# USE OF SELECTED FISH FARMING TECHNOLOGIES BY THE FARMERS

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# USE OF SELECTED FISH FARMING TECHNOLOGIES BY THE FARMERS

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# CERTIFICATE

This is to certify that the thesis entitled, **"USE OF SELECTED FISH FARMING TECHNOLOGIES BY THE FARMERS"** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka in partial fulfilment of the requirements for the degree of **Master of Science (MS) in Agricultural Extensionand Information System**, embodies the result of a piece of bona-fide research work conducted by **GOLAP RABBANY, Registration No. 18-09055** under my supervision and guidance. 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 the course of this study has been dully acknowledgement by him.

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*Dedicated to*

*My*

*Beloved Parents*

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## ABBREVIATIONS AND ACRONYMS

$D_oF$ = Department of fisheries
DAE = Department of Agricultural Extension
FAO= Food and Agriculture Organization
BBS =Bangladesh Bureau of Statistics
EPB =Export Promotion Bureau
SIS = Small indigenous species
UFO = Upazilla Fisheries Officer
AEO = Agriculture Extension Officer
BER = BER Bangladesh Economic Review

# USE OF SELECTED FISH FARMING TECHNOLOGIES BY THE FARMERS


## ABSTRACT

The purpose of this study was to determine the extent of use of selected fish farming technologies by fish farmers and to explore the relationship between selected characteristics of the farmers and their use of selected fish farming technologies. The selected characteristics were age, education, family size, fish farm size, annual fish farming income, training received in fish farming, fish farming experience, social mobility, and contact with extension media, organizational participation and knowledge of farmer on fish farming . Data were gathered from proportionally and randomly selected 93 respondents (farmers) of Niamatpur upazila under Naogaon district by using a pretested interview schedule and the entire process of collecting data was completed in January and February, 2020. Apart from descriptive statistical methods, Pearson's Product Moment Correlation Co-efficient analysis was used in order to analyze the data. Data revealed that highest portion (66.67 percent) of the fish farmers had medium use of selected fish farming technologies, while 20.43 percent had low use and 12.90 percent had high use of the selected fish farming technologies. So it can be said that there was scope to increase the use of these selected fish farming technologies in the study area. Out of eleven selected characteristics of the fish farmers, education, and fish farm size, annual fish farming income, training received in fish farming, social mobility, extension contact and knowledge on fish farming had positive and significant relationship with their use of the selected fish farming technologies. On the other side, age, family size, fish farming experience and organizational participation had no significant relationship with the farmer's use of selected fish farming technologies. The pond owners faced such major problems as fish diseases lack of quality feed and other chemicals, transportation problem, high investment etc.

# CHAPTER 1
# INTRODUCTION

## 1.1 Background Information

Fisheries sector represents one of the most productive and dynamic sectors in Bangladesh. Fish, the second most valuable agricultural crop in Bangladesh, plays a crucial role in the livelihoods and employment of millions of people. Fisheries in Bangladesh have both prospects and challenges. In the agro-based economy of Bangladesh, the culture and consumption of fish has important implications for national income and food security. The fisheries sector makes an important contribution to the economy, generating 3.61% to national gross domestic product (GDP) and more than one-fourth (25.30%) to the agricultural GDP of the country (BER, 2019). Bangladesh is exporting fish products from a long time ago and earning foreign currencies. Bangladesh earns a considerable amount of foreign currencies by exporting fish, shrimps and other fishery products. In 2018-19, the country earns BDT 42.50 million (as per EPB) by exporting almost 73.17 thousand MT of fish and fishery products that is about 1.39% to foreign exchange earnings (BER, 2019). By using fish farming technologies farmers may produce more to increase their income. Bangladesh achieved self-sufficiency in fish production with a per capita fish consumption of 62.58 g/day against set target of 60 g/day according to FAO report (BBS, 2016). Fisheries sector also plays an important role in rural employment generation and poverty alleviation. Fish is renewable natural resources and plays a vital role for the improvement of socio-economic condition of poor farmer. More than 12% of populations are directly or indirectly engaged in various activities under fisheries sector for their livelihood. Traditionally, Bengali people have had a strong preference for fish, which forms an important part of their customs and culture. Bangladeshi people are popularly referred to as "Mache Bhate Bangali" or "Fish and Rice makes a Bengali".

Bangladesh is blessed with vast and rich fisheries resources. The diversified fisheries resources of the country are divided into two groups as inland and marine fisheries. Inland fisheries has two sub sectors as inland capture and inland culture fisheries. Inland capture fisheries comprise with river and estuaries, beels, floodplain, Sundarbans and

Kaptai Lake and it covers 28.45% of total resources. On the other hand, inland culture fisheries include pond, seasonal cultured waterbody, baor, shrimp/prawn farm, crab, pen culture and cage culture it covers 56.28% of total fisheries resources. Again, marine fisheries, about 15.31% of the fisheries resources include industrial (Trawl) and artisanal fisheries.

According to FAO report *The State of World Fisheries and Aquaculture 2018*, Bangladesh ranked 3rd in inland open water capture production and 5th in world aquaculture production. Currently Bangladesh ranks 4th in tilapia production in the world and 3rd in Asia. The national fish hilsa (*Tenualosa ilisha*) as a single species has been making the highest contribution (12.15 percent) to the country's total fish production. Geographical Indication Registration Certificate has also been achieved for our national fish hilsa named as 'Bangladesh ilish'. Bangladesh is one of the world's leading fish producing countries with a total production of 43.84 lakh MT in FY 2018-19, where aquaculture accounts for 56.76 percent of the total fish production. Over the last 12 years, with the fairly steady average fisheries growth of 5.01 percent and consistent average aquaculture growth of around 8.59 percent. It is expected that the country will continue to achieve the projected production target of 45.52 lakh MT of fish by 2020-21 in conformity with the targets of Vision-2021 of the present Government.

**Table 1.1 Last 5 year's fish production scenarios of Bangladesh (2014 - 2019)**

| Year | Source-wise production (MT) | | | Total |
|---|---|---|---|---|
| | Inland open | Inland closed | Marine | |
| 2014-2015 | 1023991 | 2060408 | 599846 | 3684245 |
| 2015-2016 | 1048242 | 2203554 | 626528 | 3878324 |
| 2016-2017 | 1163606 | 2333352 | 637476 | 4134434 |
| 2017-2018 | 1216539 | 2405415 | 654687 | 4276614 |
| 2018-2019 | 1235709 | 2488601 | 659911 | 4384221 |

Inland capture fishery comprising rivers and estuaries, Sundarbans water resource in the forest, beels, Kaptai Lake, and floodplain is very rich in biodiversity with almost 260 freshwater fish species have historically dominated the fish production of Bangladesh.

But the share of inland capture fisheries to total fish production have been gradually reduced to the lowest level from 62.59% in 1983-84 to 28% in 2013-14 due to over exploitation, degradation and loss of fish habitats, siltation of water bodies and water pollution from industry and agro-chemicals.

Therefore, aquaculture will have to play a major role in meeting growing demand of fish in country in coming years through the use of various culture technologies. Inland aquaculture of indigenous and exotic carp species as well as rui, catla, silver, pangas, tilapia etc has been expanded massively and farming of valuable, nutrient-rich indigenous species like, shingi, magur, pabda, gulsha, mola etc. drew special attention among the farmers as well. Such great aquaculture contribution is achieved through the use of improved farming technologies by the farmers supported with required extension services. In addition, based on country's favorable climatic conditions, our fisheries resources and socio-economic condition of the fish farmers, the following fish farming technologies can play an important role to have sustainable fish production- polyculture of carp, carp fattening, polyculture with SIS (small indigenous species), shing-magur culture, culture of mono-sex tilapia.

There has never been any systematic attempt to document the range of production technologies in operation and study their characteristics in terms of the socioeconomic profile of farmers, access to fish farming technologies and information, and farmer rationales for engaging in production. In fact, studies documenting the characteristics of aquaculture technologies in Bangladesh are limited to a handful of systems and species. Accurate use of aquaculture technologies is particularly important to improve the performance of the sector, particularly in terms of addressing poverty and nutrition outcomes.

### 1.2 Statement of the Problem

Historically in our country, people mainly depended on capture fishery from both closed and open water bodies. But due to declining catches of wild fish by increasing fishing effort for growing population and environmental degradation, use of various selected technologies in fish farming can meet our demand and contribute to rising economy.

In view of above discussion, the researcher was interested to undertake a research study entitled "Use of selected fish farming technologies by the farmers". The purpose of the study was to determine the extent of use of selected fish farming technologies by the farmers and also to find out the relationships of the selected characteristics of the fish farmers with their use of selected fish farming technologies. Such research information will be helpful for the fish farmer, policy makers and government and non-government organizations dealing with fish production in this country. For conducting this research in a planned and appropriate way, the researcher put forwarded the following questions:

- What are the characteristics of the fish farmers that influenced them to use selected fish farming technologies?
- To what extent the selected fish farming technologies were used by the fish farmers?
- What is the relationships between the extent of use of selected fish farming technologies and each of the selected characteristics of the fish farmers?
- What are the problems faced by the fish farmers?

### 1.3 Specific Objectives

On the basis of the considerations stated above the following specific objectives are formulated for giving proper direction to the study**:**

- To determine the extent of use of selected fish farming technologies by fish farmers;
- To assess and describe following selected socio-economic characteristics of fish farmers:

i. Age
ii. Education
iii. Family size
iv. Fish farm size
v. Annual fish farming income
vi. Training received in fish farming
vii. Fish farming experience
Viii .Social mobility
ix. Extension media contact
x. Organizational participation

xi. Knowledge on fish farming

- To explore the relationship between each of the selected characteristics of fish farmers and their use of selected fish farming technologies; and
- To determine the problems faced by farmers in using the selected fish farming technologies.

**1.4 Justification of the study**

The major focus of the study is to assess the use of fish farming technologies. It is true that the fish farmers are the vital elements for the use of fish farming technologies and the fish farming technologies are essential to meet our rising demand without harming aquatic environment and other resources. At present, there is a lack of adequate information on what characteristics and how those characteristics of the farmers influence their use of fish farming technologies and at what extent they use the fish farming technologies. At this situation an investigation to ascertain the relationships of the characteristics of the farmers with their use of fish farming technologies for sustainable agriculture is necessary. Findings of this study, will be helpful to the planners and extension workers in planning and execution of programs for disseminating fish farming technologies. The findings of the study will also express the extent of use of fish farming technologies by the farmers and will give a hypothetical thought all over the nation. It is expected that this study will inspire other researchers to conduct same sorts of research in other parts of the country. Lastly, it is assumed that recommendation of this study will be helpful in formulating effective extension programs that will increase the rate of use of technologies in fish farming for maximum sustainable fish production.

**1.5 Significance of the study**

The contribution of the study provide a solutions against the problem statements. These contributions are as follows:

- The study determined the extent of use of selected fish farming technologies.
- The study explored the relationships of the selected characteristics of the farmers with their use of selected fish farming technologies.
- The study identified the problems faced by farmers in using selected fish farming technologies.

## 1.6 Assumptions of the Study

An assumption is the supposition that an apparent fact of principle is true in the light of the available evidence (Goode and Hatt, 1952). The following assumptions were undertaken by the researcher in conducting the study:

- The respondents were capable enough to serve proper responses to the questions of the questionnaire.
- The responses given by the respondents were reliable. They expressed the truth about their convictions and awareness.
- Views and opinions given by the respondents included in the sample of the study were the representative views and opinions of the whole population of the study area.
- The respondents had given their correct and rational opinions without hesitation.
- The items and questions included in the questionnaire were relevant and appropriate.
- The sample size was determinative of the whole population of the study area.
- The data collected by the researcher was free from biasness.

## 1.7 Limitations of the Study

In order to prepare the study meaningful and manageable from the point of view of the academic research, it was necessary to put down some limitations:

- The study was confined to Niamatpur Upazila of Naogaon district.
- There are many fish farming technologies but the study was limited mainly to the use of selected fish farming technologies.
- The researcher had to depend on the data furnished by the selected fish farmers from their memory during the interview with them. There were no kinds of written documents in favor of the fish framers's opinion.

- There are many characteristics of fish farmers but only eleven characteristics were selected by researcher to justify the use of selected fish farming technologies.
- There were found a number of problems but researcher only cited the major problems that faced by the fish farmers in using of selected fish farming technologies.
- Reluctance of fish farmers to provide information.

**1.8 Definitions of Important Terms**

The terms which have been frequently used throughout the thesis are defined and interpreted with specific meaning, in order to eliminate the incurious confusions of the meaning. These are-

**Fish**: Fish and fishes are cold blooded aquatic animals typically with backbone, internal gill (work as respiration) and fins (work as locomotion) depend primarily on water as a medium in which to live.

**Fish farmers**: Fish farmers are the part of human society whose livelihoods are fully or partially dependent on fishery activities.

**Fish farming**: Fish farming or pisciculture involves culturing fish commercially in tanks or enclosures such as, fish ponds usually for fish production.

**Technology**: Technology is the set of knowledge, skills, experience and techniques through which human transform and use our environment in order to create tools, machines, products and services that meet our needs and desires technology involves the design and production of innovative and creative products to meet the needs and wants of others. Technology can be viewed as an activity that forms or changes culture (Borgmann, 2006).

**Modern Technology**: Modern Technology is simply an advancement of old technology.

**Age**: Age of a fish farmer referred to the period of time (years) spent by him starting from birth to the time of interview.

**Education**: Education referred to the development of desirable change in knowledge, skill, attitude and ability in an individual through reading, writing, working, observing and other related activities. It implies to the extent of formal schooling of a fish farmers at any kind of formal educational institutions.

**Family size**: It refers to the total number of persons including the fish farming in his family.

**Fish farm size**: Fish farm size referred to the pond area in which he carried out his fish farming activities owned by the fish farmers or obtained from others on lease system.

**Annual fish farming income**: It is defined in taka annually earned by the fish farmers from fisheries activities.

**Training received in fish farming:** It was used to refer to the completion of an activity by the fish farmers which were offered by the government, semi-govt. or non-government organization (s) to improve knowledge & skills of farmers for better performance in fish culture activities. The number (days) of accepted training by fish farmers.

**Farming experience**: It is defined as how many years a farmer practically contacts with and observed of his farming system.

**Social mobility**: It refers to the degree to which an individual's tendency is out to own social system.

**Extension media contact**: It refers to the exposure of the farmers to various information sources such as extension personnel, mass media, group activities etc.

**Organizational participation**: It refers to the degree to which the farmers were involved in a formal organization as a member or as a chief executive.

**Knowledge**: It is defined as the amount of the farmers' s understood information on modern fish farming technologies.

**Problem faced**: Problem faced referred to the direct or indirect factors that act as obstruction or barrier in farmer's culture activities.

# CHAPTER 2

# REVIEW OF LITERATURE

Review of literature gives direction to the researcher to carry out the research programme. The present study is concerned with the use of selected fish farming technologies by the farmers and its relationship with their selected characteristics. An effort was made to know the findings of the past researches. This Chapter deals with the reviews of past works that relate to this investigation directly or indirectly. No research has been conducted on use of selected fish farming technologies and the researcher found only a few studies which were indirectly related to the present study. The researcher intensively searched internet, websites, available books, journals and printed materials from different sources. The reviews are accessibly existed here based on the major objectives of the study. This chapter consists of three sections. The first section deals with the general findings of various technologies related to the use of the technologies by the farmers; second section is dedicated to an observation on the findings related to the relationship between the selected characteristics of the farmers and use of technologies and third section deals with the conceptual framework of the study.

## 2.1 Review of Literature on General Context on Use of Technologies

Alam et al. (2017) conducted Study on Existing Technology and Knowledge on Aquaculture of Fish Farmers at Gomastapur Upazila in Chapai Nawabgonj District, Bangladesh. For extensive aquaculture about 83% of the fish farmers are involved and other 17% were in semi -intensive aquaculture. In the extensive aquaculture, 67% farmers were involved in monoculture but 33% in polyculture system.

Rahaman et al. (2018) studied on Present status of integrated aquaculture in some selected areas of Nilphamari District in Bangladesh and found that three different types

of integrated aquaculture systems were used in the study areas: rice-fish culture (46%), fish-horticulture (33%), and fish-poultry (21%).

Afrad and Sakib (2012) studied on Adoption of Modern Aquaculture Technologies by the Fish Farmers in Bogra District of Bangladesh and observed that about three-fifths of respondents (64%) had medium adoption of modern aquaculture practices followed by more than one-fourth (27%) high adoption and (19%) low adoption.

Ziauddin and Goswami (2010) reported that 38.3 percent of the farmers had medium adoption while 25.8 percent had low adoption and 35.8 percent had high adoption of scientific fish cultivation practices.

Saha, N.C. and Islam (2005) conducted a study to determine the factors affecting adoption of pond polyculture in six villages of three districts namely Mymensingh, Bogra and Narshingdi in Bangladesh. In Mymensingh, 75% pond owners adopted carp polyculture technology whereas in Bogra and Narshingdi only 16% and 25% pond owners, respectively adopted this technology for fish production.

Ghimire and Kafle (2014) conducted a study on Integrated Pest Management Practice and it's Use by the farmers in Nepal. The study revealed that about 53 percent of farmers were satisfied with the practice.

Chouhan and Singh (2013) reported that majority (74.16 percent) of the farmers had medium adoption while 12.50 percent had low adoption and 13.34 percent had high adoption of improved sugarcane cultivation practices.

Kumbhare and Singh (2011) observed that majority (53.75 percent) of the farmers had high adoption while 14.5 percent had low adoption and 31.75 percent had medium adoption of improved wheat and paddy production technology.

Hossain (2009) conducted a study on use of integrated pest management practices by the farmers of Brahmanbaria district. The study revealed that 57 percent of the farmers were medium users, while 22 percent were low users and 21 percent were high users of IPM practices. Hossain (2006) revealed that the highest proportion (49 percent) of farmers had medium use, while 26 percent had high use and 25 percent had low use of selected high yielding varieties of rice.

Aurangojeb (2002) studied on the extent of adoption of integrated farming technology by the rural women in RDRS. He observed that the highest proportion of rural women (64%)

used high level, (28%) of the women used medium level and only 8% used low level integrated homestead farming technologies.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandwip. The study revealed that 69 percent of the farmers had medium adoption while 13 percent had low adoption and 18 percent had high adoption of modern agricultural technologies.

Haque (2003) found that the majority (47 percent) of the growers had medium use of modern maize cultivation technologies while 28 percent had high use and 25 percent low use of technologies.

Sardar (2002) studied on "use of IPM practices by the farmers under PETRRA Project of RDRS. He observed that majority (45.9 percent) of the farmers had medium, 38.3 percent had low and 15.8 percent had high use of IPM practices.

Haider et al. (2001) studied the use level of improved Package of practices for T. aman rice cultivation in Gouripur upazila of Mymensingh district. He found that the adoption level of farmers categories were 5 percent not adopted, 62 percent low use, 24.5 percent medium adopter and 8.5 percent high adopter. Vast majority (95 percent) of the farmers adopted MV programme of T. aman rice.

Mostafa (1999) studied the use of recommended mango cultivation practices by the mango growers of Nawabganj Sadar Thana. He found that about half (49 percent) of the mango growers had "low use" 31 percent "very low" use and 20 percent had "medium" use of fertilizers.

Islam (1996) carried out a study on farmer's use of indigenous technical knowledge (ITK) in the context of sustainable agricultural development. He found the extent use of ITK by individual farmers that, the highest proportion (42.73 percent) of the respondents belonged to the lower user category as compared to 41.82 percent in the moderate user category and 15.45 percent in the higher user category respectively.

Hasan (1996) found in his study that the highest proportion (44 percent) of the respondents perceived the existence of medium use, compared to 26 percent low use and 3 percent high use in respect of selected agricultural technologies.

Ahmed.et.al (1995) conducted a study Kapasia Thana on aquaculture Technologies adaptation and found that 38% adopted carp polyculture technologies, 8% Nile tilapia monoculture and 54% silver carp monoculture.

## 2.2 Past Research Findings Relating to the Relationships of Farmers Use of Selected Fish Farming Technologies and Their Selected Characteristics

This section deals with a review of previous studies relating the association of the selected characteristics of the farmers and use of selected fish farming technologies. Eleven characteristics of the fish farmers were selected in this study.

### 2.2.1 Age and Use of Technologies

Rahaman et.al (2018) found that significant relationship between age and use of integrated aquaculture systems.

Alam et al. (2017) observed that significant relationship between age and adoption of modern aquaculture technology.

Afrad and Sakib (2012) found that age of the farmers show positive and significant relationship with their adoption of modern aquaculture technologies.

Singh (2010) observed that age of the farmers show negative and significant relationship with their adoption of potato cultivation practices.

Ziauddin and Goswami (2010) found that age of the farmers show negative and significant relationship with their adoption of scientific fish cultivation practices.

Devi (2013) found that age of the farmers did not show any significant relationship with their adoption of dairy farming technologies.

Ali (2004) found there was no relationship between age of the farmers and adoption of aquaculture technology by them.

Hossain (2009) found that age of the farmers had positive significant relationship with their use of IPM practices.

Hossain (2006) conducted a study and found that age of the farmers had no significant relationship with their use of IPM practices.

Islam (2002) found that age of the farmers had no relation with to their use of modern agricultural technologies.

### 2.2.2 Education and Use of Technologies

Afrad and Sakib (2012) found that education of the farmers show positive and significant relationship with their adoption of modern aquaculture technologies.

Rahaman et al. (2018) found that significant correlation between education and use of integrated aquaculture systems

Alam et al. (2017) observed that significant relationship between education and adoption of modern aquaculture technology.

Hossain (2006) concluded that the education of the farmers had a significant and positive relationship with their use selected of HYV rice. Similar findings were also observed by Haque (1993).

Ahmed (2006) observed in his study that education of the respondents had no significant relationship with their adoption of selected wheat varieties.

Sardar (2002) found that the education of the farmers had significant positive relationship with their use of IPM practices.

Aurangozeb (2002) studied on the extent of use of integrated homestead farming technologies by the rural women in RDRS. He observed that there was positive relationship between education and use of integrated homestead farming technologies.

Hussen (2001) indicate that the education had positive significant relationship with their use of modern sugarcane cultivation practices.

Sarker (1997) conducted a study to determine the relationship between selected characteristics of potato growers and their adoption of improved potato cultivation practices in five villages of Comilla district. He found that education of potato growers had significant relationship with their adoption of improved potato cultivation practices.

### 2.2.3 Family Size and Use of Technologies

Alam et al. (2017) observed that significant relationship between family size and adoption of modern aquaculture technology.

Afrad and Sakib (2012) found that family size of the farmers show no significant relationship with their adoption of modern aquaculture technologies.

Ziauddin and Goswami (2010) revealed that family size of the farmers show negative and non- significant relationship with their adoption of scientific fish cultivation practices.

Rahman (2001) observed that family size of the fanners had no significant relationship with their adoption of Aalok-6201 hybrid rice.

Hoque (1993) researched on his study and found that family size of growers had a negative and significantly relationship with their adoption of improved practices in sugarcane cultivation.

Chowdhury (1997) noticed that family size of the farmers had a positive and significant relationship with their adoption of selected BINA technologies. Similar findings were found by Sarkar (1997) in their respective studies.

Devi (2013) found that family size of the farmers did not show any significant relationship with their adoption of dairy farming technologies.

Hasan (2006) found that family size of the growers showed significant and negative relationship with their adoption of improved practices in litchi cultivation.

Rao and Singh (2014) observed that family size of the farmers did not show any significant relationship with their adoption of pineapple cultivation practices.

### 2.2.4 Farm Size and Use of Technologies

Hasan (2006) revealed that farm size of the growers showed significant and positive relationship with their adoption of improved practices in litchi cultivation.

Singh (2010) found that farm size of the farmers showed positive relationship with their adoption of potato cultivation practices.

Ziauddin and Goswami (2010) observed that farm size of the farmers show positive and significant relationship with their adoption of scientific fish cultivation practices.

Devi (2013) found that farm size of the farmers show negative relationship with their adoption of dairy farming technologies.

Afrad and Sakib (2012) found that farm size of the farmers show no significant relationship with their adoption of modern aquaculture technologies.

Rao and Singh (2014) reported that farm size of the farmers showed positive and significant relationship with their adoption of pineapple cultivation practices.

Hossain (2006) found that the farm size of the farmers had an insignificant relationship with their use of selected HYV rice.

Hossain (2003) revealed that farm size of the farmers had a significant and positive relationship with their use of modern boro rice cultivation practices.

Sardar (2002) found that the farm size of the farmers had significant positive relationship with their use of IPM practices.

Ahmed (2006) noticed in his study that farm size of the respondents had no significant relationship with their adoption of selected HYV wheat varieties.

**2.2.5 Annual Family Income and Use of Technologies**

Afrad and Sakib (2012) found that annual family income of the farmers show no significant relationship with their adoption of modern aquaculture technologies.

Hossain (2003) revealed that annual income of the farmers had a significant relationship with their use of modern Boro rice cultivation practices.

Aurangozeb (2002) observed that there was a positive relationship between annual income from field crop and use of integrated homestead farming technologies.

Rahman (2001) conducted a study on knowledge, attitude and use of the farmers regarding Alok 6201 hybrid rice in Sadar upazila of Mymensingh district. He found that annual income of the farmers had a significant and positive relationship with their use of Aalok 6201 hybrid rice.

Islam (2002) conducted a study on adoption of modem agricultural technologies by the trainers of Sandwip. He observed that the annual income of the farmers had no relationship with their adoption of modem agricultural technologies.

Hussen (2001) conducted an investigation on adoption of modem sugarcane cultivation practices by the farmers of Dewangonj upazila in Jamalpur district. He observed that

there was a significant positive relationship between annual income of the farmers and their adoption of modem sugarcane cultivation practices.

Rahman (2001) conducted an investigation on adoption of modem sugarcane cultivation practices by the farmers of Dewangonj upazila in Jamalpur district. He observed that there was a significant positive relationship between annual income of the farmers and their adoption of modem sugarcane cultivation practices. Hossain (2003) found the similar findings.

Sardar (2002) conducted a study on adoption of Intregated Pest Management practices by the farmers under PETRA project of RDRS. He found that the annual income of the farmers had no relationship with their adoption of Integrated Pest Management practices.

Sarker (1997) found that family income of potato growers had a significant positive relation with their use of improved potato cultivation practices.

### 2.2.6 Training Exposure and Use of Technologies

Haque (2003) found that training exposure of the respondent had positive significant relationship with their practices in farmer‟s use of modern maize cultivation technologies.

Das et.al (2014) conducted a study on Adoption of Improved Aquaculture Technologies in

Tripura, India and found that training exposure had no significance relation with adoption of improved aquaculture technologies.

Rahman (2001) observed in study that training received of the farmers had a significant and positive relationship with their use regarding Aalok 6201 hybrid rice.

Haque (2003) found that training received of the respondent had positive significant relationship with their practices in farmers' adoption of modern maize cultivation technologies.

Sardar (2002) conducted a study on adoption of IPM practices by the farmers under PETRRA projects of RDRS. He found that training experience of the farmers had a positive significant relationship with their adoption of IPM practices.

Sana (2003) found that Training exposure with Practice on shrimp culture had Significant and positive relationship.

### 2.2.7 Farming Experience and Use of Technologies

Das et.al (2014) conducted a study on Adoption of Improved Aquaculture Technologies in Tripura, India and found that experience had no significance relation with adoption of improved aquaculture technologies.

Sarkar (1997) found that farming experience of potato growers had no significant relationship with their adoption of improved potato cultivation practices.

Hoque (1993) in his study found that farming experience had negative significant relationship with their adoption of improved practices in sugarcane cultivation.

Hasan (2003) found that farming experience of the farmers had no significant relationship with their adoption of recommended potato cultivation practices.

Chowdhury (1996) that farming experience significantly influenced farmers in accepting production technology.

### 2.2.8 Social Mobility and Use of Technologies

Patel and Vejapara (2016) found that social mobility of Sugarcane growers had negative significant in sugarcane cultivation.

Ali (2015) reported that social mobility of the rural women had significant and positive relationships with their knowledge and practices of homestead vegetable cultivation.

Singh et al., (2014) concluded that social mobility had no relationship with their knowledge on improving wheat production technology.

### 2.2.9 Contact with Extension Media and Use of Technologies

Hossain (2006) concluded that the extension contact of the farmers had positive significant relationship with their use of selected HYV rice.

Aurangozeb (2002) observed that there was significant relationship between contact with extension media and use of integrated homestead farming technologies

Alam et al. (2017) observed that Extension media contact was positively correlated with farmers' knowledge on pond aquaculture practices

Alfrad and Sakib (2012) found that extension media contact and adoption of modern aquaculture technologies had significant relationship.

Sarma et al. (2011) observed Extension media contact and adoption of aquaculture technologies had significant relation.

Sana (2003) found that Extension contact had Significant and positive relationship with Practice on shrimp culture.

Ziauddin and Goswami (2010) found that extension contact of the farmers showed positive and significant relationship with their adoption of scientific fish cultivation practices.

### 2.2.10 Organizational Participation and Use of Technologies

Fardaus (2017) showed that organizational participation of tribal women had no significant relationships with their practice and knowledge on biochar promotion for homestead gardening.

Farhad (2003) observed in his study that organizational participation of the farmers had positive and significant relationship with their knowledge on using IPM in vegetable cultivation.

Sana (2003) found that organizational participation by the farmers had a positive and significant relationship with their knowledge in shrimp.

Rahman (2004) reported that organizational participation of the farmers had a significant and positive relationship with their adoption of IPM practices.

Sarker (1997) conducted a study to determine the relationship between selected characteristics of potato growers and observed that organizational participation of the potato growers had no significant relationship with their adoption improved potato cultivation practices.

### 2.2.11 Culture Knowledge and Use of Technologies

Ahmed (2006) found in his study that knowledge on wheat cultivation of the respondents had significant positive and relationship with their use of selected wheat varieties.

Chouhan and Singh (2013) reported that knowledge of the farmers showed significant relationship with their adoption of improved sugarcane cultivation practices.

Devi (2013) found that knowledge of the farmers showed positive and significant relationship with their adoption of dairy farming technologies.

Ziauddin and Goswami (2010) reported that knowledge of the farmers show positive and significant relationship with their adoption of scientific fish cultivation practices.

Chouhan and Singh (2013) reported that knowledge of the farmers showed significant relationship with their adoption of improved sugarcane cultivation practices.

Alam (1997) observed that agricultural knowledge of the rice growers had significant relationship with their use of farm practices in rice cultivation.

Sarkar (1997) found that potato production knowledge of potato growers had a positive and significant relationship with their use of improved potato cultivation practices.

**2.3 Problem Faced**

Roy (2018) identified problems ( fish diseases, poor transportation, low market price of fish, inputs are very costly, poor management system, chemical runways from the nearby land, high labour cost) in his study and found that these problems had significant relation with practice of modern fish farming technologies.

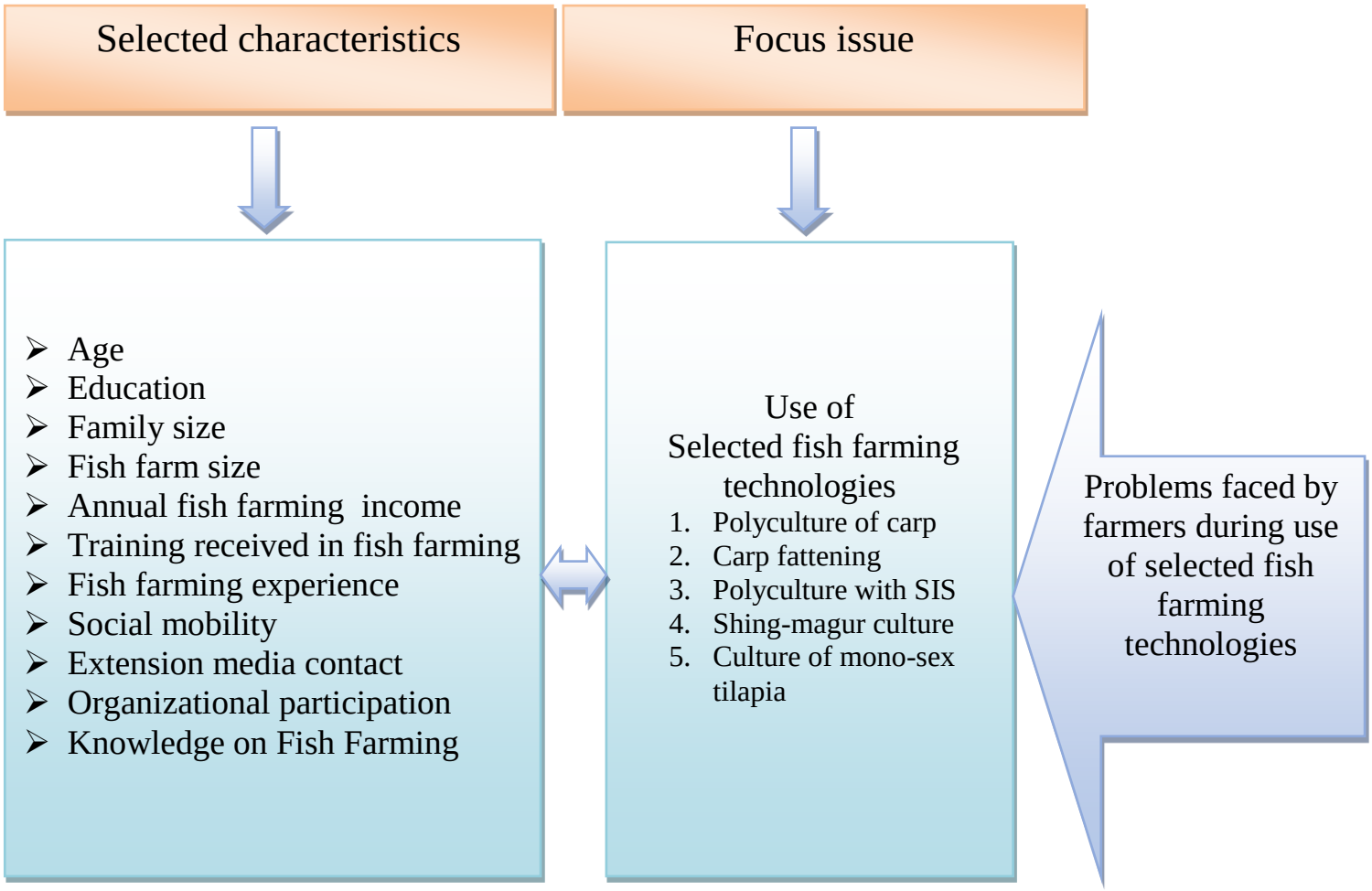
Saha (2001) found that Practice of pineapple cultivation had significant relationship with problem faced.

Islam (2005) observed that Practice of IPM in crop production had no relationship with problem faced.

**2.4 Conceptual Framework of the Study**

The conceptual framework is the researcher's understanding of how the particular variables in study connect with each other. Thus, it identifies the variables required in the research investigation. It is the researcher's "map" in pursuing the investigation. From the past studies and literature it is observed that various personal characteristics affected respondents on use of various technologies but it is quite impossible to deal with all the characteristics. No literature was found directly related with the use of selected fish farming technologies and the contribution of the selected characteristics of the fish farmers on their use of the selected fish farming technologies. Based on these considerations a conceptual framework has been developed for this study where the researcher mainly attempted to highlight two concepts, namely selected characteristics of

the fish farmers (age, education, family size, fish farm size, annual fish farming income, training received in fish farming, fish farming experience, social mobility, extension media contact, organizational participation, knowledge on fish farming) as and the focus issue ( use of selected fish farming technologies -polyculture of carp, carp fattening, polyculture with SIS, shing-magur culture, culture of mono-sex tilapia ). Further, the problems faced by the fish farmers are also included. The conceptual framework has been given in the next page:



## Figure 2.1 A conceptual framework of the study

# CHAPTER 3
# MATERIALS AND METHODS

It is one of the most important parts for data collection and analysis in any scientific research. It must have a careful consideration before conducting a study. The researcher has responsibility to properly describe what sorts of research design, methods and procedures would be follow in collecting valid and reliable data and analyzing and interpreting those to arrive at correct summery and meaningful conclusion. The chapter also mention the operational format and comparative reflection of some variables, statistical methods used in the study.

### 3.1 Locale of the Study

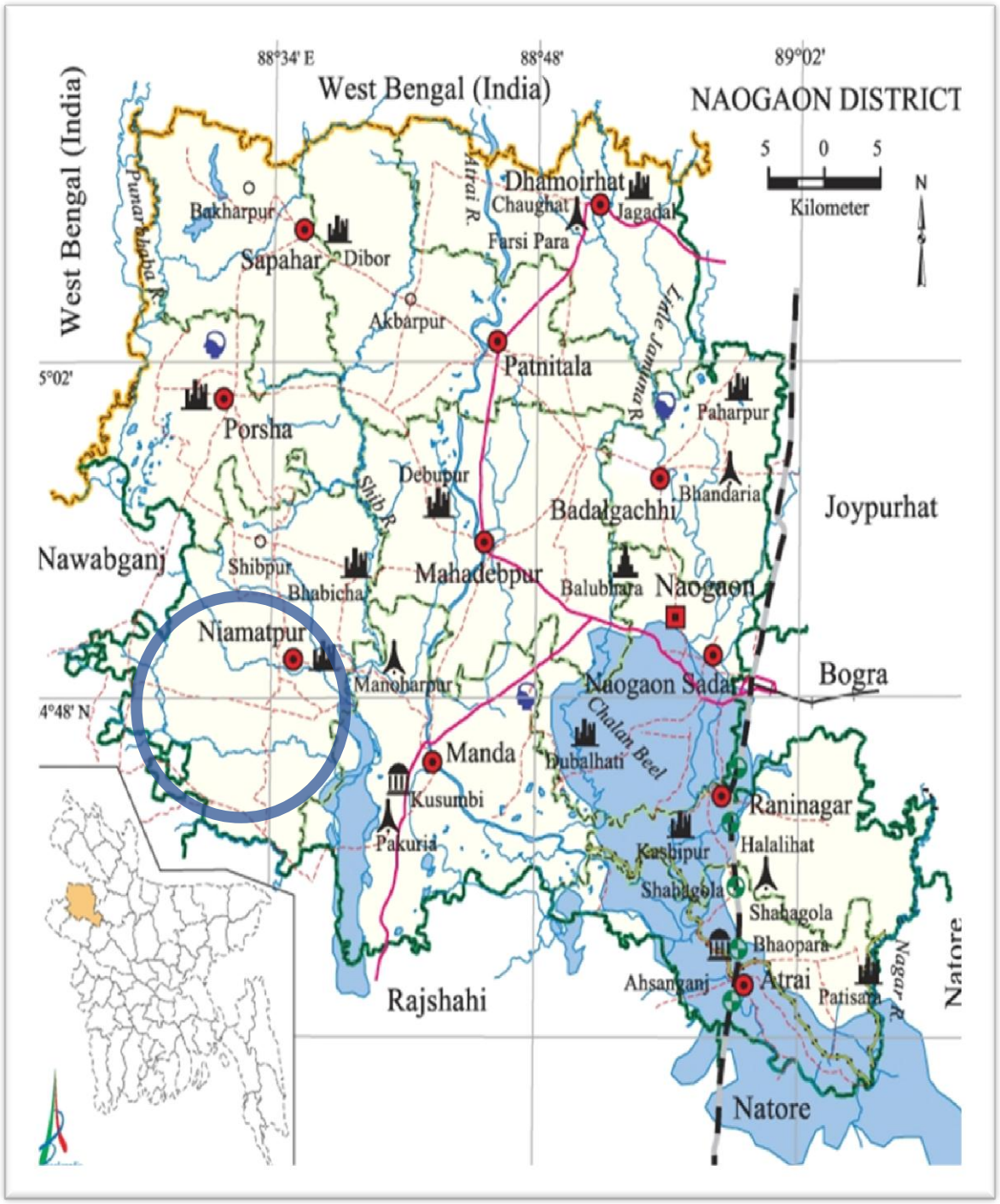
Data on use of selected fish farming technologies by farmers were collected from Niamatpur upazilla under Naogaon district where the target farmers were available in 8 unions. Out of 8 unions of Niamatpur upazilla, 5 unions namely, Parail, Niamatpur, Rosulpur Sreemanthpur and Bahadurpur were selected purposively. The main reasons for selecting this study area were:

i. Most of the villagers use selected fish farming technologies in the study area and the researcher had a good chance for obtaining reliable data from the farmers.
ii. The researcher's familiarity with the socio-economic status of the locality.

### 3.2 Research Design of the Study

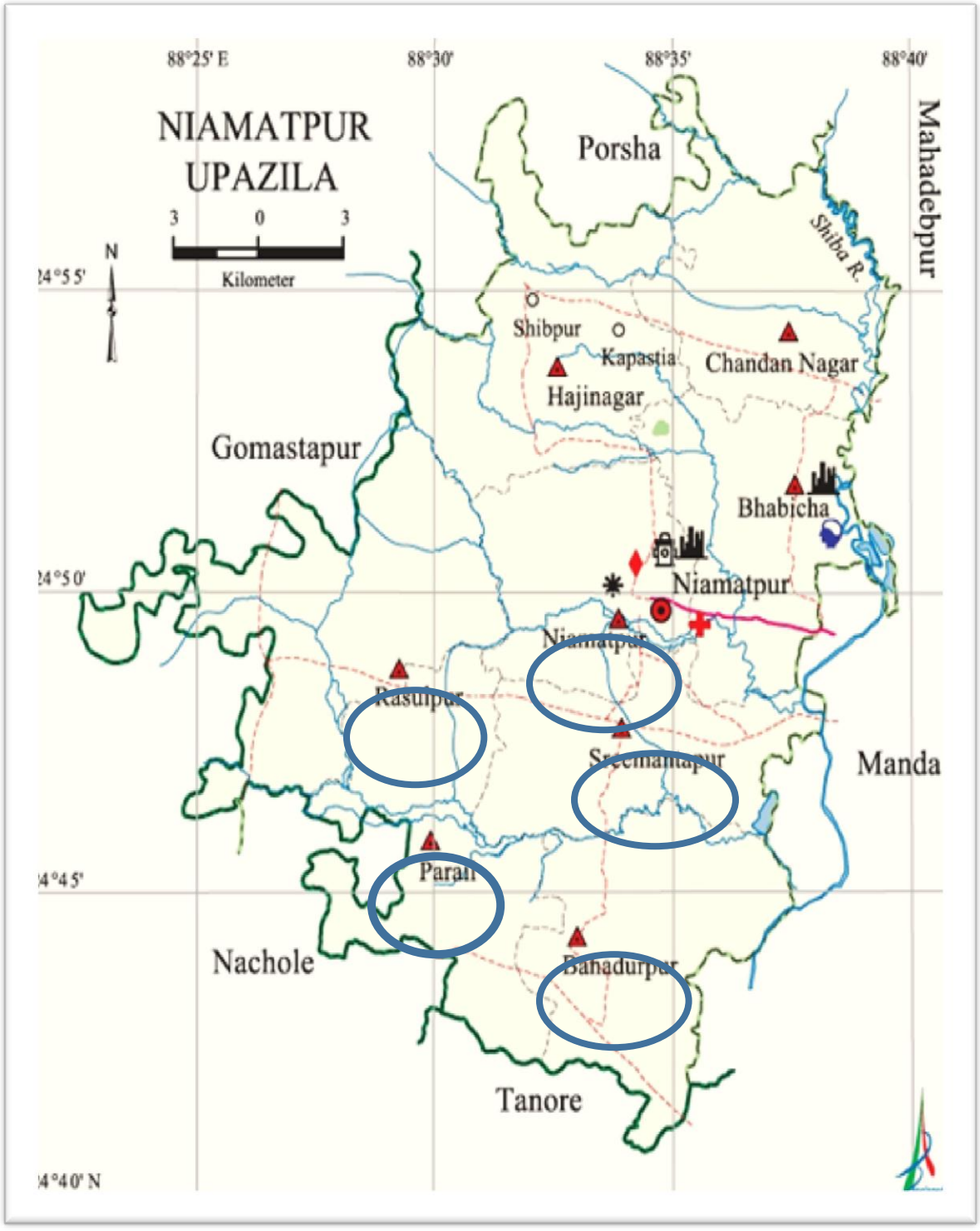
Research design means the plan of structure and strategy of inspection on imagined so as to get answer to research question control variance (Kerlinger, 1973). Designing the research for the study was taken in a scientific method. At first, researcher gathered and analyzed. Reviews were studies to choose appropriate variables and readiness of research instrument pre-testing of the research instrument was done before ultimate data collection. Then the collected data was analyzed and report was done. The maps of the study place were depicted.

The researcher himself with the cooperation of upazilla fisheries officer (UFO), collected an updated list of all the farmers of the selected villages of respective union. The total




numbers of fish farmer in these area were 925 which constituted the population of the study. A map of Naogaon district showing Niamatpur upazila and a map of Niamatpur upazilla showing study area have been shown in figure 3.1 and 3.2 respectively.

**Figure 3.1: Map of Naogaon showing Bangladesh inset**



## Figure 3.2: Map of Niamtpur upazilla showing study area

### 3.3 Research Instruments

In a social research field interview schedule is the popular instrument for data collection. Data were collected personally by the researcher himself through face to face interview from the selected fish farmers keeping in mind the objectives of the study. Necessary co-operation was gotten from the upazilla fisheries officer (UFO) and staff of Niamatpur fisheries office. Interviews were usually conducted with the respondent in their homes. At the time of interview with fish farmers the researcher took all possible care to establish rapport with them so that their co-operation and response to the questions and statements in the schedule was excellent. The entire process of collecting data was completed in January and February, 2020.

### 3.4 Population and Sample of the Study

The researcher collected data from 93 fish farmers (respondents) as a sample around 10 percent of the total population (925 fish farmers) of the current study following random sampling procedure. Simultaneously a reserved list of 15 farmers was made in order to use in case of non-availability of sampled farmers. The detailed distribution of population and sample are showed in Table 3.1.

**Table 3.1 Village wise distribution of the population and sample**

| Name of unions | Population | Sample | Reserved list |
|---|---|---|---|
| Parail | 175 | 18 | 4 |
| Niamatpur | 252 | 25 | 3 |
| Sreemanthpur | 110 | 11 | 2 |
| Rosulpur | 250 | 25 | 4 |
| Bahadurpur | 138 | 14 | 2 |
| Total | 925 | 93 | 15 |

### 3.5 Variables and Their Measurement Techniques

A variable is any measurable characteristic which can assume varying or different values in successive individual cases (Ezekiel and Fox, 1959). A well-organized research

usually contains at least two important elements. In any scientific research, the selection and measurement of variables is very important. The researcher reviewed the literature to widen his understanding about the nature and scope of the variables relevant to this research. The selected individual characteristics of the fish farmers were the experimental variables (namely, age, education, family size, fish farm size, fish farming experience, social mobility, organizational participation, annual fish farming income, knowledge in fish farming and extension contact). Use of selected fish farming technologies was the main focus of the study was considered as the predicted variable.

### 3.6 Measurement of the Selected Characteristics of the Fish Farmers

The socio-economic characteristics of the fish farmers and their knowledge on fish farming might have influence on use of selected fish farming technologies. These characteristics were age, education, family size, fish farm size, annual fish farming income, training received in fish farming, fish farming experience, social mobility extension contact, organizational participation and knowledge on fish farming. Measurement of all these characteristics and their knowledge are discussed in the following sub-sections.

#### 3.6.1 Age

The age of a fish farmers was measured in terms of actual years from his birth to the time of interview on the basis of the fish farmer's statement. Age define the significance of biological maturity of an individual. The contribution of age on use of various technologies has not been well established but it is used in social research to understand the demographic character of a population. A score of 1 (one) was assigned for each year of his age. Question of this characteristic appears in item no. 1 in the interview schedule (Appendix-A).

#### 3.6.2 Education

The education of a pond owner was measured by the number of years of schooling completed in an educational institution. A score of one (1) was given for each year of schooling completed. If a pond owner didn’t t know how to read and write, his education score was zero, while a score of 0.5 was given to a pond owner who could sign his name

only. If a pond owner did not go to school but studied at home or adult learning center, his knowledge status was determined as the equivalent to a formal school student. This variable appears in item no.2 in the interview schedule (Appendix-A).

### 3.6.3 Family Size

Family size of a fish farmer was measured by counting total number of persons in his family including himself and other person living and being dependent fully or partially on his income. The total number of persons was considered as his family size score .This variable appears in item no. 3 in the interview schedule (Appendix-A).

### 3.6.4 Fish Farm Size

The fish farm size of a farmer referred to the total area of pond either owned by a farmer or obtained from others on lease during the study period, on which he carried out farming operations, the area being in terms of full benefits to family. The total farm size in hectare was considered as farm size score of the farmers. Here a score of 1 (one) was assigned for 1 hectare of the farm size. The farm size was determined on the basis of responding data providers. This characteristic included in item no.4 in the interview schedule (Appendix-A).

### 3.6.5 Annual Fish Farming Income

Annual income of a farmer referred to the gross annual income obtained from fisheries sources. It was measured on the basis of his family's yearly earning from fish culture. The Annual fish farming income was expressed in taka. In measuring the variable total earning in taka of a farmers was converted into score. A score of 1 was assigned for each '1000' taka of the annual income to compute .It is included in item no. 5 in the interview schedule (Appendix-A).

### 3.6.6 Training Received in Fish Farming

Training received of a fish farmers was measured by total number of days attended in different fish culture related training programs in his life from different organizations. A score of 1 was assigned for per day receiving training of a farmer. This variable appears in item no.6 in the interview schedule (Appendix-A).

### 3.6.7 Fish Farming Experience

A farming experience was determined by total number of years since a farmer engaged in fish culture. The actual experience given by the fish farmers was measured as score. A score of 1 (one) was assigned for each year from starting the fish culture. This characteristic appears in item no.7 in the interview schedule (Appendix-A).

### 3.6.8 Social Mobility

Social mobility of the fish farmers was measured by computing score on the basis of his frequency of visit to 6 (six) different type of places. The scales, used for computing the extent of participation were not at all, rarely, occasionally and frequently. The score assigned for these scales were 0, 1, 2 and 3 respectively. The possible range of score could vary from 0 to18, where '0' indicated no social mobility and '18' indicated the highest level of Social mobility. This characteristic appears in item no.8 in the interview schedule (Appendix-A).

### 3.6.9 Extension Media Contact

This variable was measured by computing an extension contact score on the basis of a fish farmer's extent of contact with nine (9) selected media. Selected media with four alternative response as frequently, occasionally, rarely, and not at all, were assigned as 3, 2, 1 and 0 respectively. Logical frequencies were assigned for each alternative response for each of the 9 selected items. The extension contact score of a fish farmer was decided by summing up his score could vary from zero 0 to 27, where '0' indicated no extension contact and '27' indicated the highest level of extension contact .This characteristic appears in item no. 9 in the interview schedule (Appendix -A).

### 3.6.10 Organizational Participation

This variable of a farmer was measured by calculating the organizational participation score two dimensions based on nature of involvement as a member or as a chief

executive. Scoring 0, 1 and 2 for not involvement, as a member and as a chief executive in an organization. This characteristic appears in item no. 10 in the interview schedule (Appendix -A).

### 3.6.11 Knowledge on Fish Farming

Knowledge on fish farming of a fish farmer was measured by asking 15 questions regarding fish farming. Two (2) score was assigned for each correct answer and zero (0) for wrong or no answer. Score was also assigned for partially correct answer. The knowledge score of fish farmers on fish farming range from 0 to 30, where zero indicating very poor knowledge and 30 indicate the very high level of knowledge on fish farming technologies. The total obtained score of each farmer was counted for analysis the distribution overall knowledge of farmers. This issue has presented in item no. 11 of the interview schedule (Appendix-A).

## 3.7 Measurement of Use of Selected Fish Farming Technologies

Fish farming technologies were selected for the study through consultation with relevant expertise was the focus variable in this work. The fish farmers were asked to indicate their use of five selected fish farming technologies The farmers were asked to indicate their extent of use of these technologies with four alternative responses as regularly, occasionally, rarely and never and score were assigned to the alternative responses as 3, 2, 1 and 0 respectively. Use of selected fish farming technologies by the farmers were computed by summing up all the scores obtained by them. The possible range of use of selected fish farming technologies score was 0-15, while 0 indicated no use and 15 indicated highest use of selected fish farming technologies. This characteristic appears in item no. 12 in the interview schedule (Appendix -A).

To compare among the technologies, a rank order was made based on fish farming technologies use index (FFTUI). FFTUI at each of the technology items were computed by using the following formula.

Fish farming technologies use index (FFTUI) = $U_{Re} \times 3 + U_O \times 2 + U_R \times 1 + U_N \times 0$

Where,

$U_{Re}$ = Use of technology regularly

$U_O$ = Use of technology occasionally

$U_R$ = Use of technology rarely

$U_N$ = No use of technology

The possible range of fish farming technologies use index (FFTUI) of the farmers for each technology was 0 to 279, while 0 indicated no use and 279 indicated highest use of modern fish farming technology.

### 3.8 Measurement of Problems Faced in Use of Selected Fish Farming Technologies

Problems were measured by using of closed form of questions. The farmers were asked to give their opinion on 8 selected problems which were identified during pre-testing of the questionnaire on the use of selected fish farming technologies. The respondent were asked to indicate their extent of problem faced with four alternative responses as high, medium, low and never and score were assigned to the alternative responses as 3, 2, 1 and 0 respectively. Extent of problem faced by the farmers were computed by summing up all the scores obtained by them. The possible range of problem faced was 0 to 24, while 0 indicated no problem and 24 indicated highest problem faced. This characteristic appears in item no. 13 in the interview schedule (Appendix –A). Again Problem faced Index (PFI) was computed for each of the problems by using the following formula.

Problem faced Index (PFI) = $P_h \times 3 + P_m \times 2 + P_l \times 1 + P_n \times 0$

Where,

$P_h$ = Farmers faced problem at high extent

$P_m$ = Farmers faced problem at medium extent

$P_l$ = Farmers faced problem at low extent

$P_n$ = Farmers faced problem never

The PFI for each problem ranges from 0 to 279, where 0 indicated no problem and 279 indicated high problem.

### 3.9 Statement of Hypothesis

A hypothesis is a conjectural statement of the relation between two or more variables which can be put to a test to determine its validity. Hypothesis are always in declarative sentence form and they are related, either generally or specifically from variables to

variables (Kiplinger, 1973). In broad sense hypotheses are divided into two categories: (a) Research hypothesis and (b) Null hypothesis.

### 3.9.1 Research Hypothesis

Research hypothesis states a possible relationship between the variables being studied or a difference between experimental treatments that the researcher expects to emerge. The research hypothesis was formulated: 'there were significant relationships between the selected characteristics fish farmers and their use of selected fish farming technologies'.

### 3.9.2 Null Hypothesis

A null hypothesis states that there is no relationship between the concerned variables .The null hypothesis was formulated: 'there were no significant relationships between the selected characteristics of fish farmers and their use of selected fish farming technologies'.

## 3.10 Categorization of Data

For describing different characteristics, the farmers were classified into several categories. These categories were developed by considering the nature of distribution of data, general understanding prevailing in the social system and possible scores system. The procedure for categorization of data in respect of different variables is elaborately discussed while describing those variables in Chapter 4.

## 3.11 Data Processing

After completing the field survey, all data were coded, compiled & tabulated following the objectives of the study. All local units were converted into standard units. In case of qualitative data, proper scoring technique was followed to convert the data into quantitative form. All the individual responses to all questions of the interview schedule were transferred into a master sheet to simplify tabulation, categorization and organization.

## 3.12 Statistical Procedures or Analysis

The data collected were analyzed according to the objectives of the study. For regulating the qualitative data were converted into quantitative data by means of suitable scoring technique. The analysis was performed using SPSS (Statistical Package for Social Sciences) computer package and the statistical measures such as range, means, standard deviation, number and percentage distribution were used to describe the variables. Pearson's Product Moment coefficient of correlation (r) was used to describe the relationships between the concerned variables. At highest five percent (0.05) level of probability and one percent (0.01) level of probability were used for the rejecting of null hypothesis.

# CHAPTER 4

# RESULTS AND DISCUSSIONS

In this Chapter, the findings of the study and interpretation of the results have been presented according to the objectives of the study. This Chapter has been divided into four sections. The first section deals with the selected individual characteristics of the fish farmers while the second section deals with the extent of use of selected fish farming technologies. The third section deals with the relationships between the farmers selected characteristics and their extent of use of selected fish farming technologies. Finally, the fourth section deals with the problems faced by the farmers during the use of selected fish farming technologies.

## 4.1 Selected Characteristics of the Fish Farmers

Effective use of fish farming technologies plays a vital role in the gross agricultural production. Farmers use selected technologies when they find those useful and cost effective. Farmer's individual characteristics play a vital role in adopting those technologies. A particular technology might be beneficial but he may not accept due to his socio-economic condition or other factors. The individual characteristics of the fish farmers might have great impact on their use of the selected fish farming technologies.

This section deals with the categorization of the fish farmers based on their various characteristics. The characteristics of the fish farmers were selected to find out their relationships with the use of selected fish farming technologies were age, education, family size, fish farm size, annual fish farming income, training received in fish farming, social mobility, fish farming experience, extension media contact, organizational participation and knowledge on fish farming. These characteristics of the pond farmers are described in this section.

Table 4.1 reveal the salient features of the characteristics of the fish farmers and separate tables are provided while presenting categorizations, discussing and /or interpreting results concerning each of the characteristics in this chapter.

**Table 4.1: Salient features of the selected characteristics of the fish farmers (n=93)**

| SL NO. | Individuals Characteristics | Range | | Mean | Standard Deviation |
|---|---|---|---|---|---|
| | | Minimum | Maximum | | |
| 1 | Age | 24 | 65 | 40.32 | 9.63 |
| 2 | Education | 0 | 18 | 6.57 | 4.78 |
| 3 | Family size | 3 | 9 | 5.24 | 1.49 |
| 4 | Fish farm Size | 0.13 | 3.34 | 0.94 | 0.64 |
| 5 | Annual fish farming income | 20 | 800 | 232.31 | 181.26 |
| 6 | Training received in fish farming | 0 | 13 | 4.27 | 3.52 |
| 7 | Fish farming experience | 2 | 30 | 8.89 | 5.72 |
| 8 | Social mobility | 3 | 14 | 9.70 | 2.22 |
| 9 | Extension media contact | 5 | 21 | 11.94 | 3.53 |
| 10 | Organizational participation | 0 | 6 | 2.66 | 1.09 |
| 11 | Knowledge on pond fish farming | 9 | 26 | 19.08 | 3.75 |
| 12 | Use of selected fish farming technologies | 5 | 13 | 8.99 | 1.92 |

### 4.1.1 Age

The observed score of age of the farmers ranged from 24 to 65 with the average of 40.32 and the standard deviation of 9.629. Based on the age scores, the fish farmers were classified into three categories following legislative standard such as young (up to 30), middle aged (31-50) and old (above 50) as shown in Table 4.1.1

**Table 4.1.1 Distribution of the farmers according to their age**

| Categories | Farmers (n=93) | Mean | SD |
|---|---|---|---|

| | Number | Percent | | |
|---|---|---|---|---|
| Young( Up to 35 years ) | 37 | 38.79 | 40.32 | 9.629 |
| Middle-aged (36-55 years ) | 52 | 55.91 | | |
| Old(Above 50 years ) | 4 | 4.30 | | |
| Total | 93 | 100 | | |

Data showed that the highest proportion (55.91 percent) of the fish farmers were middle aged compared to 38.79 percent being young and only 4.30 percent old. That means majority (94.70 percent) in the study area were young to middle aged. Young people are more interested to new ideas and things. However, they might have valuable opinion in regard to use of selected fish farming technologies. This means that selected fish farming technologies in the study area are used by comparatively younger farmers.

### 4.1.2 Education

The education score of the pond owners ranged from 0-18, with an average of 6.57 and standard deviation 4.78. Based on their education scores, the fish farmer's educational status was classified into five categories namely illiterate (0), can sign only (0.5), primary education (1-5), secondary education (6-10) and above secondary (above 10). The distribution of the fish farmers according to their education is shown in Table 4.1.2

**Table 4.1.2 Distribution of the fish farmers according to their education**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | Number | Percentage | | |
| Can't read and write(0) | 7 | 7.52 | 6.57 | 4.78 |
| Can sign name only(0.5) | 11 | 11.82 | | |
| Primary Level(1-5) | 22 | 23.65 | | |
| Secondary Level(6-10) | 35 | 37.63 | | |
| Above Secondary(above 10) | 18 | 19.35 | | |
| Total | 93 | 100 | | |

Data indicated that the highest proportion (37.63percent) of the farmers had secondary education, 19.35 percent had higher secondary and above education, 23.65 percent had primary education, 11.82 percent could sign only and only 7.52 percent was illiterate. It

was revealed that higher level of educated farmers were likely to be more receptive to the modem facts and ideas. They have better mental strength in decision making and problem solving activities. Education helps the farmers to gain knowledge by reading books, leaflets, bulletins and other printed materials about various technologies. The findings of this study, illiterate farmers face a great difficulty in use of selected technologies.

### 4.1.3 Family Size

The observed range of family size of the farmers ranged from 3 to 9 with the average of 5.24 and the standard deviation of 1.49. Based on the family size scores, the farmers family size were classified into three categories such as small (up to 4), medium (5-6) and large (above 7) as shown in Table 4.1.3

**Table 4.1.3 Distribution of the fish farmers according to their family size**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | Number | Percentage | | |
| Small (up to 4) | 33 | 35.48 | 5.24 | 1.49 |
| Medium (5-6) | 38 | 40.86 | | |
| Large (above 7) | 22 | 23.65 | | |
| Total | 93 | 100 | | |

Data showed that 40.86 percent of the farmers belong to medium family, 35.48 percent had small family and 23.65 percent had large family. It could be said that majority of the fish farmers had small to medium family size.

### 4.1.4 Fish Farm Size

The observed score of fish farm size of the farmers ranged from 0.13 to 3.34 with the average of 0.94 and the standard deviation of 0.64. Based on fish farm size score, the fish farms were classified into small (up to o.50), medium (0.51-1.20) and large (above 1.20). The distribution of the fish farmers according to their fish farm size is shown in Table 4.1.4

**Table 4.1.4 Distribution of the fish farmers according to their fish farm size**

| **Categories** | **Farmers (n=93)** | | **Mean** | **SD** |
|---|---|---|---|---|
| | **Number** | **Percentage** | 0.94 | 0.64 |

| | | | | |
|---|---|---|---|---|
| Small(up to 0.50) | 21 | 22.58 | | |
| Medium (0.51-1.20) | 50 | 53.76 | | |
| Large(above 1.20) | 22 | 23.65 | | |
| Total | 93 | 100 | | |

Data presented that the majority (53.76 percent) of the farmers had medium farm size, small farm size had 22.58 percent, while only 23.65 percent had large farm size. It might be indicated that approximately half of the farmers had medium farm size and they were more interested to use selected fish farming technologies.

### 4.1.5 Annual Fish Farming Income

The observed score of annual fish farming income (taka in thousands) of the farmers ranged from 100 to 1400 with the average of 232.31 and the standard deviation of 181.25. Based on the annual family income score, the fish farmers were classified into three categories considering mean and standard deviation such as low income (up to 100), medium income (100-300) and high income (above 300) as shown in Table 4.1.5

**Table 4.1.5.Distribution of the farmers according to their annual fish farming income**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | Number | Percentage | | |
| Low income(up to 100) | 33 | 35.48 | 232.31 | 181.25 |
| Medium income(100-300) | 39 | 41.94 | | |
| High income(above 300) | 21 | 22.58 | | |
| Total | 93 | 100 | | |

Data indicated that the highest proportion (41.94 percent) of the farmers had medium income when 35.48 percent farmers had low income and 22.58 percent farmers had high income. Thus, the majority (64.52) of the pond farmers had medium to high income, indicating that the selected fish farming technologies were usually used by the fish farmers of comparatively higher economic standings.

### 4.1.6 Training Received in Fish Farming

The observed score of training received in fish farming of the farmers ranged from 0 to 13 with the average of 4.27 and the standard deviation of 3.52. Based on this, the farmers were classified into four categories considering the observed score such as no training received (0), low extent of training received (up to 4), medium extent of training received (5-8) and high extent of training received (above 8) as shown in Table 4.1.6

**Table 4.1.6.Distribution of the fish farmers according to their training received in fish farming**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | Number | Percentage | | |
| No training received (0) | 26 | 27.95 | 4.27 | 3.52 |
| Low extent of training received (up to 4) | 21 | 22.58 | | |
| Medium extent of training received (5-8) | 32 | 34.40 | | |
| High extent of training received (above 8) | 14 | 15.05 | | |
| Total | 93 | 100 | | |

Data revealed that about 27.95 percent fish farmers had no training received when low and high extent of training received of farmers followed by 22.58 and 15.05 percent respectively and highest (34.40percent) portion of farmers had medium extent of training received. It could be said that majority of the farmers received any kind of training.

### 4.1.7 Fish Farming Experience

The observed score of fish farming experience of the farmers ranged from 2 to 30 with the average of 8.89 and the standard deviation of 5.75. Based on farming experience score, the farmers were classified into three categories considering mean and standard deviation such as low ( up to 4), medium (5-14), and high (above 14) as shown in Table 4.1.7

**Table 4.1.7 Distribution of the fish farmers according to their Farming experience**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | number | Percentage | 8.89 | 5.75 |

| | | | | |
|---|---|---|---|---|
| Low( up to 4) | 20 | 21.51 | | |
| Medium (5-14) | 55 | 59.14 | | |
| High (above 14) | 18 | 19.35 | | |
| Total | 93 | 100 | | |

Data revealed that about half of the farmers (21.51 percent) had low farming experience, while 59.14 percent and 19.35 percent had medium and high farming experience respectively.

### 4.1.8 Social Mobility

The observed score of social mobility of the fish farmers ranged from 3 to 14 with the average of 9.70 and the standard deviation of 2.22. Based on possible score of the fish farmers were classified into three categories such as low (up to 7), medium (8-11) and high (above 11) as shown in Table 4.1.8

**Table 4.1.8 Distribution of the fish farmers according to their Social mobility**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | number | Percentage | | |
| Low (up to 7) | 14 | 15.05 | 9.70 | 2.22 |
| Medium(8-11) | 70 | 75.26 | | |
| High (above 11) | 9 | 9.68 | | |
| Total | 93 | 100 | | |

Data indicated that the 15.05 percent of the farmers had low social mobility, while 75.26 percent had medium and only 9.68 percent had high. It could be said that the majority of the farmers had low movements to medium movements from here and there under different social conditions.

### 4.1.9 Extension Media Contact

The observed score of extension media contact of the farmers ranged from 5 to 21 with the average of 11.94 and the standard deviation of 3.53. Based On possible score, the fish farmers were classified into three categories such as low (up to 9), medium (10-15) and high (above 15) as shown in Table 4.1.9

**Table 4.1.9 Distribution of the fish farmers according to their extension media contact**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | Number | Percentage | | |
| Low (up to 9) | 23 | 24.73 | 11.94 | 3.53 |
| Medium (10-15) | 59 | 63.44 | | |
| High (above 15) | 11 | 11.83 | | |
| Total | 93 | 100 | | |

Data showed that the majority (63.44 percent) of the farmers had medium extension media contact, when 24.73 percent had low and 11.83 percent had high extension media contact. It is logical that there may be a relationship between contact with different media and use of selected fish farming technologies. In order to increase use of selected fish farming technologies, contact with different media of the fanners should be increased.

**Table 4.1.10 Organizational Participation**

The observed score of organizational participation of the respondents ranged from 0 to 6 with the average of 2.66 and the standard deviation of 1.09. Based on observed score, the farmers were classified into three categories such as low (up to 2) medium (3-4) and high (above 4) as shown in Table 4.1.10

**Table 4.1.10 Distribution of the fish farmers according to their organizational participation**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | Number | Percentage | | |
| Low (up to 2) | 48 | 51.61 | 2.66 | 1.09 |
| Medium (3-4) | 39 | 41.94 | | |
| High (above 4) | 6 | 6.45 | | |
| Total | 93 | 100 | | |

Data indicated that the highest proportion (51.61 percent) of the fish farmers had low organizational participation, while 41.94 percent had medium and only 6.46 percent had

high organizational participation of the study area. It could be said that about half of the farmers had low organizational participation.

### 4.1.11 Knowledge of farmers on Fish Farming

The observed score of knowledge on fish farming ranged from 9 to 26. With the average of 19.08 and standard deviation of 3.75. Based on the theoretical scores, the fish farmers were classified into four categories as: low level knowledge (up to 15), medium level knowledge (16 to 22), high level knowledge (above 22). The distribution of the farmers according to their knowledge level is shown in Table 4.1.11

**Table 4.1.11 Distribution of the farmers according to their knowledge on fish farming**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | Number | Percentage | | |
| Low (up to 15) | 15 | 16.13 | 19.08 | 3.75 |
| Medium (16 to 22) | 61 | 65.59 | | |
| High (above 22) | 17 | 18.27 | | |
| Total | 93 | 100 | | |

Data reveal that the highest proportion (65.59 percent) of the fish farmer had medium level knowledge followed by 18.27 percent and 16.13 percent had high and low level of knowledge respectively. The result indicated that more than half of the farmers had medium level knowledge on fish farming.

## 4.2 Use of Selected Fish Farming Technologies

The observed score of use of selected fish farming technologies by the farmers ranged from 5 to 13 with an average of 8.99 and standard deviation of 1.92 (Table 4.1). Based on these, the fish farmers were classified into three categories namely low extent of use (up to 7), medium extent of use (8-11) and high extent of use (above 11). The distribution of the fish farmers according to their use of selected fish farming technologies is given in Table 4.2

**Table 4.2 Distribution of the fish farmers according to their use of selected fish farming technologies**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | Number | Percentage | | |
| Low (up to 7) | 19 | 20.43 | 8.99 | 1.92 |
| Medium (8-11) | 62 | 66.67 | | |
| High (above 11) | 12 | 12.90 | | |
| Total | 93 | 100 | | |

Data revealed that highest portion (66.67 percent) of the fish farmers had medium extent of use of selected fish farming technologies, while 20.43 percent had low extent of use and 12.90 percent had high extent of use of selected fish farming technologies. So it can be said that there was scope to increase the use of selected fish farming technologies in the study area.

### 4.2.1 Comparison of Selected Fish Farming Technologies Used By the Farmers

The use of selected fish farming technologies by the farmers was the focus variable of this study. An attempt was made to determine the use of selected fish farming technologies by the farmers on the five selected technologies of fish production. To compare among the technologies, a rank order was made based on fish farming technologies use index (FFTUI).

**Table 4.2.1 Comparison of selected fish farming technologies used by the farmers**

| SL NO | Technologies | Farmers (n=93) | | | | FFTUI | Rank order |
|---|---|---|---|---|---|---|---|
| | | Re | O | R | N | | |
| 1 | Polyculture of carp | 85 | 7 | 0 | 0 | 269 | **1st** |
| 2 | Carp fattening | 42 | 29 | 19 | 3 | 203 | **2nd** |
| 3 | Culture of mono-sex tilapia | 26 | 25 | 19 | 23 | 147 | **3rd** |
| 4 | Shing-magur culture | 13 | 25 | 27 | 28 | 116 | **4th** |
| 5 | Polyculture with SIS | 12 | 18 | 29 | 34 | 101 | **5th** |

Re=Regularly, O= Occasionally, R= Rarely, N= Never

Data obtained in Table revealed that the highest proportion of farmers use technology named 'Polyculture of carp' (FFTUI =269). The result may be due to:

- Different species of carp consume food from different layers of pond in polyculture that reduce loss of food and so it is cost effective.
- Cultured fish can be further reared for fattening.
- Harvesting can be done at various time so they can get money in need.

Carp fattening (FFTUI =203) obtained 2nd position in the rank table. This was occurred may be due to:

- More profitable than any other culture techniques.
- High food conversion ratio of fish.
- High investment is required .Regular monitoring is very important to avoid any kind of undesirable occurrence.

Culture of mono-sex tilapia (FFTUI =147) took 3rd position in table. This was happened may be due to:

- High growth rate of mono-sex tilapia.
- Disease resistance and can be cultured in high density.
- Inadequate supply of properly produced mono-sex tilapia fry.

Shing-magur culture (FFTUI =116) took position 4th in the rank table, due to-

- Shing and magur have high market demand and nutritional value.
- High growth rate and food conversion ratio.
- Lack of fry supply on demand and on time.
- All farmers are not properly informed about this technology, they take it traditional and not profitable.

The lowest use of technology was observed on Polyculture with SIS (FFTUI =101). The findings might be due to:

- SIS (small indigenous species) are good source of vitamins and minerals.
- Farmers are not much familiar with this technology and think SIS interfere other cultured species, pollute pond environment and have less economic value.
- Natural source is not enough and hatcheries far away from the culture area.

### 4.3 Problem Faced in Fish Farming

The problem faced score of the pond farmers ranged from 6 to 18 with a mean of 13.01 and standard deviation of 3.13. Based on the problem faced scores, the fish farmers were classified into three categories: low (up to 10), medium (11-16) and high (above 16). The distribution of the pond farmers according to their problem faced is presented in Table 4.3.

**Table 4.3**

| Categories | Farmers (n=93) | | Mean | SD |
|---|---|---|---|---|
| | Numbers | Percentage | | |
| Low (up to 10) | 22 | 23.66 | 13.01 | 3.13 |
| Medium (11-16) | 51 | 54.84 | | |
| High (above 16) | 20 | 21.50 | | |
| Total | 93 | 100 | | |

Data presented in Table 4.3 shows that majority (54.84 percent) of the farmers faced medium problems, 23.66 percent low and 21.50 percent faced high problems in use of selected fish farming technologies. The findings indicate that more than three-fourths (76.34 percent) of the farmers faced medium to high problems.

### 4.3.1 Comparison of the Problems Faced By the Farmers in Using of Selected Fish Farming Technologies

To determine the extent of severity of problem faced by the farmers in using of modern technologies in fish farming, a Problem Faced Index (PFI) was computed. The PFI for each problem ranges from 0 to 279, where 0 indicated no problem and 279 indicated high problem. The Computed Problem Confrontation Index of the problems ranged from 80 to 152.

**Table 4.3.1 Problem Faced Index (PFI) in using of selected fish farming technologies with rank order**

| SL NO | Problems | Farmers (n=93) | | | | PFI | Rank order |
|---|---|---|---|---|---|---|---|
| | | High | Medium | Low | Never | | |
| 1 | Fish diseases | 51 | 35 | 7 | 0 | 230 | 1st |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | High investment | 42 | 32 | 10 | 0 | 200 | 2nd |
| 3 | Lack of quality seed on demand | 45 | 24 | 10 | 14 | 193 | 3rd |
| 4 | Lack of loan | 17 | 31 | 34 | 11 | 147 | 4th |
| 5 | Lack of quality feed and chemicals | 14 | 25 | 37 | 17 | 129 | 5th |
| 6 | Transportation problem | 17 | 21 | 32 | 23 | 125 | 6th |
| 7 | Algal bloom | 8 | 23 | 28 | 34 | 98 | 7th |
| 8 | Poaching and vandalism | 5 | 16 | 41 | 31 | 88 | 8th |

Data contained in Table 4.16 indicate that fish diseases ranked first severe problem. Most pond fish farmers do not have a good understanding of health and disease issues in their system. In pond aquaculture system, high stocking density and irregularly feed supply is very prone to disease outbreak.

Many diseases of fish are secondary to environmental insult. According to fish farmers, most of the diseases mainly occurred during the winter season. During this time water level of farmer's pond become very low and the water quality also become very poor. Fish take less food at this time and their physiological condition become gradually weak leading fish more susceptible to disease. So most of the can be prevented through proper management.

High investment take 2nd position in the rank table. It is occurred due to high price of fish feed, seed, equipment used for water quality measurement and pond lease system.

Table revealed that lack of quality seed on demand was the 3rd severe problem. Because most of the hatchery far away from the farm area and not capable to produce enough seed to meet farmers demand.

As use of modern technologies in fish farming required high investment and majority farmers had low to medium income, they were in need of loan. But due to inadequate and complex loan system, they faced lack of loan and lack of loan took 4th position in the rank table.

Lack of quality feed and other chemicals was the 5th major problem of the farmers. Most of modern technologies in fish farming depend on artificial food and chemical to treat fish and water. But there was lack of quality feed and other chemicals in market.

It was observed that transportation problem obtained 6th position in rank table. Because high mortality rate of fry occurred and the quality of fish transported to distant places often gets deteriorated and damaged due poor transportation system.

Due to poor water supply and farmer's poor understanding on food and chemicals supply, algal bloom occurred in pond especially in winter season. For these reasons, algal bloom took 7th rank in the table.

Poaching and vandalism occurred at low extent but it could lead farmers to loss at large extent and it took 8th position in the rank table.

## 4.4 Relationships between the Selected Characteristics of the Fish Farmers and Use of Selected Fish Farming Technologies

The purpose of this section is to deals with the relationships of the selected characteristics of the fish farmers with their use of selected fish farming technologies. The characteristics include age, education, family size, fish farm size, annual fish farming income, training received in fish farming, fish farming experience, social mobility, extension media contact, organizational participation, and knowledge on fish farming.

Pearson's Product Moment co-efficient of correlation (r) was used to test a null hypothesis concerning the relation between any two variables. Five percent (0.05) and one percent (0.01) level of significance was used as the basis for acceptance or rejection of a null hypothesis. Results of co-efficient of correlation between each of the selected characteristics of the fish farmers and their use of selected fish farming technologies have shown in table 4.3. In addition, a correlation matrix has been presented in Appendix-B.

**Table 4.4 Relationships between the focus issue and the selected characteristics of the farmers.**

| Focus Issue | Selected Characteristics | Correlation coefficient | Tabulated 'r' value with 91df |
|---|---|---|---|

| | | (r) | At 0.05 level | At 0.01 level |
|---|---|---|---|---|
| Use of selected fish farming technologies | Age | 0.167 | 0.203 | 0.265 |
| | Education | 0.281** | | |
| | Family size | 0.130 | | |
| | Fish farm size | 0.436** | | |
| | Annual fish farming income | 0.444** | | |
| | Training received in fish farming | 0.338** | | |
| | Fish farming experience | 0.187 | | |
| | Social mobility | 0.214* | | |
| | Extension media contact | 0.542** | | |
| | Organizational participation | 0.189 | | |
| | Knowledge on fish farming | 0.342** | | |

"**" indicates correlation is significant at the 0.01 level (2-tailed) and

"*" indicates correlation is significant at the 0.05 level (2-tailed).

### 4.4.1 Age and Farmer's Use of Selected Fish Farming Technologies

The computed 'r' (0.167) value was smaller than that of the tabulated value (r = 0.203) with 91 degree of freedom at 0.05 level of probability as shown in Table 4.3. It lead to the following observation:

- It could be said that age of fish farmers had no significant but positive relationship with their use of selected fish farming technologies.
- The concerned null hypothesis could not be rejected.
- It could be said that use of selected fish farming technologies not influenced by the age of fish farmers.

### 4.4.2 Education and Farmer's Use of Selected Fish Farming Technologies

The computed 'r' (0.281) value was higher than the tabulated value (r = 0.265) with 91 degree of freedom at 0.01 level of probability as shown in Table 4.3 and it directed to the following observations:

- The relationship between education of the fish farmers and use of selected fish farming technologies showed significant and positive trend.
- Hence, the concerned null hypothesis could be rejected.

- It could be said that the use of selected fish farming technologies positively influenced by education.

### 4.4.3 Family Size and Farmer's Use of Selected Fish Farming Technologies

The computed 'r' (0.130) value was smaller than that of the tabulated value (r = 0.203) with 91 degree of freedom at 0.05 level of probability as shown in Table 4.3 and observations were:

- The relationship between family size of the fish farmers and use of selected fish farming technologies showed non-significant and positive trend.
- . Hence, the concerned null hypothesis could not be rejected.
- It could be said that use of selected fish farming technologies not influenced by the family size of fish farmers.

### 4.4.4 Farm Size and Farmer's Use of Selected Fish Farming Technologies

The computed 'r' (0.436) value was higher than that of the tabulated value (r = 0.265) with 91 degree of freedom at 0.01 level of probability as shown in Table 4.3. The findings showed that:

- There had significant and positive relationship between farm size of the fish farmers and use of selected fish farming technologies.
- Hence, the concerned null hypothesis could be rejected.
- It could be said that use of selected fish farming technologies was high when the farm size of fish farmers was high.

### 4.4.5 Annual Fish Farming Income and Use of Selected Fish Farming Technologies

The computed value of 'r' (0.444) was higher than the tabulated value (r = 0.265) with 91 degree of freedom at 0.01 level of probability as shown in Table 4.3.and the findings were:

- There had significant and positive relationship between annual family income of the fish farmers and use of selected fish farming technologies.
- Hence, the concerned null hypothesis could be rejected.

- It could be said that use of selected fish farming technologies positively affected by farmers annual fish farming income.

### 4.4.6 Training Received in Fish Farming and Use of Selected Fish Farming Technologies

The computed 'r' (0.338) value was larger than the tabulated value (r = 0.265) with 91 degree of freedom at 0.01 level of probability as shown in Table 4.3.and the observation were:

- The relationship between training received of the fish farmers and use of selected fish farming technologies was significant was positive.
- The concerned null hypothesis could be rejected.
- Considering the findings it can be concluded that the higher training receiver fish farmers, the higher use of selected fish farming technologies.

### 4.4.7 Fish Farming Experience and Use of Selected Fish Farming Technologies

The computed 'r' (0.187) value was smaller than the tabulated value (r = 0.203) with 91 degree of freedom at 0.05 level of probability as shown in Table 4.3, where observations were:

- Relationship between fish farming experience and use selected fish farming technologies of the fish farmers was non-significant but positive.
- Hence, the concerned null hypothesis could not be rejected.

### 4.4.8 Social Mobility and Use of Selected Fish Farming Technologies

The computed 'r' (0.214) value was larger than the tabulated value (r = 0.203) with 91 degree of freedom at 0.05 level of probability as shown in Table 4.3 that showed:

- Relationships between use of selected fish farming technologies and this selected characteristics of the fish farmers had significant and positive trend.
- Hence, the concerned null hypothesis could be rejected.
- Considering the findings, it could be said that the use of selected fish farming technologies positively influenced by social mobility.

### 4.4.9 Extension Media Contact and Use of Selected Fish Farming Technologies

The computed ‘r' (0.524) value was larger than the tabulated value (r = 0.265) with 91 degree of freedom at 0.01 level of probability as shown in Table 4.3. And the observations were:

- The findings indicated that extension contact of the fish farmers had significant relationship with use of selected fish farming technologies.
- Hence, the concerned null hypothesis could be rejected.
- Higher the extension contact higher the use of selected fish farming technologies.

### 4.4.10 Organizational Participation and Use of Selected Fish Farming Technologies

The co-efficient of correlation (r) between the concerned variables was computed and found to be 0.189 which was smaller than the tabulated value (r = 0.203) with 91 degrees of freedom at 0.05 level of probability as shown in Table 4.3 the observations were:

- There was non-significant but positive relationships between organizational participation and use of selected fish farming technologies.
- Hence, the concerned null hypothesis could not be rejected.

### 4.4.11. Knowledge on Fish Farming and Their Use of Selected Fish Farming Technologies

The co-efficient of correlation (r) between the concerned variables was computed and found to be 0.342 presented in Table 4.3 The computed value (r = 0.342) was found to be greater than the Table value of (r = 0.265) with 91 degrees of freedom at 0.01 level of probability., Which led to the following observations:

- The relationship showed a positive direction and significant relationship between knowledge and use of selected fish farming technologies.
- The concerned null hypothesis was rejected.
- It could be said that the farmers who has more knowledge on fish farming technologies have higher attitude for use of selected fish farming technologies.

# CHAPTER 5
# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Summary of the Findings

The major findings of the study have been summarized in four sections. The first section deals with the selected characteristics of the farmers. The second section shows the farmer's use of selected fish farming technologies. The third section deals with the relationships between the selected characteristics and use of selected fish farming technologies and finally the fourth section sites the major problems.

### 5.1.1 Selected Characteristics of the Farmers

**Age:** The 55.91 percent fish farmers had middle aged compared to 38.79 percent of the farmers belonged to the young aged categories, while the old aged category had 4.30 percent. This means that selected fish farming technologies in the study area is used by comparatively younger farmers.

**Education:** The highest proportion (37.63 percent) of the farmers had secondary education, 19.35 percent had higher secondary and above education, 23.65 percent had primary education, 11.82 percent can sign only and only 7.52 percent was illiterate. It was revealed that educated farmers were likely to be more receptive to the modem facts and idea.

**Family Size**: about 40.86 percent of the respondents belong to medium family, 35.48 percent had small family and 23.65 percent had large family. That means majority had small to medium family.

**Fish Farm Size:** About 53.76 percent of the farmers had medium farm size, 22.58 percent had small farm size, while only 23.65 percent had large farm size. That means about half of the farmers had medium farm size and they were more interested to use selected fish farming technologies.

**Annual Fish Farming Income**: Highest proportion (41.94 percent) of the farmers had medium income where 35.48 percent farmers had low and 22.58 percent farmers had high income. Thus, majority (64.52) of the pond farmers had medium to high income so that selected fish farming technologies were usually used by the pond farmers having higher income.

**Training received in fish farming:** About 27.95 percent fish farmer didn't receive any training when low and high extent of training received by the farmers followed by 22.58 and 15.05 percent respectively and highest (34.40percent) portion of farmers had received medium extent of training. It could be said that majority of the farmers received any kind of training.

**Fish Farming Experience:** About 21.51 percent had low farming experience, while 59.14 percent and 19.35 percent had medium and high farming experience respectively.

**Social Mobility:** The 15.05 percent of the fish farmers had low social mobility, while 75.26 percent had medium and only 9.68 percent had high. It could be said that the majority of the farmers had low to medium movements.

**Extension Media Contact:** About 63.44 percent of the farmers had medium extension media contact, 24.73 percent had low and 11.83 percent had high.

**Organizational Participation**: Highest proportion (51.61 percent) of the fish farmers had low organizational participation, while 41.94 percent had medium and only 6.46 percent had high organizational participation.

**Knowledge on Fish Farming:** Highest proportion (65.59 percent) of the fish farmer had medium level knowledge when 18.27 percent and 16.13 percent had high and low level of knowledge respectively.

### 5.1.2 Farmer's Use of Selected Fish Farming Technologies

The average use score of the pond farmers was 8.99 against the possible range of 0 to 13. About 66.67 percent of the pond farmers had medium extent of use, while 20.43 percent farmers had low extent of use and only 12.90 percent farmers had high extent of use of selected fish farming technologies. Thus, a proportion of 87.1 percent of the pond farmers had low to medium extent of use on various aspects of selected fish farming technologies. Among the technologies, highest proportion of farmers use polyculture of carp due to different species of carp consume food from different layers of pond in polyculture that reduce loss of food and so it is cost effective, cultured fish can be further reared for fattening, harvesting can be done at various time so they can get money in need.

### 5.1.3 Problems Faced by Farmers in Use of Selected Fish Farming Technologies

Majority (54.84 percent) of the farmers faced medium problems, 23.66 percent low problems and 21.50 percent faced high problems in use of selected fish farming technologies. The findings indicate that more than three-fourths (76.34 percent) of the farmers faced medium to high problems. Among the problems, farmers mostly faced fish diseases problem due to most pond fish farmers do not have a good understanding of health and disease issues in their system. In pond aquaculture system, high stocking density and irregularly feed supply is very prone to disease outbreak.

### 5.1.4 Relationships between the Selected Characteristics of the Farmers and Use of Selected Fish Farming Technologies

Correlation coefficient analysis indicated that age, family size, fish farming experience and organizational participation did not show significant relationships with the use of selected fish farming technologies. On the contrary, education, fish farm size, annual fish

farming income training received in fish farming, fish farming experience, social mobility, extension media contact and knowledge on fisheries technologies showed significant and positive relationships with the use selected fish farming technologies.

### 5.2 Conclusions

Based on findings of the study and the logical interpretations in the light of relevant facts the researcher has drawn the following conclusions:

1) This study found out that a proportion of 87.1 percent of the pond farmers had low to medium extent of use on various aspects of selected fish farming technologies. When only 12.90 percent farmers had high extent of use of selected fish farming technologies Therefore, it may be concluded that there is ample scope for increasing the use of selected fish farming technologies in the study area.

2) Correlation test showed that education, fish farm size, annual fish farming income, training received in fish farming, social mobility, extension media contact and knowledge on fish farming had significant and positive relationships with the use of selected fish farming technologies. Therefore, it can be concluded that these characteristics of the fish farmers significantly contribute to influencing the use of these selected fish farming technologies.

3) Age, family size, fish farming experience and organizational participation did not showed significant relationship with the use of selected fish farming technologies. So it could be concluded that these characteristics of the farmers did not significantly contribute to influence the use of selected fish farming technologies.

4) The highest problem faced by the fish farmers was ‘fish disease’. They had faced other problems too. These problems need to be solved as much as possible.

## 5.3 Recommendations

### 5.3.1 Recommendations for Policy Implication

Based on the findings and conclusions of the study, the following recommendations are made:

1) It is observed that 87.1 percent of the pond farmers had low to medium extent of use of selected fish farming technologies. So, it is strongly recommended that adequate

technical support and training facilities need to be extended to ensure proper and effective use of technologies.

2) As majority of fish farmers had low social mobility, extension media contact and organizational participation, so care should be taken to increase their participation and social mobility through various GO and NGOs.

3) It was revealed that farmers of higher educated level were more receptive to selected fish farming technologies. It may be recommended that special attention should be given by the extension providers to the illiterate and less educated farmers, so that they become aware about the benefit of use of these selected fish farming technologies.

4) Training had significant positive relationship with the use of selected fish farming technologies. Therefore, it may be recommended that DoF and other related organizations should conduct more training programs on selected fish farming technologies.

5) The highest problem faced by the farmers was ‘fish disease'. It may be recommended that concern authority should take proper step with preventive measures towards the fish diseases and other problems by UFO and other relevant departments.

### 5.3.2 Recommendations for Further Study

The following recommendations could be made for further research works:

1) The present study was conducted among the farmers of selected area under Niamatpur Upazila of Naogaon district. Similar studies may be conducted in other parts of the country to generalize the findings.

2) The present study was undertaken to explore the relationships of eleven selected characteristics of the farmers with the use of selected fish farming technologies Therefore, it could be recommended that further studies should be conducted with other characteristics of the farmers and fish farming technologies.

3) This study showed that Age, family size, Fish farming experience and organizational participation the farmers had no relationships with the use of these selected fish farming technologies. Hence, further studies are necessary to find out the relationships between the concerned variables to make the present findings valid.

4) More intensive research should be undertaken to identify the problems which are faced by fish farmers during selected fish farming technologies along with their suggestions to overcome the problems.

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**APPENDIX -A**

## Department of the Agricultural Extension and Information System

## Sher-e-Bangla Agricultural University

An interview schedule of the research study entitled

**Use of Selected Fish Farming Technologies by the Farmers**

Date……. Serial No: …...

Respondent's name: …… Father's name: …….....

Village: ……..…Union: …….Upazilla…….

District: ……...

[Please answer the following questions and put tick (√) where necessary]

1. **Age**: please mention of your age? .....years.
2. **Education**: What is your educational qualification?
   a) Can't read and write
   b) Can sign name only
   c) Passed class:
      i) Up to **V**
      ii) VI-X
      iii) Above X

**3. Family size**:

| Male | Female | Total |
|---|---|---|
| | | |

**4. Fish arm size:** Please indicate your fish farming area.

| Sl. No | Types of Pond | Amount of Land | |
|---|---|---|---|
| | | Local unit | Hectare |
| b) | Own pond under fish culture | | |
| d) | Pond taken on lease | | |
| | **Total** | | |

**5. Annual fish farming income**: Please mention your annual fish farming income:

……..TK

**6. Training received in fish culture:** Have you received any training about fish culture from any organization? Yes No

If yes,

| Sl. No. | Topics of training | Duration (days) | Organization or Venue |
|---|---|---|---|
| 1 | | | |
| 2 | | | |

**7. Fish Farming Experience**: How many years are you engaged in fish farming?

.....years

**8. Social mobility**: Please indicate how frequently you visit and participate in the following activities.

| SL. No. | Places of visitation | Not at all | Extent of participation | | |
|---|---|---|---|---|---|
| | | | Rarely | Occasionally | Frequently |
| 1 | Meeting with friends/ relatives (weekly) | 0 time | 1-2 times | 3-5 times | ≥5 times |
| 2 | Visit to local market (weekly) | 0 time | 1-2 times | 3-5 times | ≥5 times |
| 3 | Visit to Upazilla (monthly) | 0 time | 1-2 times | 3-5 times | ≥5 times |
| 4 | Visit to own District(half yearly) | 0 time | 1-2 times | 3-5times | ≥5 times |
| 5 | Visit to Other District (yearly) | 0 time | 1-2 times | 3-5 times | ≥5 times |
| 6 | Participation in picnic/tour(yearly) | 0 time | 1-2 times | 3-5 times | ≥5 times |

**9. Extension media contact:** Please indicate the extent of your contact with the following information sources.

| Sl. No. | Types of media contact | Extent of contact | | | |
|---|---|---|---|---|---|
| | | Frequently | Occasionally | Rarely | Not at all |
| a) Personal media contact | | | | | |
| 1 | Upazilla Fisheries Officer (monthly) | ≥5 times | 2-4 times | 1-2 times | 0 time |
| 2 | Sub-Assistant Fisheries Officer (monthly | ≥3 times | 2 times | 1 time | 0 time |
| 3 | Upazilla Agricultural Extension Officer (monthly) | ≥3 times | 2 times | 1 time | 0 time |
| 4 | Local Extension Agents for Fisheries (monthly) | ≥10 times | 5-9 times | 1-4 times | 0 time |

| | | | | | |
|---|---|---|---|---|---|
| b) Group media contact | | | | | |
| 5 | Result demonstration (yearly) | ≥5 times | 3-4times | 1-2 times | 0 time |
| 6 | Group meeting (three months) | ≥4 times | 2-3 times | 1 time | 0 time |
| c) Mass media contact | | | | | |
| 7 | Watching agricultural programs by TV(monthly) | ≥10times | 5-9 times | 1-4 times | 0 time |
| 8 | Listening agricultural programs to FM (monthly) | ≥3times | 2 times | 1 time | 0 time |
| 9 | Leaflet (yearly) | ≥4 times | 2-3 times | 1 time | time |

**10. Organizational participation:** Please indicate information according to the following table:

| Sl. No. | Name of Organization | Not involved | Nature of involvement | |
|---|---|---|---|---|
| | | | As a member | As a chief Executive |
| 1. | School committee | | | |
| 2. | Mosque/Mondir committee | | | |
| 3. | Madrasha committee | | | |
| 4. | Club | | | |
| 5. | Union parishad | | | |
| 6. | NGOs group | | | |
| 7. | Others (specify) | | | |

**11. Knowledge of farmer about modern fish farming technologies:** Please answer the following questions:

| **SL NO** | **Questions** | **Score (0 to 2)** | |
|---|---|---|---|
| | | **Assigned** | **Obtained** |
| 1 | What do you mean by fish farming technologies? | 2 | |
| 2 | Mention three modern fish farming technologies. | 2 | |
| 3 | Can you show any distinction between the modern culture techniques to traditional culture technique? | 2 | |

| | | | |
|---|---|---|---|
| 4 | Do you know about integrated fish culture? | 2 | |
| 5 | Site two integrated culture techniques. | 2 | |
| 6 | What is the meant by artificial feed? | 2 | |
| 7 | How do you prepare the formulated fish feed? | 2 | |
| 8 | Why fertilizers are used in pond? | 2 | |
| 9 | Mention three commonly fertilizers. | 2 | |
| 10 | Why do you apply lime in pond? | 2 | |
| 11 | How do you control predator fish? | 2 | |
| 12 | How do you treat fish fry during releasing in pond? | 2 | |
| 13 | Mention three common problem in fish culture. | 2 | |
| 14 | Can you identify the common diseases of fish? | 2 | |
| 15 | Which measures are taken by you to overcome the common fish diseases? | 2 | |
| **Total** | | **30** | |

**12. Use of Technologies in fish farming:** Please mention the use of following technologies:

| **Sl. No.** | **Statement** | **Extent of use** | | | | **Obtained score** |
|---|---|---|---|---|---|---|
| | | **Re** | **O** | **R** | **N** | |
| 1 | Polyculture of carp | | | | | |
| 2 | Carp fattening | | | | | |
| 3 | Polyculture with SIS | | | | | |
| 4 | Shing-magur culture | | | | | |
| 5 | Culture of mono-sex tilapia | | | | | |
| **Total** | | | | | | |

Re=Regularly, O= Occasional, R= Rare, N= Never

**13. Problem faced**

Please mention the extent of problem that you faced in use of modern technologies in fish farming:

| Sl. No. | Problems | Extent of problem faced | | | | Obtained score |
|---|---|---|---|---|---|---|
| | | High | Medium | Low | Never | |
| 1 | Fish diseases | | | | | |
| 2 | Lack of quality feed and other chemicals | | | | | |
| 3 | Transportation problem | | | | | |
| 4 | High investment | | | | | |
| 5 | Lack of loan | | | | | |
| 6 | Lack of quality seed on demand | | | | | |
| 7 | Algal bloom | | | | | |
| 8 | Poaching and vandalism | | | | | |

Thank you very much for your kind co-operation.

Signature of Interviewer

Date:.....

## Appendix B: Correlation matrix

| Variables | $X_1$ | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ | $X_7$ | $X_8$ | $X_9$ | $X_{10}$ | $X_{11}$ | Y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $X_1$ | 1 | | | | | | | | | | | |
| $X_2$ | -0.299** | 1 | | | | | | | | | | |
| $X_3$ | 0.222* | -0.207* | 1 | | | | | | | | | |
| $X_4$ | 0.191 | 0.332** | 0.131 | 1 | | | | | | | | |
| $X_5$ | 0.257* | 0.311** | 0.037 | 0.814** | 1 | | | | | | | |
| $X_6$ | -0.187 | 0.338** | -0.116 | 0.266** | 0.314** | 1 | | | | | | |
| $X_7$ | 0.843* | -0.330** | 0.232* | 0.139 | 0.196 | -0.167 | 1 | | | | | |
| $X_8$ | -0.281* | 0.142 | -0.044 | 0.078 | 0.188 | 0.155 | -0.247* | 1 | | | | |
| $X_9$ | 0.094 | 0.356** | 0.030 | 0.533** | 0.465** | 0.370** | 0.109 | 0.261* | 1 | | | |
| $X_{10}$ | 0.423** | 0.075 | -0.016 | 0.065 | 0.118 | 0.041 | 0.367** | 0.015 | 0.053 | 1 | | |
| $X_{11}$ | -0.103 | 0.513** | -0.200 | 0.251** | 0.192 | 0.232* | -0.120 | 0.071 | 0.364** | 0.028 | 1 | |
| Y | 0.167 | 0.281* | 0.130 | 0.436** | 0.444** | 0.338** | 0.187 | 0.214* | 0.542** | 0.189 | 0.342** | 1 |

*Correlation is significant at 0.05 level of probability

** Correlation is significant at 0.01 level of probability

$X_1$ = Age

$X_2$= Education

$X_3$= Family size

$X_4$= Fish farm size

$X_5$= Annual fish farming income

$X_6$= Training received in fish farming

$X_7$=Fish farming experience

$X_8$= Social mobility

$X_9$= Extension media contact

$X_{10}$= Organizational participation

$X_{11}$= Knowledge on fish farming

Y= Use of selected fish farming technologies