It must be high enough to cover costs and provide profits. It is a measure of how much a farm keep of the revenue that collects from sale. It implies the difference between how much revenue capture and how much spend to capture, expressed in terms of percentage. Gross profit margin refers to sale minus cost of products sold. Study revealed that gross profit margin for Tilapia fish farm is 33.082% (Table 5.1).

5.7.5 Net Profit Margin

Net profit margin means the ratio of gross return and net return. It represents the proportion of sales that is left over after all relevant expenses have been adjusted. Study also revealed that the net profit margin for Tilapia fish farm was 18.474%. (Table 5.1).

Chapter 6

Problem in Tilapia Fish Culture

CHAPTER 6

PROBLEM IN TILAPIA FISH CULTURE

Farmers faced a lot of problems in Tilapia fish culture. The problems were social and cultural, financial and technical. This chapter aims at represent some socio-economic problems in Tilapia fish culture. The problems faced by the farmers were identified according to opinions given by the fish farmers. The major problems and constraints related to in Tilapia fish culture are discussed below:

6.1 Lack of Quality Fingerlings

Lack of quality fingerlings was one of the most important limitations of producing in Tilapia fish culture in the study area. Farmers told that they were cheated by buying so called good quality fingerlings from the local markets and from the hatchery in some cases.

6.2 Lack of Scientific Knowledge of Farming

Although modem agricultural technologies have been using in the study area; a large number of farmers have no adequate knowledge of right doses and methods of using modern inputs and technologies in Tilapia fish culture.

6.3 Inadequate Extension Service

During the investigation some tanners complained that they did not get any extension services regarding improved method of Tilapia fish culture from the relevant officials of the Department of Fisheries.

6.4 High Price of Inputs

Non-availability of inputs like fingerlings, fertilizers, human labor etc. at fair price was a problem in the way of producing enterprises. During the production period price of some inputs tend to rise due to their scarcity.

6.5 Low Price of Output

Most of the farmers had to sell a large portion of their product immediately after harvest but after harvest time price of Tilapia remained low because of ample supply. So they could not get reasonable return for their products.

6.6 Attack of Diseases

The growers of in Tilapia fish culture were also affected by the problem of attack of different diseases. Pests and diseases attack reduce yield and increase cost of production.

6.7 Lack of Operating Capital

The farmers of the study area had capital constraints. For cultivation of in Tilapia fish a huge amount of cash money was needed to purchase various inputs like, human labor, fingerlings, fertilizers, etc. but the farmers reported that they did not have sufficient amount of money for purchasing the required quantity of inputs for the relevant enterprises.

6.8 Shortage of Human Labour

Tilapia fish culture reported that they faced a lot of problem due to human labour in fish culture.

6.9 Natural Calamities

It was found that in Tilapia fish culture faced some acute problems relating to the nature in their production process. Natural calamities like drought hail storm, excessive rainfall, caused substantial damage.

The above mentioned discussions it indicates that in Tilapia fish growers in the study area have currently been facing some major problems in conducting their farming. These are the major constraints for the producers of Tilapia fish farmers. Public and private initiative should be taken to reduce or eliminate these problems for the sake of better production Tilapia fish.

Chapter 7

Summary, Conclusion and Recommendations

CHAPTER 7

SUMMARY, CONCLUSION AND RECOMMENTATION

7.1 Summary

This study tried to find out the socio-economic status and the financial profitability of Tilapia farming of Bangladesh. Financial profitability was measured from different point of view. It was revealed that most of the farmers were in prime working age group. They completed primary level of education while a few of them were illiterate. Study also revealed that Tilapia farming was profitable. Benefit cost ratio, gross profit margin, net profit margin and break-even point indicated that Tilapia farming is profitable in the study area. It can be recommended from the study that Tilapia farmers should continue their business and should not give lease their land to the large farmers.

Freshwater aquaculture is an important and promising sector of the economy in Bangladesh. Over the years, production of freshwater aquaculture has grown significantly. Government is trying to sustain this growth performance which eventually ensures to achieve the projected production target of 4.55 million MT by 2020-2021. Bangladesh is ranked 5th in the world aquaculture production. Most of the people in Bangladesh depend on fish as principal source of animal protein. The demand of fish is increasing rapidly because of increasing population of Bangladesh. To fulfil this demand there is a crying need to cultivate quick growing fish under scientific method and management. In respect to different tilapia species, the following sections describe tilapia (*Oreochromi*s sp) culture with its production, distribution and marketing activities. Tilapia generally grows in rivers, haor, baor, beels and flood plains with natural care and culture of Tilapia would be successful and profitable in Bangladesh due to its fast growth, wider tolerance in water quality fluctuation, disease resistance as well as high market demand. Currently Bangladesh ranks 4^{th} position in tilapia production in the world and 3^{rd} in Asia.

Tilapia fish farms have sufficient liquidity for repaying current liabilities with current assets. They are capable of paying off its short-term liabilities that indicate the farms might be able to expand its operations. Both farms are sustainable and less risky to lend in future loans.

Here some specific objectives are address in the study:

(i) To assess the socio-economic characteristics of Tilapia fish farmers in the study area.
(ii) To find out the profitability of tilapia fish farmers in the study area.
(iii) To determine the factors affecting the productivity of tilapia farmers in the study area.
(iv) To identify the constraints of Tilapia fish farmers in the study area.

In order to achieve these objectives a farm survey was conducted in Cumilla, district in 2019 following stratified random sampling technique. Data were collected from a total of 75 samples of Tilapia farmers data were then summarized, tabulated and analyzed according to the objective of the study.

Simple profitability analysis of aquaculture production was measured in terms of gross return, gross margin, net return and BCR. Total variable cost was Tk 2,347,514.3 per hectare for tilapia fish farm where average water cleaning cost, fingerling cost, feed cost, temporary human labour cost, and miscellaneous cost were included. Again total fixed cost was 304,102.35 Tk/ hectare per hectare for Tilapia fish farm where average land use cost, cost of equipment, permanent labour cost were included. Considering all the sample farmers, per hectare gross return of Tilapia Tk Tk. 1,777,204.70. Per hectare net return was estimated at Tk. 329,618.29 per hectare. Here, BCR was calculated at 1.2434 for Tilapia farm considering all the sample farmers. Overall it may be calculated that both Tilapia fish farming is a profitable as for higher productivity. The farmers need to be very conscious about the inputs application, and this has to be made in the light of the inputs prices paid as well as the price of Tilapia received by the farmers.

In order to spread Tilapia farming throughout the country, it is necessary to make the farmers aware about the cost implications in the use of inputs. Proper input mixing given the prices can make aquaculture fish production further profitable. It is equally important to bring it to the notice of the farmers that it is not only the quantity but also larger size of fingerling that matters much to improve production. Because feed is the most dominant inputs in Tilapia fish production, efforts should be made to make it available at lower prices. Bangladesh has the potential to produce more Tilapia per unit of water area than what it is today. Thus, profitability should be further increased in the production of Tilapia. To facilitate getting higher price for the aquaculture farmer for their produce, government should encourage them to identify and enter into the external market. Based on the above consideration, the study puts forward the suggestions and implications for the policy plan.

7.2 Policy Recommendation

1. Profitability analysis revealed that Tilapia fish farming is a profitable venture in Bangladesh but at present that cost of feed is very high. Government should give subsidy on feed for encouraging Tilapia fish culture.
2. Proper scientific cultural method and management practices ensure the higher amount of profit from Tilapia fish culture and this helps the Tilapia farm owner to increase productivity. So, government should increase training facility on proper cultural and management practices of Tilapia fish culture.
3. Government should arrange program for disseminating information to the fish farmers related to Tilapia and other fish culture that will assist farmers to identify and solve the problems related to the fish farming.
4. Government should take necessary measures for proper extension work, which improve the social, moral, and scientific education among the farmers and neighbors; therefore the fish production including Tilapia fish will be ultimately improved.

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Appendices

APPENDICES

Appendix I. An Interview Schedule

DEPARTMENT OF DEVELOPMENT AND POVERTY STUDIES

SHER-E-BANGLA AGRICULTURAL UNIVERSITY
DHAKA 1207

An Interview Schedule for a Research Study Entitle

'Economic Analysis of Tilapia Fish Farmers in Some Selected Areas of Cumilla District in Bangladesh'

Respondent Name : Serial No.....

Village : Union: Upazila: Contact Number:

[Please provide following information. Your information will be kept confidential and will be used for research purpose only]

1. **Age of the Tilapia Fish Farmers**
   What is your present age? ..... Years
2. **Educational Status of the Tilapia Fish Farmers**
   What is the level of your education?
   a) Illiterate ( ) b. Can sign only ( ) c. Have passed class.....
   d. Did not read in School/Madrasha but can read and write and level of education is equivalent to class ..... as non-formal education
3. **Family Size of the Tilapia Fish Farmers**
   State the number of your family members.....
4. **Farm Size of the Tilapia Fish Farmers**
   Please mention the area of your land according to use

Sl. No.	Type of land use	Area of land	
		Local unit (Decimal/Bigha/others)	Hectare
A	Homestead area		
B	Own land under fish cultivation		
C	Own land under crop cultivation		
D	Area taken by a respondent to others on borga system		
E	Area Given by a respondent to others on borga system		
F	Cultivated area taken as lease by respondent from other		
Total = A+B+C+1/2(D+E)+F			

5. Experience in Tilapia Fish Farming

Mention how long you are involve in Tilapia Fish Farming..... Years

6. Annual Income of the Tilapia Fish Farmers

Please mention the income of your family in last year

Sl. No.	Source of income	Total Income (Tk.)/Year
A	**Agricultural Sector**	
	Fishery	
	Crops	
	Livestock	
	Poultry	
	Sub-Total (A)	
B	**Non-agricultural Sector**	
	Small Business	
	Service	
	Other family members' income	
	Day labor	
	Fishing	
	Others (if any, please specify)	
	Sub-total (B)	
	Total (A+B)	

7. Organizational Participation of the Tilapia Fish Farmers

Please mention the nature of your participation with the following organizations (Tick mark in right place)

Sl. No.	Organizations	No. Participation (0)	Nature and duration of participation		
			Ordinary Member (1)	Executive Member (2)	President/ Secretary (3)
1.	NGO Organized Group				
2.	Rural Arbitration Committee				
3.	Ansar/VDP				
4.	School Committee				
5.	Madrasha/Temple Committee				
6.	Fishery/Farmer Co-operative Society				
7.	Hat/Bazaar Committee				
8.	Youth Club Committee				
9.	Others (Please specify)				

9. Training Exposure of the Tilapia Fish Farmers

Did you receive any kind of training on fish culture in the last five years?

Yes...../ No.....(If yes, please furnish following information)

Sl. No.	Title of training course	Duration	Training offering organization
1.			
2.			
3.			
4.			
5.			
6.			
7.			
Total			

10. Per Hectare Production cost of Tilapia Fish Farming

Please answer the following questions

Sl. No.	Cost item	Cost (BDT/hectare) (average)
A.	**Variable cost**	
1.	Human labor cost	
2.	Fingerlings cost	
3.	Feed cost	
4.	Fertilizer cost	
5.	Water supply cost	
6.	Total run cost farm	
7.	Miscellaneous cost	
	Total variable cost	
B.	**Fixed cost**	
1.	Land use cost	
2.	Permanent labor cost	
3.	Interest cost on investment	
	Total fixed cost	
	Total cost (A+B)	

11. Per Hectare Return of Tilapia Fish Farming

Please answer the following questions

Sl. No.	Return item	Quantification of return
A.	**Production**	
1.	Harvest from Tilapia (kg)	
2.	Price of Tilapia (kg)	
3.	Harvest from other fishes (kg)	
4.	Price of other fishes (kg)	
	Total Return	

12. Mention the Factors that Affecting the Productivity of Tilapia Fish in this Area/Locality

Sl. No.	Factors	Extent of factors		
		High	Medium	Low
1.	Location of water body			
2.	Tilapia Fingerlings			
3.	Feeds			
4.	Management of pond			
5.	Polyculture			
6.				
7.				
8.				
9.				
10.				

13. Mention the Major Problems/Constraints of Tilapia Fish Cultivation in this Area/Locality

Sl. No.	Factors	Extent of constraints		
		High	Medium	Low
1.	Lack of quality fingerlings			
2.	Lack of Scientific Knowledge of Farming			
3.	Inadequate Extension Service			
4.	High Price of Inputs			
5.	Low Price of Output			
6.	Attack of Diseases			
7.	Lack of Operating Capital			
8.	Shortage of Human Labor			
9.	Natural Calamities			
10.	Others (Please specify)			

Thanks for Your Co-operation

Signature of the Interviewer with Date