PROFITABILITY ANALYSIS OF CAGE FISH CULTURE: A STUDY IN CHANDPUR DISTRICT, BANGLADESH

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PROFITABILITY ANALYSIS OF CAGE FISH CULTURE: A STUDY IN CHANDPUR DISTRICT, BANGLADESH

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

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DEDICATED TO

MY Beloved PARENTS

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ABSTRACT

Fisheries sector in Bangladesh has been playing a vital role in the economy of Bangladesh from the time immemorial. The contribution of agricultural sector to Gross Domestic Product (GDP) is about 14.2 percent in the FY 2017-18 of which fisheries sub-sector contributed about 3.61 percent to the broad agricultural sector Gross Domestic Product. The overall objectives of the present study were to examine socio-demographic profile of fish producing farmers, to assess profitability and cage fish farming. Chandpur district was selected for the study on the basis of extensive cultivation of fish. Simple random sampling technique had been used for collecting data from 106 sample farmers through interview schedule. After analyzing the data, net return, and gross margin were found to be Tk. Tk. 13680 & Tk 28680, respectively. Total costs of fish production were calculated at Tk. 48320 per cage fish production. Benefit Cost Ratio (BCR) was found to be 1.59 for cage fish farming. Thus it was found that cage fish farming was highly profitable. This study also identified some of the problems and constraints associated with cage fish farming. These were categorized into economic, technical and social problems. Problems faced by the farmers were ranked on the basis of corresponding percentages.

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ABBREVIATIONSANDACRONYMS

BARC :Bangladesh Agricultural Research Council
BB :Bangladesh Bank
BBS :Bangladesh Bureau of Statistic
BCR :Benefit Cost Ratio
BER :Bangladesh Economic Review
DAE :Department of Agricultural Extension
DoF :Department of Fisheries
EU :European Union
et al. :and others (at elli)
FFP :Fourth Fisheries Project
FRI :Fisheries Research Institute
GDP :Gross Domestic Product
GNP :Gross National Product
GR :Gross Return
ha :Hectare
HSC :Higher Secondary Certificate
IOC :Interest on Operating Capital
JSC :Junior School Certificate
kg :Kilogram
MFC :Marginal Factor Cost
MPP :Marginal Physical Product
MT :Metric Ton
MVP :Marginal Value Product
MV :Modern Varieties
NGOs :Non Government Organizations
No. :Number
OC :Operating Capital
PL :Post Larva
PSC :Primary School Certificate
SPSS :Statistical Package for Social Sciences
SSC :Secondary School Certificate
sq. km :Square Kilometer
TC :Total Cost
TFC :Total Fixed Cost
Tk. :Taka
TVC :Total Fixed Cost
USA :United States of America
UFO :Upazila Fisheries Office

CHAPTER I

INTRODUCTION

1.1 General Background

Bangladesh is a land of thousands of potentialities. In spite of having only a total area of 147610 square kilometer, it nurtures almost 166.37 million population with shielding affection (BBS,2018).The economy of Bangladesh is mainly based on agriculture still now but the contribution to GDP is now 14.2% for agriculture and 3.61&of the fish sector (BBS,2018). About 11% of total population is dependent on fisheries (Hossain, 2014). As the contribution of agriculture in national economy declining but new, modern agricultural practices can guide us to new hopes of future. Here comes the modern concept of a sustainable livelihood- Aquaculture. Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated. For statistical purposes, aquatic organisms which are harvested by an individual or corporate body which has owned them throughout their rearing period contribute to aquaculture, while aquatic organisms which are exploitable by the public as a common property resources, with or without appropriate licences, are the harvest of fisheries (FAO,1998)

Demand is increasing for fish and fish protein resulting from widespread overfishing in wild fisheries. The fisheries can broadly be classified into three categories: inland capture fisheries, inland aquaculture and marine fisheries of which the inland aquaculture sector is contributing more than 55% of the total production (DoF, 2016). The fisheries sector plays a very important role in the national economy, contributing 3.69% to the Gross Domestic Product (GDP) of the country and 22.60% to the agricultural GDP (FRSS, 2016). Over the last 10 years (2004-2005 to 2013-2014 FY), the fisheries growth was fairly steady and at an average of 5.38% per year (FRSS, 2015). This sector experienced more or less consistent growth rate, ranging from 7.32% growth in 2009-2010 to 4.04% aquaculture production, which accounted for half of the country's total fish production (55.15%) (DoF, 2016). In 2014-2015, total fishery production of Bangladesh was 3,684,245 metric tons, of which 1,023,991 metric tons was obtained from inland capture fisheries, 2,060,408 metric tons from inland aquaculture and 599,846 metric tons from marine water production (FRSS, 2016) . There have been few reviews of the development and potential of fisheries and aquaculture in many parts of Bangladesh published and no studies have been published on the present status of fisheries in Bangladesh.

Fish can be cultivated extensively and intensively. Within intensive and extensive aquaculture methods, numerous specific types of fish farms are used; each has benefits and applications unique to its design. They are cage system, pond system, composite fish culture,Integrated recycling systems,Classic fry farming.

Now a day, cage culture is receiving more attention by both researchers and commercial producers. Factors such as increasing consumption of fish, declining stocks of wild fishes and poor farm economy has increased interest in fish production in cages. Very small or marginal farmers are looking for alternatives to traditional agricultural crops. Aquaculture appears to be a rapidly expanding industry and it offers opportunities even on a small scale. Cage culture also offers the farmer a chance to utilize existing water resources in which most cases have only limited use for other purposes.

Cage aquaculture involves the growing of fishes in existing water resources while being enclosed in a net cage which allows free flow of water. It is an aquaculture production system made of a floating frame, net materials and mooring system (with rope, buoy, anchor etc.) with a round or square shape floating net to hold and culture large number of fishes and can be installed in reservoir, river, lake or sea. A catwalk and handrail is built around a battery of floating cages. Economically speaking, cage culture is a low impact farming practice with high returns and least carbon emission activity. Farming of fish in an existing water body removes one of the biggest constraints of fish farming on land, ie., the need for a constant flow of clean, oxygenated water. Cage farms are positioned in a way to utilize natural currents, which provide the fish with oxygen and other appropriate natural conditions.

In view of the high production attainable in cage culture system, it can play a significant role in increasing the overall fish production in Bangladesh. Suitable locations in Bangladesh long coastline, vast brackish water areas available in coastal states and other underutilized water bodies can be better utilized by adopting cage culture. Since the investment is low and requires very little / no land area, this farming method is ideal for small scale fisher folks as an alternative income source. This can be taken up as an household / women activity since labor involved is minimal and can be managed by a small family. The design of the cage and its accessories can be tailor-made in accordance to the individual farmer’s requirements.

1.2. Research Objectives

The main focus of the study is to identify the ‘Profitability Analysis of Cage Fish Culture: A Study in Chandpur District, Bangladesh. The specific objectives are as follows:

1. To know the socioeconomic profile of cage fish culture fish of practicing farmers under the study areas.

2.To measure the profitability of fish farming through cage culture.

3. To identify the problems in cage fish farming and suggest some policy recommendations for the improvement of cage fish farming practies.

1.3Justification of the Study

Cage culture is being popular day by day to the poor farmer of Bangladesh. This research is conducted in the Chandpur of Bangladesh. This region is very important for the fisheries production as it is near to Dakatia River. Most of the fishermen live on it and they are related to the cage cultivation. In this research we need to know the productivity of fish farmers.To know the socio economical condition of fish farmer in Chandpur district fish farmers we need this research work. In this research work by using SPSS software and logit model we can slove the problem. The findings of the study would be helpful drawing hypothetical thought of a cage fish farmer all over the country. This study will also inspire other researchers to conduct same sorts of research in the other parts of the country. Lastly, this study will be helpful to the policy makers to decide further institution of cage culture in order to educate the farming community about cage culture fish farming thought out the country.

1.4 Limitations of the Study

Considering the time, money and other necessary resources available to make the study manageable and meaningful, it was necessary to consider the following limitations:

1. The study was confined to four villages of two Upazillasof Chandpur district.
2. There were many farmers in the study area, but only the farmers who were trained on cage culture were considered for this study.
3. For information about the study, the researcher was dependent on the data furnished by the randomly selected trained cage farmers during interview with them.
4. Characteristics of the farmers were many but only eleven characteristics were selected for investigation in this study.
5. The researcher had to depend on data information furnished by the respondents. As most of the farmers do not keep records of their

farming activities, they furnished information to the different questions by recall.

6. The present study highlighted a new dimension of research in the field of development and poverty studies in Bangladesh. So, the researcher could not provide sufficient evidence in equipping the study report with relevant literature reviews.

1.5 Organization of the Thesis

The study imprisons five chapters. The current chapter is the introduction and is divided as follows: (1) Background to the study (2) Objectives of the study (3) Justification of the study (4) Limitation of the study (5) Organization of the thesis and (6) Conclusion. The 2nd chapter provides a brief review of existing literatures. Chapter three deals with the methodology and analytical techniques of the study. In chapter four result and discussions are presented. Finally the summary, recommendations for cage farming and conclusions are discussed in chapter five.

1.6 Conclusion

Cage culture is a new concept to the fish farmers in our country. A fisherman plays an important role in economic development. Cage culture technology enhances the growth of fish farming. In the recent time, cage fish farming practice is being adopted by many farms in different areas. It is expected that, this practice would help improving the economic condition of the farms.

CHAPTER 2

REVIEW OF LITERATURE

2.1Introduction:

The main objective of this chapter is to review the past research works. Firstly the chapter focuses conceptual relationship between aquaculture and poverty. These include how poverty related to the aquaculture. Secondly it represents some past thesis work which related to cage culture and livelihood. Finally the chapter summary is presented.

2.2 Conceptual relationship between aquaculture and poverty:

Aquaculture has direct and indirect impacts on poverty. The indirect impacts are income, consumption and farm sustainability. Direct impacts affect the welfare of aquaculture adopting household through for example increase income and consumption. This would be significant if the poor adopt the aquaculture. There are many constraints to adoption for poor, they are less capital and less knowledge and high risk. Extensive or semi-intensive systems are more pro-poor than intensive systems, as the poor are often unable to purchase the large amounts of inputs such as feed and seed used in intensive systems (Irz et al., 2007)

Increased household food security through on-farm consumption of nutritionally rich food is an important potential direct benefit (Prein and Ahmed, 2000). Brummett et al. (2008) suggest that although rarely captured in official statistics, small-scale integrated aquaculture systems promoted by governments and development agencies since the 1970s have had substantial impact on rural food security. Other potential direct benefits include increased farm sustainability through constructing ponds which also serve as on-farm reservoirs, and improved farm productivity (leading to potentially higher incomes and fish consumption) through Integrated Agriculture Aquaculture (IAA) technology, exploiting synergies between production systems, enabling more effective use of conventional inputs like labour, organic fertilizer and capital, along with conserving the environment (Edwards, 2000; Dey et al., 2007).

Indirect poverty impacts also affect welfare of poor and non poor farmers. Aquaculture increases the fish supplies by increasing availability and lowering the price of fish. If only high-value species are farmed, it is unlikely these potential nutritional benefits will affect the poor (Irz *et al*., 2007a). Aquaculture development can increase employment both full time and seasonal employment of unskilled labour. The labour intensities of different aquaculture systems influence their relative potentials for poverty reduction (Irz *et al*., 2007). Aquaculture also increase the economic growth by creating employment, increasing wage through the production linkage.

2.3:Cage Culture Related Studies:

Wiriy *et al*. (2013) concluded that Cage culture globally is hugely varied, ranging from subsistence level holding of a few kilos of fish in small nets to salmon farms producing more than 5 000 tonnes per year. In Asia more than 50 species are reared in various forms of cage culture. Cage culture can be very profitable, but it is also risky and its success is dependent on local circumstances. The examples of successes in salmon culture, tilapia, spiny lobster and Asian seabass reveal a range of factors which have underpinned the development of the industry in other parts of the world. Strong market demand and well established marketing networks are critical in all cases. In Asia, the availability of both wild seed and low value 'trash' fish has been critical to the early stages of development of many forms of cage aquaculture. In the case of tilapia the increasing availability of pelleted feed and the demands of the market for consistent and high.

Ferreira (2013) reported that the aquaculture growth required to meet increasing protein demand by a growing world population, predicted to reach 9 billion people by 2050, is driving innovation in both siting and culture practice. Limited possibilities for expansion on land and in inshore coastal areas, and technological improvements in farming structures, have led to widespread interest in offshore aquaculture. A gilthead bream (Sparus aurata) model has been developed and integrated with existing shellfish models in the Farm Aquaculture Management System (FARM) model, in order to analyze various aspects of onshore and offshore aquaculture. The FARM model was used to compare the quantitative effects of finfish monoculture with Integrated Multi-Trophic Aquaculture (IMTA) in ponds, in terms of production, environmental externalities, and economic performance. Very clear benefits of IMTA could be seen in the comparison. The same approach was then applied to offshore culture, considering a combination of gilthead in cages and Pacific oyster (Crassostrea gigas) suspended from longlines. For offshore culture, the primary production and diagenesis modules of FARM were switched off, since there are no feedbacks from those processes to the farm area. We calculate the environmental benefits of IMTA both in terms of population-equivalents and the potential for nutrient credit trading. The finfish model integrated in FARM deals explicitly with the metabolic energy cost of opposing offshore currents in cage culture, and a model analysis suggests that gilthead cultivation at current speeds in the range of 0.1 to 0.5ms-1is optimal. The lower end of that spectrum probably translates into a greater deviation from the fillet quality obtained from wild fish, and above that limit there is a rapid increase of the feed conversion ratio (FCR) and cultivation becomes financially unattractive.

Mangaliso J.Gondwe (2012) found that Cage culture of native tilapiine cichlids was initiated in Lake Malawi in 2004. The lake is well known for its highly endemic ichthyo diversity, and it is estimated to have more species of fish than any other lake in the world. Consequently there is concern about the impact of cage farming operations on the wild fish communities. In 2007, high densities of diverse wild fish were observed around the cages and stable isotopes, δ13C and δ15N analyses, established that cage wastes were incorporated in the food web that supported diverse wild fishes in the vicinity of the cages. Comparison of δ13C and δ15N signals of caged and wild fish caught in 2007 in the vicinity of the fish farm and signals of fish samples caught between 1995 and 1997 before the fish farm was started in 2004 established a shift in the isotopic signatures of wild fish indicating the incorporation of cage wastes into the wild fish diet. Sedimentation of cage wastes collected in sediment traps below the fish cages was also confirmed using the δ13C and δ15N analyses. The accumulation of the cage wastes in the sediments below the cages was, however, minimal as indicated by the small differences in the isotopic ratios between the bulk sediments and some sedimentary organisms (bivalves, snails and earthworms) under the cages relative to ratios in similar organisms at control stations. The low impact of cage wastes on underlying sediments and benthic organisms was due to the rapid and efficient dispersion of the cage wastes facilitated by water currents through the fish farm which averaged 9.3cms-1as well as the consumption and subsequent dispersion of cage wastes by the large numbers of wild fishes which aggregated around the cages. This study has also shown that in Lake Malawi, fish rather than benthic organisms and plankton material may be a more sensitive monitor of the dispersion of cage wastes. © 2012 Elsevier B.V.

The traditional cage culture techniques in Cambodia and the adaptations of these techniques used in the Republic of south Viet-Nam were studied by Pantulu (1979). In Cambodia, cages are made of bamboo poles and splints which are often reinforced with wooden planks and beams. Cages vary in size from 40 to 625 m Super (3), and the major genera cultured include Pangasius, Clarias, Channa and Oxyelestris. Fry for stocking are obtained from natural sources and fish are fed with local vegetable or animal products. According to a survey conducted in 1969, there were 946 cages operating in Cambodia. Cages culture was initiated in the Republic of south Viet-Nam by immigrants from Cambodia, although the technique is rapidly gaining popularity with South Vietnamese fishermen and entrepreneurs. There are now an estimated 10,000 cages operating in the Republic of South Viet-Nam. Cages vary in size from 60 to 181 m Super(3) and have an average life of 10 yrs. The most important genera cultured include Barbus and Leptobarbus (in 60.7% of the cages), Pangasius (20.2%), and Channa (17.9%). Fry are collected from natural sources with weirs, traps, seine nets and dip nets, and stocked at densities varying from 80 to 361 fry/m

Super(3). Fish are fed with local vegetable and animal products and the average feed conversion rate is 4.0. Period of culture ranges from 9 to 11.5 months depending on the species and annual harvest of 3,000-25,000 kg/cage/yr is valued at US $2,500 to US $31,500. Operating costs for cage culture in the Republic of South Viet-Nam exceed capital investment by 120 to >300% while net returns on total costs are generally between 12 and 44%. Cage culture is not subject to the many inherent problems of pond culture and it is recommended that more emphasis should be placed on developing sound cage-culture practices.

Yongjian Xu (2004) found that the increasing production of sea food mainly depends on the developing mari-culture. Cage culture is intensive-culture and affects enormously their ambient waters. During the past 20 years, cage culture expended very rapidly, and the marine environment of cage area was worsen. This article reviews the impacts of cage culture on the aquatic environment, using studies published in the last 20 years. The impacts are numerous, including water pollution, impact on the sediment, genetic pollution, chemical pollution, and their resulting impacts on biodiversity in coastal sea.

Beveridge(1997) reported that Cage aquaculture in lakes and reservoirs continues to expand and intensify, especially in Asia, despite conflicts in resource use and social inequity, problems arising, from waste production and questions regarding sustainability. Environmental impacts arise from the consumption of resources (environmental goods) and the production and release of wastes into the environment, which is relied upon to disperse and assimilate those wastes (environmental services). Cages may have slightly greater demands than ponds in terms of consumption of environmental goods and services per unit fish production. However, environmental impacts are much more strongly related to intensity of production methods and scale of development within a lake or reservoir. In view of the likely scale of operation, cage-based hatcheries and nurseries are unlikely to pose much of an environmental threat. In some circumstances such impacts may be beneficial in terms of enhanced fisheries production. Problems of resource use conflict may be anticipated by addressing questions of ownership of the lake or reservoir and the use and control of resources within tile water body.

Hambrey (2010) reported that recent studies on cage aquaculture and its potential for poverty alleviation have been completed in Bangladesh in association with local NGOs.

Kabir Chowdhury (2000) found that a total of 5488 ha of oxbow lakes in Bangladesh has recently gained importance as a potential fishery resource. The growing need to utilize this resource to a fuller potential requires consideration of cage culture by resource-poor fishing communities as a compliment to existing stock enhancement programmes. The existing management systems of eight lakes are reviewed. Water quality was analysed with reference to the largest lake, i.e. Lake Baluhar. During the study, > 100 cm transparency indicated the suitability of a lake for cage culture. Other water quality parameters, especially dissolved oxygen, ammonia and nitrite concentrations, also indicated suitability for cage culture. Non-fisheries activities, such as the use of agricultural pesticides in the lake catchment and jute retting in its basin, were identified as the most harmful to fish by the majority of the fishermen. An integrated pest management programme using rice-fish based rearing systems in the lake catchment is recommended. It is further recommended that a unified management system should replace the existing dispersed systems under different management bodies.

Rifai (1980) conducted experiments to control reproduction of Tilapia nilotica using cage culture compared with growth and reproduction in ponds. Three rearing densities (5, 15, and 45 fish per cage), and three kinds of aquatic plant (Hydrilla sp., Lemna sp., and Chara sp.) were used as feed. Results of the study showed that Tilapia reproduced in both cages and ponds; however, the intensity of reproduction was low. Growth rates of fish reared in cages were higher than those of fish reared in ponds. Lemna sp. as feed gave the best results in terms of growth rate and protein content of fish flesh. There was no interaction between feed and rearing density.

Hambrey (1999) a description is given of the marine cage culture component of a research project to develop sustained small scale cage fish culture, conducted in KhanhHoa Province, Viet Nam. A field study was conducted in early 1998 to identify the present status and future potential of grouper seed supply, from ecological, technical and socio-economic perspectives. A range of existing and possible future options for marine cage culture is being explored in terms of their sustainability and suitability for poverty alleviation. It is concluded that cage culture of marine lobsters and finfish in Khanh Hoa Province is profitable, and can be undertaken on a small scale. It therefore has clear potential for the generation of increased income to poor local people. The major constraints to further development at the present time appear to be the high cost and probable inadequate supply of wild seed, and lack of access to low interest capital. Although hatchery production of grouper seed is possible, it is difficult and risky. A possible easier alternative is seabass, which is now routinely produced in hatcheries in Thailand.

Denes Gal *et al*. (2011) concluded that the intensive cage culture has an adverse effect on the quality of water due to the high nutrient discharge of intensive fish culture. The combination of the intensive cage and the extensive aquaculture exploits the advantages of traditional pond farming and intensive fish culture systems. Valuable predatory fish species can be produced in the intensive part of the system, whilst the integration of an extensive pond as a treatment unit results in decreased nutrient loading to the environment and increased nutrient recovery in fish production. The combination of cage and pond fish farming is a new method for predatory fish production in fishponds. By the exploiting of the traditional fish ponds with intensive fish production in cages makes possible for the traditional carp farmers to increase their production capacity, diversify the cultured species and recycle the nutrients within the production systems.

Hall *et al*. (1986) reported that cultivation of fish in floating net cages increased rapidly during the 1970's. It was not until recently that investigations on environmental impact of fish cage farming were initiated. The need for such studies has increased due to the intensified use of the cage culture technique. A project designed to study environmental impact of a fish cage farm in the marine environment is presented. Results from measurements of sedimentation, benthic fluxes of nutrients in-situ, sediment oxygen uptake, gas ebullition, and chemical composition of sediments and pore waters are presented.

Shariff *et al*. (2000) observed that the cage culture industry is a relatively recent development in Malaysia with large scale farming in marine water taking off only in the 1980's and in inland waters in the 1990's. In 1997, total production from cage farms amounted to 7,314 tons or 8% of the total aquaculture production. However, cage farm output amounted to US$ 29 million or 18% of the total aquaculture value. Production was oriented largely towards production of high valued finfish for the live trade. In 1997, there were 58,500 marine cages in the country with a total area of 680,893 m super(2). Production amounted to 5,621 tons valued at US$ 26.4 million. Unit production from marine cage farms averaged about 8.5 kg/m super(2). The average wholesale price of cage farmed marine finfish in 1997 was US$ 4,696/tonne. The main finfish reared is the sea bass (Latescalcarifer), which in 1997 accounted for 50% of the total finfish production and 35% of wholesale value. Other fishes reared include the groupers (*Epinephelus sp.*) and mangrove jacks (*Lutjanus spp*.). Though groupers account for only 14% of the finfish production, they accounted for 28% of the total value. The snappers (mangrove and red snappers) and tilapia which accounted for just 5% of the total cage culture output in 1992, accounted for nearly 50% in 1997. Major constraints include seed supply, congestion of existing sites and lack of new sites for expansion. In inland waters, the number of units rose to 200% over 1992-1997, from 2,152 to 6,516 units. As with marine cage culture, the emphasis is on the production of live fish for the restaurant market. However, the value of the freshwater fish output (average wholesale value US$ 1,426/ton) is generally lower than that of cage farmed marine fish. Production increased to 250% from 484 tons in 1992 to 1,693 tons in 1997, while its contribution to overall freshwater fish production increased from 3% in 1992 to 5% over the same period. Unit production rates ranged from 18-23 kg/m super(2). The main species cultured include the tilapia (*Oreochromis niloticus*), sultan fish (*Leptobarbushoevenii*), mystid catfish (Mystusnemerus) and striped catfish (Pangasius sutchii). Smaller quantities of Javanese carp (Barbodesgonionotus), common carp (*Cyprinus carpio*) and grass carp (*Ctenopharyngodonidella*) were also produced. The future for cage culture development in Malaysia is promising, especially for freshwater cage culture. There are over 206,000 ha of reservoir area in the country suitable for inland cage culture. However, the market for freshwater fish is more limited. On the other hand, the scenario facing marine cage culture appears to be more limited. Though markets are not constraining, the limited resource base, disease, feeds and seed supply are serious impediments to the continued growth of marine cage farming.

Huguenin (1997) reported that the commercial culturing of fish in cages has expanded significantly in the past 20 years. While most of this expansion has been with salmonid species, there is still considerable worldwide diversity of cage culture species and culture conditions. Trends are toward larger individual cages and more exposed sites. Many interactive site, species, environmental, engineering, economic and operational factors must be considered during the cage system design process. This process is reviewed and potential problems in design and operations are discussed. ‘Rules of good practice’ are provided as guidance in avoiding potential pitfalls.

Lin (2000) found that despite its long history and a large number of rivers and reservoirs in Thailand, cage culture contributed only 0.3% of 200,000 tons in total fish production from freshwater aquaculture. Over the last decade, the peak of annual fish production from freshwater cages reached 2,700 tons in 1991 and declined since to a minimum of 600 tons in 1995. Although cage culture takes place in various habitats such as river, reservoirs, irrigation canals and large ponds, its predominant habitats are in flowing waters. Among a dozen of cultured species, red snake-head (*Channamicropeltes*), catfish (*Pangasius spp*.), marble goby (*Oxyeleotrismarmoratus*) and tilapia (*Oreochromis spp*.) topped the list. The production of those species fluctuated drastically resulting mainly from deteriorating water quality, competing for trash fish feed, changing market value, and shifting culture practices. However, disease and fingerling supply caused the reduction and limitation in culture of the most valued marble goby. Recently, the cage culture of tilapia has gained great popularity in certain parts of the country. Cage culture has been a small-scale, artisanal operation with little research and technical innovation. Further development of cage cultures in freshwater lies on ecologically sound multiple uses of reservoirs and flowing waters. In addition, integration of intensive cage culture with semi-intensive species in ponds should also be promoted.

Guerrero (1982) reported that The Philippines has vast freshwater resources for cage culture of fish. Two tilapia species, Tilapia mossambica and Tilapia nilotica, are cultured commercially in cages in several lakes. Field testing for cage culture of Tilapia nilotica, the preferred species is described. A pilot commerical cage farm has been established. The major problems affecting development are the short supply of quality fingerlings, the lack of a standard commercial feed, and the increasing costs of cage construction. Recommendations for resolving these problems are given.

CHAPTER III

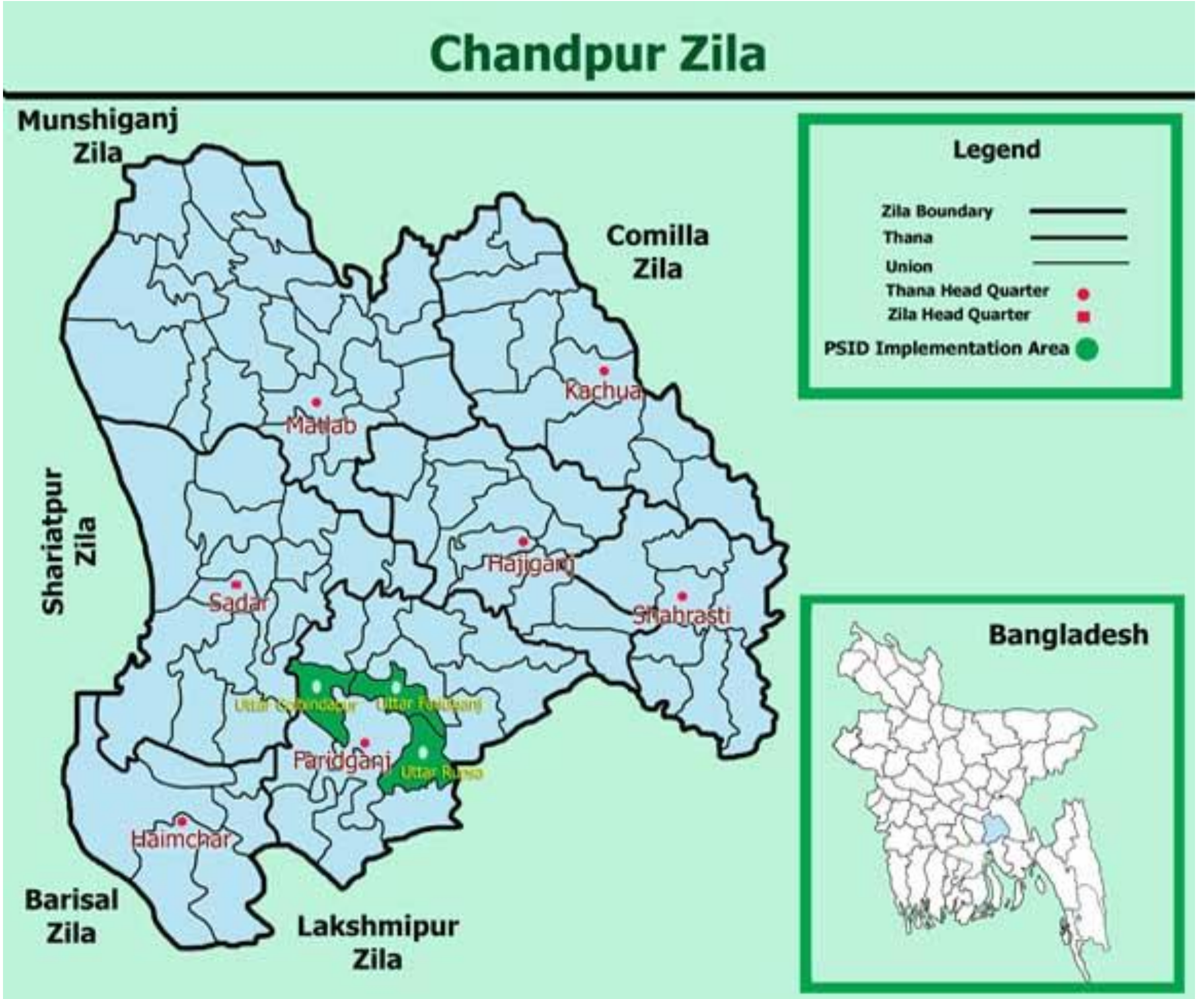
METHEDOLOGY

Methodology is an important and integral part of research which determines whether a scientific research will be fruitful or not. As such careful consideration is to be given in order to organize methodology to make the study systematic. A proper methodology helps researcher collecting valid and reliable data for arriving at fruitful decisions. Themethods and procedures followed in conducting this study has been described in this Chapter and are presented below in the following sections and sub-sections.

3.1:Locale of the Study :The locale of the study was Bagadi and Raghunathpur of Chandpur sadar upazila and Noyani Luxmipur in Haimchar upazila.According to (2011 Bangladesh census) Chandpur sadar had 85062 households and population of 436680 of whom 49.84% were female.

On the other hand Haimchar has 20946 households and total area of 174.49 km^2.According to (1991, Bangladesh census) Haimchar had a population of 113,306 where males 51.29% and female48.71%.This study area was 100 km south-east from Dhaka .Most of the people of this village are cage farmers .They cultivate fish in the Dakatia river on cages. That’s why this villages were selected. A map of Chandpur sadar and Haimchar upazila is presented below:


CHANDPUR
SADAR UPAZILA
90°34'
90°38'
90°42'
90°46' E
23° 20' N
23° 16'
23° 12'
23° 08'
90°36'
Padma R
Meghna R
Lower Meghna R
Dhonagoda R
Dakatia R
Bishnupur
MATLAB
Rajrajeshwar
Ashikati
Kalyanpur
Shah Mahmudpur
HAJIGANJ
Tarpur Chandi
Maishadi
Rampur
Paurashava
BHEDARGANJ
Puran Bazar
CHANDPUR SADAR
Baghadi
FARIDGANJ
Sakhua
Balia
Ibrahimpur
Hanarchar
Chandra
HAIM CHAR
1 0 1 2 km


Chandpur Zila
Munshiganj Zila
Comilla Zila
Shariatpur Zila
Barisal Zila
Lakshmipur Zila
Legend
Zila Boundary
Thana
Union
Thana Head Quarter
Zila Head Quarter
PSID Implementation Area
Bangladesh
Matlab
Kachua
Hajiganj
Shahrasti
Sadar
Faridganj
Haimchar

3.2: Population and Sampling Design: The farmers who cultivate fish in the cage were selected with the help of fisheries officers and local farmer of the study area. A total number of 106 farmers where randomly selected from the list. Thus the selected farmers where interviewed to gather the required information for the study.

3.3: Selection of Variables: The researcher employed good care in selecting variables of the study. Considering personal, economical, social, psychological, factor of rural community, time and resources availability of the researcher and discussing with relevant experts, the researcher selected the variable for the study. How cage culture practice change the livelihood of the fish farmers is the main focus of the study. The researcher selects 11 characters. These were: age, education, family size, annual family income, peer group influence, cosmopolitans, extension media contact, organizational participation, innovativeness, fatalism and problems faced by the cage farmers in fish farming.

3.4: Data collection: The researcher himself collected data from the respondents using of interview schedule through personal interviewing. Assistant Fisheries Officer and village representatives of the selected villages helped to introduce the respondents with the researcher. The researcher collected data using pre-tested interview schedule and on the basis of pre-test experiences necessary corrections, additions, modifications and alternations were made before finalizing the interview schedule for final data collection. Appointment with the respondents was made in advance with the help of Fisheries officer. The researcher took all possible care to establish rapport with the respondents so that they don't hesitate to answer to the questions and statements. Whenever any respondent faced any difficulty in understanding any question care was taken to explain the same clearly. Data collection was done in February, 2018. However, researcher didn't face any serious difficulties during data collection because the respondents and other villagers of the study area were very much helpful and cooperative.

3.5: Processing of Data: The collected raw data were examined thoroughly to detect errors and omissions. Qualitative data were converted into quantitative data by means of suitable scoring whenever necessary. For this the collected data were given numerical coded values. The obtained data were then compiled on a master sheet and then tabulated and analyzed with keeping the objectives of the study in mind.. The researcher contacted different relevant sources such as books, journals, articles, theses, abstracts, and internet in order to set a concrete research plan and to delineate the research background.

3.5.1: Data Analysis: The statistical measurement used in describing the selected explanatory and focus variables were frequency distribution, range, mean, percentage and standard deviation whenever necessary. To clarify the understanding tables were used in presenting data. Some figures were also used for clarification.

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

3.5.2: Calculation of Gross Return

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

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

3.5.3: Calculation of Gross Margin

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

3.5.4: Calculation of Net Return

Net return or profit was calculated by deducting the total production cost from the total return or gross return. That is, Net return = Total return – Total production cost. The following conventional profit equation was applied to examine farmer's profitability level of the fish producing farms in the study areas.

Net profit, $\pi = \Sigma PmQm + \Sigma PfQf - \Sigma (Pxi\ Xi) - TFC$.

Where, π = Net profit/Net return from fish farming (Tk/ha);

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

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

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

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

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

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

TFC = Total fixed cost (Tk/ha); and

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

3.5.5: Undiscounted Benefit Cost Ratio (BCR) Average

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

BCR= Total Return/ Total Cost

CHAPTER 4

SOCIOECONOMIC PROFILE OF CAGE CULTURE FISH FARMERS

4.1 Introduction

This chapter deals with the socioeconomic characteristics of the sample farmers. Socioeconomic characteristics of the farmers are important in influencing production planning. People differ from one another in many respects. Behavior of an individual is largely determined by his/her characteristics. There are numerous interrelated and constituent attributes that characterize an individual and profoundly influence development of his/her behavior and personality. It was, therefore, assumed that enterprise combination, consumption pattern, purchase pattern, and employment patterns of different farm household would be influenced by their various characteristics. In the present study farmers were taken from the Chandpur sadar upzilla and Haimchar upzilla respectively. Finally socioeconomic aspects of the sample households were examined. These were family size and composition, age distribution. Occupation, level of education, involvement of women, land ownership pattern etc. A brief discussion of these aspects is given below.

4.2 Involvement of men and women in fish farming

Women in our country are the most deprived one but at present this situation is changing. About half of the population of our country is women. So without their development, the total social and economical development of our country is not possible. In the present study, involvements of men and women are fish farming. It is evident from the table 4.1 that 92.45 percent male farmers has a fish farm, 11.43 percent women farmers has a fish farm. So the result implies that involvement of women in fish farming activities were very small.

Table 4.1: Distribution of the sample fish farming according to gender group

Particulars	No. of respondent	% of respondent
Male	98	92.45
Female	8	07.55
Total	106	100

4.3 Age Distribution of the sample farmers

Age of farmers have an influence on the production and in the better management of the farming system. Some researchers think that older farmers are more experienced and more efficient in resource use. Other researchers comment that younger farmers are eager to adopt improved technology than older.

In the present study, all categories of farmers of the study area were classified into different age groups as presented in Table 4.2. It is evident from the table that most of the farmers were middle aged in the study area. The fish producing farmers were classified into three age groups: up to 35 years, 36-50 years and above 50. Out of the total sample farmers 37.70 percent belonged to the age group of up to 35 years, 55.66 percent belonged to the age group of 36-50 years and 6.61 percent fell into the age group of above 50 years. This finding imply that majority of the sample farmers were in the most active age group of 36-50 years indicating that they provided more physical efforts for farming. This age group is supposed to have enormous vigor and risk bearing ability.

Table 4.2: Distribution of the cage cultivators according to their age

Particulars	No. of respondent	% of respondent
15-35	40	37.73
36-50	59	55.66
>50	7	06.61
Total	106	100

4.4 Educational status of the respondents

Education is generally regarded as an index of social improvement of a community. It plays a critically important role in reducing poverty and inequality, improving health and enabling the use of knowledge. Education means efficiency. Education of farmers helps to increase skill and productivity as well. Education plays an important role in accelerating the pace of agricultural development and it greatly influences the level of adoption of new technology and enriches scientific knowledge regarding farming. It is evident from table 4.3 that out of 106 sample farmers, 2.83 percent farmers can’t read and sign, 4.72 percent farmers can sign only, 34.92 percent farmers had primary education, 44.34 percent farmers had completed Secondary education, 11.32 percent farmers had completed higher secondary, 1.87 percent farmers had completed their higher secondary education.

Table 4.3: Distribution of the sample farmers according to the level of education

Category	No. of respondent	% of respondent
Can’t read and sign	3	2.83
Can sign only	5	04.72
Primary education	37	34.92
Secondary education	47	44.34
Higher secondary	12	11.32
Above higher secondary	2	01.87
Total	106	100

4.5 Occupational status of the fish farming farmers

The work in which a man was engaged more or less throughout the year was considered as the occupation of the person. The distribution of principle occupation is fascinating because it varies greatly depending on how much they are involved and what level of income is earned from the present occupation. In the present study, the selected farmers were engaged with various types of occupation along with fish farming. It was observed that, on the consideration of main income generation, fish farming was the principle occupation for cage fish farmers. Some of them had opportunity to be engaged in other activities. Occupational status of the sample farmers are shown in the following fig. 4.1 and 4.2. It is evident from the figure that 77 percent and 18 percent farmers were involved in fish farming as a main and subsidiary occupation. After that small business was their second most important occupation. Very few of them were also involved in animal husbandry, agriculture and service etc

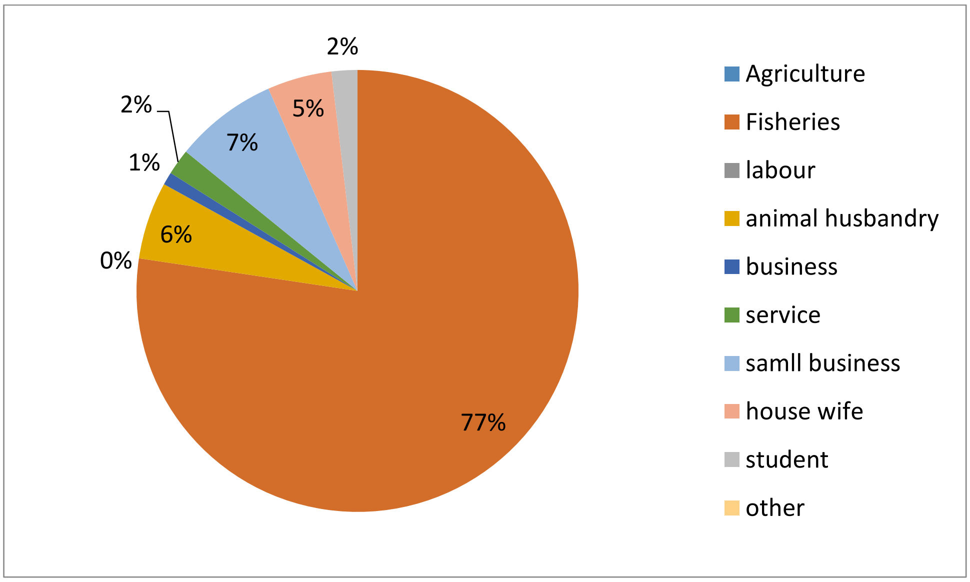


Fig.4.1: Distribution of the farmers based on main occupation

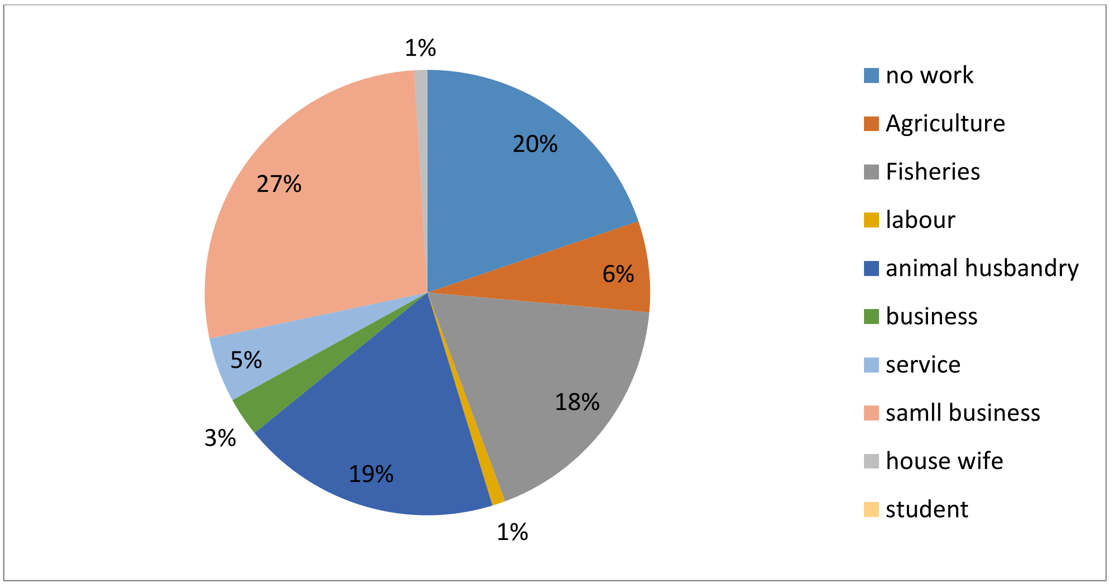


Fig.4.2: Distribution of the farmers based on sub occupation

4.6 Involvement of family members in fish farming

In the present study, involvements of family member in fish farming were categorized into three categories on the basis of level of engagement of family worker in fish farming dignities: 1 worker in fisheries activity, 2 person workers in fisheries activity and 3 person workers\ in fisheries activity. It is evident from the fig. 4.3 that 61 percent farmers used 3woker in their farm, 32 percent farmers used 2 workers in their farm and only 7 percent farmers used 1workerin their farm. So the result implies that involvement of family member in fish farming activities were very high.

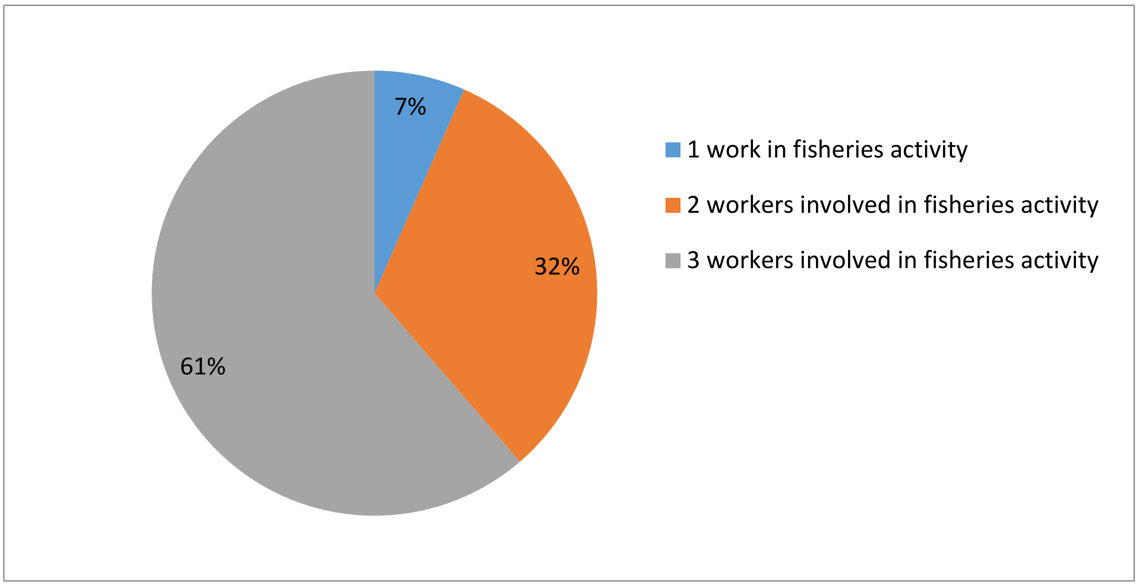


Fig 4.3: Distribution of the farmers based on family members engaged in fisheries activities.

4.8 Size of land holdings of the sample farmers

In the present study the size of land holdings of the fish producing farmers are classified into different categories. Size of land holdings includes homestead area, orchard, pond, cultivated land, fallow land, leased in, leased out and mortgage in as reported by the sample farmers. It is evident from the table 4.4 that 2.75 percent, 23.70 percent, 3.37 percent, and 36.72 percent areas were homestead area, cultivated land, leased out and leased in area respectively hold by the sample farmers on an average.

Table4.4: Size of land holdings of the sample farmers

Types of the land	Average area (Decimal)	% of the area
Homestead	1005	23.70
Orchard	143	03.37
Pond	1557	36.72
Cultivated land	1250	29.48
Fallow land	135	03.18
Leased in	150	03.53
Leased out	0	0
Mortgage in	0	0
Total	4240	100

4.9 Concluding Remarks

This chapter analyzed the socioeconomic attributes of the sample farmers. The analysis clearly indicate the socioeconomic characteristics from each other in respect of age distribution, education, occupation, farm size, involvement of family member etc.

CHAPTER V

PROFITABILITY ANALYSIS OF CAGE FISH FARMING

5.1 Introduction

For every production process, cost plays a vital role for making right decision of the farmers. This chapter mainly deals with the estimation and analysis of costs of cage fish production. The costs were classified into variable costs and fixed costs. Most of the inputs were valued at the current market rate and sometimes governments' rates in the study area during the survey period or the prices at which farmers bought the inputs. But, for some unpaid inputs such as family labor, non-cash price was actually paid and pricing was very difficult in such cages. In these cages, the rule of opportunity cost was followed

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

i. Human labor cost
ii. Fish fry cost;
iii. Feed cost;
iv. Cage making cost
v. Construction of guard shed and other housing cost
vi. Miscellaneous cost;
vii. Interest on operating capital (OC).

5.2 Variable Costs

5.2.1 Human labor cost

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

In this study, the opportunity cost of family labor was assumed to be as wage rate per man i.e., the wage rate, which the farmers actually paid to the hired labor for working a man-day. The labor of women and children was converted into man-equivalent day by presenting a ratio of 2 children day = 1.5 women days = 1 man equivalent day (Miah, 1987). In this study a man-day was considered to be 8 hours of work. For avoiding complexity, average rate has been taken into account. Labor wage rate varies with respect to different seasons. In the study area it varied from 300 to 400 Tk. per man-days. Thus the computed average rate was Tk. 350 per man-days for fish farming.

Use of human labor and its relevant cost incurred were shown in table 5.1. The per cage fish produced labor cost was Tk. 4140 which constituted 11.72 percent of total variable cost. Human labor is one of the most important variable inputs in the production process.

5.2.2 Cost of fish fry

Fish fry is a major input of fish farming in the study area. The farmers used purchased seed from fry collectors and hatchery. There was a variation in the per unit price of seed from location to location and time to time. But cost was calculated on the basis of actual price paid by the farmers. The average price of fish seed was Tk. 10.50 per piece. The per cage fish produced costs of fish fry were estimated at Tk.4200 which constituted 11.89 percent of total variable cost (Table 5.1).

5.2.3 Cost of feed

Supply of artificial supplementary feeds, which can compliment nutritional deficiency, is important to increase fish production. In the study area only commercial floating feeds are used. Cost of feeds was estimated at the prevailing market price. The average cost of ready feed was calculated at Tk. 45 per kg during the study period. Average per cage fish produced costs of feed were calculated at Tk. 2060 which was found to be 58.32 percent of total variable cost (Table 5.1).

5.2.4 Miscellaneous cost

Fish farmers had to bear some miscellaneous cost for purchasing different material, such as rope, light, umbrella, bamboo, boat, transportation, netting, cage depreciation, commission for caretaker etc. It also included the payment of some charges and donation of different religious and social institutions. These miscellaneous costs were calculated on the basis of actual price paid by the farmers. In the study area, average per cage fish produced miscellaneous costs for fish farming was found to be Tk. 4980 which constituted 14.10 percent of total variable cost (Table 5.1).

5.2.5 Interest on operating capital

Interest on operating capital was determined on the basis of opportunity cost principle. The operating capital actually represented the investment on different farm operation over the period because all the cost was not incurred at the beginning or at any single point of time. The cost was incurred throughout the whole production period; hence, at the rate of 12 percent per annum interest on operating capital for six months was computed for fish production (Interest rate was taken according to the bank rate prevailing in the market during the study period). Interest on operating capital was calculated by using the following standard formula (Miah, 1992).

Interest on Operating Capital (IOC) = Alit

Where,

Al= Total investment /2,

t = Total time period of a cycle

i= interest rate which was 12 percent per year during the study period.

The interest on operating capital was estimated at Tk. 1400.00 per cage fish produced constituted 3.96 percent share of total variable cost (Table 5.1).

Table 5.1 Per cage fish produced variable costs of cage fish farming

Variable cost items	**Cost (Tk./cage fish produced)**	**Percent of total variable cost (%)**
Human labor	4140	11.72
fish fry	4200	11.89
Feed cost	20600	58.32
Interest on operating capital	1400	3.96
Miscellaneous cost	4980	14.10
Total variable cost	35320	100

5.2.6 Total variable cost

In the study area, the total variable costs varied from year to year. It was observed that the total per cage fish produced variable cost for fish farming was Tk. 35320 which comprised of 73.09 percent of total cost. They are stocked at a density of approximately 30 per cubic meter, and each cage yields 400kg of fish per 8 month cropping cycle (Table 5.3)

5.3 Fixed costs

5.3.1 Cages cost

The farmers used Cages are approximately 30 m^3 in size and constructed using metal pipe, polyethylene netting and oil drums. The cost of net materials metal pipe, oil drums and labor for making a one cubic meter cage was around Tk. 400. They are stocked at a density of approximately 30 per cubic meter. The fixed cost per cage was estimated at Tk. 12000 which occupied 92.30 percent of total fixed cost (Table 5.2).

5.3.2 Construction of guard shed other housing cost.

Guard shed was constructed to protect fish from thieves and dacoits. Cost for constructing guard shed cost was taken one third of the average of this cost. Average per cage average construction cost of guard shed and other housing cost were calculated at Tk. 1000 for cage fish farming which shared 7.70 percent of total fixed cost (Table 5.2).

Table 5.2 per cage fixed costs of cage fish farming

Fixed cost items	Cost (Tk./cage)	Percent of total fixed cost (%)
Cage making cost	12000	92.30
Construction of guard shed and other housing cost	1000	7.70
Total fixed costs	13000	100

5.3.4 Total fixed cost

In the study area, it was estimated that per cage total fixed cost for year round fish farming was Tk. 13000 which shared of 26.91 percent of total cost (Table 5.3).

5.4 Total cost

The total costs were calculated by adding up total variable cost and total fixed cost. In the study per cage total cost of cage fish farming was calculated at Tk. 48320 (Table 5.3).

Table 5.3 Per cage total cost of cage fish farming

Cost items	Cost (Tk./ha)	Percent of total cost (%)
a. Total variable cost	35320	73.09
b. Total fixed cost	13000	26.91
Total cost (a+b)	48320	100

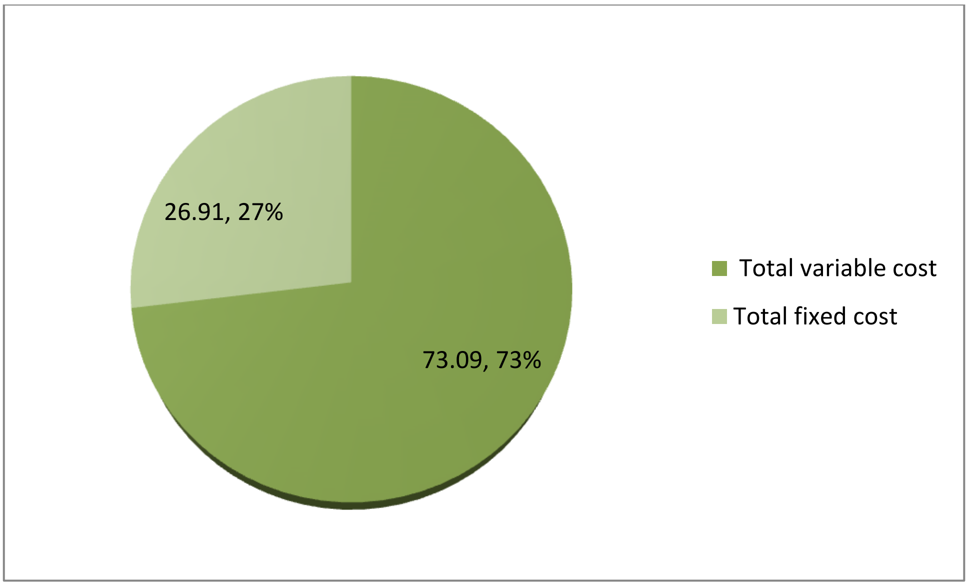


Figure 5.1: Level of per cage total variable cost and total fixed Cost of cage fish farming

5.5 Returns of cage farming

5.5.1 Gross return

Gross return is the pecuniary value of total product. Per cage gross returns were calculated by multiplying the total amount of production by their respective market prices. In the study area, per cage average yield of fish was 400 kg and its money value was Tk64000. Fish are harvested live at a size of around 500g and sold at Tk160/kg to traders who dispose of them in local markets.

5.5.2 Net return

In general net return is termed as entrepreneur's income. To evaluate the profitability of fish production, net return is an important aspect. Net return is the difference between gross return and total costs. Per cage net return was estimated at Tk.13680 which indicates that fish production is profitable business for the fish farmers (Table 5.4).

5.5.3 Gross margin

Farmers usually want to gain maximum return over variable cost of production. The probable reason is that estimation of fixed cost of production is difficult to determine. Thus the gross margin analysis has been taken into account to calculate the relative profitability of fish farming. The gross margin of fish farming was estimated at Tk. 28680 (Table 5.4).

Table 5.4 Gross margin and benefit cost ratio (Undiscounted) of fish farming

Sl. No	Items	Amount (Tk./hectare)
A	Gross returns (GR)	64000
B	Total variable costs (TVC)	35320
C	Total fixed cost (TFC)	13000
D	Total costs (TVC+TFC)	48320
E	Net return (GR-TC)	13680
F	Gross margin (GR-TVC)	28680
G	Benefit-cost ratio (BCR) = GR/TC	1.59

5.5.4 Benefit cost ratio (Undiscounted)

Benefit cost ratio was calculated by dividing gross return by gross cost or total cost. It implies return per taka invested. It helps to analyze financial efficiency of the farm. It was evident from the study that the benefit cost ratio of fish farming was accounted for 1.59 implying that Tk. 1.59 would be earned by investing Tk. 1.00 for fish production. So, the fish farming was found to be profitable for farmers (Table5.4).

5.6 Concluding remarks

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

CHAPTER 6

PROBLEMS OF CAGE FISH FARMING

6.1 Introduction

Fishery as a source of livelihood has been an age-old practice for thousand of fishermen in Bangladesh. But fishermen are socially, economically and educationally in backward profile. In the present study, an attempt had been made to identify and analyze the major problems and constraints faced by the farmers which act as main barriers in running the fish farming business. The problems were broadly classified under three categories such as economic, technical and social. Thereafter, the problems were ranked on the basis of their percentages.

6.2 Economic problems

High Price of Input: About 61.32 percent of farmers reported that high price of input was one of the most important problems for fish farming (Table 6.1). But at present high price of input is not a major problem for the farmers. Because the government already providing subsidy on fertilizer like urea and other inputs required for fish farming.

6.2.1 Lack of sufficient fund:

Most of the farmers were not economically solvent. They had to borrow money from local NGOs at higher interest rate for continuing fish production. About 40.56 percent of farmers reported that lack of sufficient fund was one of the major problems for them (Table 6.1). They pointed out that when they need loan for fish farming as per possible amount they did not get that help from institutional sources due to complicated bureaucratic procedures. To mitigate this problem, immediate measures should be taken to simplify the lending procedures as early as possible.

6.2.2 Lack of marketing facilities: Lack of marketing facilities both for inputs and outputs was the major problems faced by the farmers in conducting fish farming in the study area. About 23.58 percent of farmers reported that there were inadequate marketing facilities such as storage and transport facilities (Table 6.1)

6.2.3 Low price of output:

Low price of output was considered as another important problem and reported by 29.25 percent of farmers (Table 6.1). Most of the farmers reported that they had to sell their products at local market at low price owing to the transportation problem. But the findings of the study indicated that BCR was high and price of output was also good. So, there was some inconsistency of their answer.

Table 6.1 Major problems faced by the sample farmers

Problems and constraints	No. of respondent	Type of problems	Percent (%)	Rank
High price of input	65	Economic	61.32	1st
Insufficient water in dry season	52	Technical	49.06	2nd
Attack of fish diseases	46	Technical	43.39	3rd
Lack of sufficient fund	43	Economic	40.56	4th
Lack of extension services	39	Technical	36.79	5th
Lack of scientific knowledge and technology	33	Technical	31.13	6th
Low price of output	31	Economic	29.25	7th
Lack of marketing facilities	25	Economic	23.58	8th
Over flooding in rainy season	23	Natural	21.70	9th
Theft of fish from farm	19	Social	17.92	10th
Capture of fish and fish farm by force	18	Social	16.98	11th
Pushing poison to fish	11	Social	10.38	12th
Multiple ownership	9	Social	8.49	13th

Note: one fish farmer reported more than one problems, so addition of percentage will not necessarily equal to 100.

6.3 Technical Problems

6.3.1 Lack of scientific knowledge and technology: Scientific knowledge and skilled labor are essential for fish farming. Among the respondent farmers, some farmers had basic knowledge of input use, but there were many farmers who had knowledge gap in farming of fish. In the study area, about 31.13 percent of farmers claimed that they had lack of scientific knowledge and technology (Table 6.1). Training including optimum application of fertilizers, feeds, fingerlings and lime should be given. Research organizations and NGOs can play a vital role to disseminate scientific knowledge and technology.

6.3.2 Over flooding in rainy season:

Uncertainties due to flooding during the heavy rains, the fish farms become flooded and fish escape from one field to another. About 21.27 percent of fish producing farmers reported such type of problem in the study area (Table 6.1). This problem can be solved by making embankment, proper canal and drainage system.

6.3.3 Insufficient water in dry season: About 49.06 percent of fish producing farmers reported that insufficient water in dry season hampered production of fish (Table 6.1). Government can solve this problem by keeping the diesel price at a reasonable level so that farmers can supply sufficient water in the canal in dry season.

6.3.4 Attack of fish diseases: About 43.39 percent of fish producing farmers reported that attack of fish disease hampered the production of fish (Table 6.1). To overcome this problem, scientific use of chemicals should be ensured and supplementary supply of irrigation should be arranged in dry season. Extension workers, Upazila Fisheries Officers (UFO) & FRI scientists may take initiatives to ensure scientific approach to overcome this problem.

6.3.5 Lack of extension services: About 36.79 percent of farmers complained that they did not get any advice from the concerned extension approach regarding the improved method of fish production (Table 6.1). Farmers used traditional method of fish cultivation. For these reasons, extension workers should pay immediate attention to this matter for the improvement of this situation.

6.4 Social problems

Theft of Fish from Farm: About 17.92 percent of fish producing farmers reported that theft of fish from farm by thieves was another major problem (Table 6.1). Farmers should look after their fish farm at a regular basis. Social security must be provided by the local government.

6.4.1Multiple ownerships

About 8.49 percent of fish producing farmers reported that they were suffering from this problem (Table 6.1). Measures should be taken by the government to resolve the land use conflict.

6.4.2 Pushing poison to fish: About 10.38 percent of farmers reported that this problem was hampering their total production (Table 6.1). To overcome this problem community based management should be developed.

6.4.3 Capture of fish and fish farm by force: About 17.92 percent of fish producing farmers reported about capturing of fish and fish farm by political leaders, or socially powerful persons (Table 6.1). Proper action should be taken by the government to overcome this problem.

6.5 Concluding remarks

The above mentioned problems and constraints, of course, are interrelated with one another and hence need to be removed comprehensively through an integrated programme for the overall development of fish farming. Problems faced by the farmers ranked on the basis of corresponding percentages. Most of the farmers were reported that high price of input was the main constraint in fish production. And this problem ranked first according to the ranking. But I think there are some inconsistencies in the answer. My opinion is that diseas attack and the insufficient water in the dry season were the main constraints hampering fish production. Government already gave subsidy on these inputs.

So, price of input was not a severe problem for the farmers. If proper vaccine were given and direct entry of water at the right time were provided then the production will increase substantially and thus the farmers will be benefited.

CHAPTER 7

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

7.1 Summary

Fisheries sector has been playing a very vital role in the economy of Bangladesh from the time immemorial. Bangladeshi people are popularly referred to as "Mache Bhate Bangali" or "fish and rice makes a Bengali". This sector plays a significant role in meeting the protein demand, earning foreign exchange and socio-economic development of the rural poor by reducing poverty through employment generation.

Broad agriculture sector which includes crops, livestock, fisheries and forestry contributes 13.82 percent to the Gross Domestic Product (GDP) as a whole in the FY 2017-18. In the same period, fisheries sub-sector contributed about 25.00 percent to the broad agricultural sector Gross Domestic Product (GDP). The ecology of the country is appropriate for the growth and production of the fisheries resources. Fish production in ponds, lakes, burrow pits, floodplains, oxbow lakes, and semi-closed water bodies are increasing day-by-day with the blessings of modern technology. Fish production has increased to 40.50 lakh MT in 2016-17, which was 38.78 lakh MT in 2015-16. Bangladesh is endowed with vast water bodies such as 39.25 lakh hectares of open water fisheries, 7.74 lakh hectares of culture fisheries and 0.48 sq. nautical miles of marine fisheries. In 2016-17, total fish production was 40.50 lakh MT of which 55 percent production was contributed by the culture fisheries, 28 percent by theopen water fisheries and rest 17 percent by the marine water fisheries. The country earned about Tk. 4287 crore during the year 2016-17 by exporting fish, fish and prawn. In Bangladesh, fish industry is the second largest foreign currency earner after the garment industry.

In this context, the specific objectives of the study were formulated to determine relative profitability and to assess the resource use efficiency of fish farming in selected areas of Chandpur district. The specific objectives were as follows:

a) Socioeconomic profile of cage fish producing farms in some selected areas.
b) Costs and returns of cage fish farming.
c) Problems and constraints to cage fish farming in the study areas.

The study was mainly based on primary data, collected by the researcher himself through interviewing the sample farmers. A total of 106 fish farmers were selected from two upzila of Chandpur district namely, Chandpur sadar and Haimchar. Sample survey was done to collect the required data exploding, simple random sampling technique to select the fish farmers.

Data analysis revealed that 59.43% of the respondents had used technology of fish farming while 40.57 percent farms did not adopt such practice.

In the study areas, involvements of both men and women were observed in fish farming. It is evident from the table 4.1 that 92.45 percent male farmers own a fish farm, 07.55 percent women farmers own a fish farm.

The fish producing farmers were classified into three age groups: up to 35 years, 36-50 years and above 50. Out of the total sample farmers 37.70 percent farmers fell under to the age group of up to 35 years, 55.66 percent belonged to the age group of 36-50 years and 6.61 percent fell into the age group of above 50 years. Education of farmers helps to increase skill and productivity. Analysis revealed that in the study areas 2.83 percent farmers can't read and sign, 4.72 percent farmers can sign only, 34.92 percent farmers had primary education, 44.34 percent farmers had completed Secondary education, 11.32 percent farmers had completed higher secondary, 01.87 percent farmers had completed their higher secondary education. The main occupation of the majority of the sample farmers was fish farming. About 77 percent and 18 percent farmers were involved in fish farming as a main and subsidiary occupation. After that small business was their second most important occupation. Size of land holdings includes homestead area, orchard, pond, cultivated land, fallow land, leased in, leased out and mortgage in as reported by the sample farmers. It is evident from the table 4.5 that 2.75 percent, 23.70 percent, 3.37 percent, and 36.72 percent areas were homestead area, cultivated land, leased out and leased in area respectively hold by the sample farmers.

A financial return of producing cage fish was calculated from the standpoint of farmers. The per kg fish produced labor cost was Tk. 10.35 which constituted 11.72 percent of total variable cost. The per kg fish produced costs of fish fry were estimated at Tk.10.50 which constituted 11.89 percent of total variable cost Per kg fish produced costs of feed were calculated at Tk. 51.50 which was found to be 58.32 percent of total variable cost. average per kg fish produced miscellaneous costs for fish farming was found to be Tk. 12.45 which constituted 14.10 percent of total variable cost. The interest on operating capital was estimated at Tk. 3.50 kg fish produced constituted 3.96 percent share of total variable cost. It was observed that the total variable cost per cage fish farming was 35320 Tk. which comprised of 73.09 percent of total cost. The fixed cost per cage was estimated at Tk. 12000 which occupied 92.30 percent of total fixed cost. Average per cage average construction cost of guard shed and other housing cost were calculated at Tk. 1000 for cage fish farming which shared 7.70 percent of total fixed cost. it was estimated that per cage total fixed cost for year round fish farming was Tk. 13000 which shared of 26.91 percent of total cost. Per cage total cost of cage fish farming was calculated at Tk. 48320. Per cage average yield of fish was 400 kg and its money value was Tk64000. Per cage net return was estimated at Tk. 13680 which indicates that fish production is profitable business for the fish farmers. The gross margin of fish farming was estimated at Tk. 28680. The benefit cost ratio of cage fish farming was 1.59 implying that Tk. 1.59 would be earned by investing Tk. 1.00 for fish production.

This study also identified some of the problems and constraints associated with fish farming. These were categorized into economic, technical and social problems. The findings revealed that high price of input, lack of sufficient fund, lack of marketing facilities, low price of output, lack of scientific knowledge and technology, over flooding in rainy season, insufficient water in dry season, attack of fish diseases, lack of extension services, theft of fish from farm, multiple ownerships, pushing poison to fish and capture of fish and fish farm by force etc were the major constraints which stand in the way of cage culture cage fish farming in the study area.

7.2 Conclusion and Policy Recommendations

It may be concluded that fish farming is highly profitable. If modern inputs and production technology can be made available to farmers in time, yield and production could increase which can help farmers to increase income and improve livelihood standards. It can help in improving the nutritional status of rural people. The results however, clearly showed that per hectare yield of fish farming are still low among other fish producing Asian countries. There is an ample opportunity to improve per hectare yield of year roundfish production. To enhance the productivity, efficiency and effectiveness of fish farming, the following recommendations are made.

i. Though the government already given subsidy on fertilizers and other inputs required for fish farming, fair prices of inputs should be ensured so that the farmers can get the inputs at a reasonable price.

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

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

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

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

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

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

7.3 Limitations of the Study

- ❖ Data used in this study were collected through interview to the farmers. Sometimes the sample respondent did not show well-cooperat with the interviewer.
- ❖ The information was collected mostly through the memories of the respondents. As such cross might have happened in the statements.
- ❖ Lack of experience and time hampered the in-depth of the study.
- ❖ Secondary data are extremely difficult to collect and may be contradictory. All the information is not based on valid data.

7.4 Avenues for Further Research

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

- Similar study considering a large number of samples could be taken.
- As the present study covered only Chandpur sadar and Haimchar under Chandpur district, a similar study could be conducted covering various geographical regions of the country and thus make a cross country comparisons of fish farming.

So there is an ample opportunity to conduct study on technical efficiency of fish farming

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