

**ADOPTION OF VIETNAMESE KOI (*Anabas testudineus*) FISH
BY THE FARMERS OF MURADNAGAR UPAZILLA UNDER
CUMILLA DISTRICT**

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BY

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CERTIFICATE

This is to certify that the thesis enlightens, “**Adoption of Vietnamese Koi (*Anabas testudineus*) by the Fish Farmers of Muradnagar Upazilla, Cumilla**” submitted to the faculty of agriculture, Sher-e-Bangla Agricultural University, Dhaka in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE in AGRICULTURAL EXTENSION AND INFORMATION SYSTEM**, embodies the result of a piece of bona fide research work conducted by **MD. KAMAL UDDIN**, Registration no. **20-11137** 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 duly acknowledgement.

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*DEDICATED TO MY BELOVED
PARENTS*

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LIST OF CONTENTS

Acknowledgements	I
List of contents	II
List of tables	VI
List of figures	VII
List of appendixes	VIII
List of abbreviations and glossary	IX
Abstract	X

CHAPTER	PAGE NO
1. INTRODUCTION.....	1
1.1 General background of the study.....	3
1.2 Statement of the Problem	4
1.3 Objectives of the Study	5
1.4 Justification of the Study.....	5
1.5 Assumptions of the Study	7
1.6 Limitation of the Study	7
1.7 Definition of Terms.....	7
2. REVIEW OF THE LITERATURE.....	10
2.1 Theoretical Basis of Adoption of Innovation	10
2.2 Review of Literatures related to General Issues on Adoption of Innovation	10
2.3 Relationship between farmers characteristic and adoption of Vietnamese	
Koi	14
2.3.1 Age and adoption of Vietnamese koi farming.....	14
2.3.2 Education and adoption of Vietnamese koi farming.....	16
2.3.3 Farm size and adoption	16
2.3.4 Annual income and adoption.....	17
2.3.5 Knowledge on Vietnamese koi and adoption.....	18
2.3.6 Training exposers and adoption.....	19
2.3.7 Extension media contact and adoption	19
2.3.8 Cosmopolitanism and adoption of Vietnamese koi	19
2.3.9 Attitude and adoption of Vietnamese koi.....	21
2.3.10 Problems faced by the farmers and adoption	19
2.4 Conceptual framework of the study	20
3. METHODOLOGY	21
3.1 Locale of the Study.....	22
3.2 Selection of the study area	25
3.3 Population and sample size	26
3.4 Instruments for data collection.....	25
3.5 Measurement of Independent Variables.....	25
3.5.1 Age.....	25
3.5.2 Education.....	25
3.5.3 Family size.....	25
3.5.4 Pond size.....	25

3.5.5	Annual income.....	26
3.5.6	Fish farming experience.....	26
3.5.7	Knowledge on Vietnamese koi.....	26
3.5.8	Extension media contact.....	26
3.5.9	Cosmopolitnness.....	26
3.5.10	Training exposser.....	27
3.5.11	Attitude towards Vietnamese koi.....	27
3.5.12	Problem faced by the fish farmers.....	27
3.6	Measurement of dependent variables.....	28
3.7	Collection of data.....	28
3.6	Data analysis.....	28
3.7	Hypothesis of the study.....	28
3.7.5	Research hypothesis.....	29
3.7.6	Null hypothesis.....	29
3.8	Data processing.....	29
4	RESULTS AND DISCUSSION.....	30
4.1	Selected Characteristics of the Vietnamese Farmers	31
4.1.1	Age of the respondents	31
4.1.2	Education of the respondents.....	32
4.1.3	Family size of the respondents	33
4.1.4	Farm size of the respondents	33
4.1.5	Annual income of the respondents	34
4.1.6	Fish farming experience of the respondents	34
4.1.7	Knowledge on Vietnamese koi of the respondents	35
4.1.8	Extension media contact	36
4.1.9	Cosmopolitnness.....	37
4.1.10	Training exposser	37
4.1.11	Attitude towards Vietnamese koi farming.....	38
4.1.12	Problem faced by the farmers.....	39
4.2	Rate of adoption of Vietnamese koi by the fish farmers	39
4.3	Relationship between the selected characteristics of the fish farmers and Their rate of adoption of Vietnamese koi.....	
4.3.1	Relationship between age and adoption.....	41
4.3.2	Relationship between education and adoption.....	42
4.3.3	Relationship between family size and adoption.....	43

4.3.4	Relationship between farm size and adoption.....	44
4.3.5	Relationship between annual income and adoption.....	45
4.3.6	Relationship between experience and adoption.....	46
4.3.7	Relationship between knowledge and adoption.....	47
4.3.8	Relationship between extension media contact and adoption.....	48
4.3.9	Relationship between cosmopolitanism and adoption.....	48
4.3.10	Relationship between training exposers and adoption.....	49
4.3.11	Relationship between attitude towards Vietnamese koi and Rate of adoption.....	49
4.3.12	Relationship between problems faced by the farmer and Adoption of Vietnamese koi.....	50
4.4	Rank order of problem faced by respondents by the farmer in Vietnamese koi culture.....	50
5	SUMMARY, CONCLUSIONS AND RECOMMENDATION.....	51
5.1	Summary of the Findings.....	51
5.1.1	Farmer's characteristics and related factors	52
5.1.2	Adoption of Vietnamese Koi	52
5.2	Conclusions.....	53
5.3	Recommendations.....	53
5.3.1	Recommendations for policy implication.....	55
5.3.2	Recommendations for further study	56
6	REFERENCES	57

LIST OF TABLES

Table No	Page No
Table 4.1 The salient features of selected characteristics of Vietnamese koi farmers	31
Table 4.2 Distribution of the respondents according to their age	32
Table 4.3 Distribution of the respondents according to their education.....	32
Table 4.4 Distribution of the respondents according to their family size.....	33
Table 4.5 Distribution of the respondents according to their farm size.....	34
Table 4.6 Distribution of the respondents according to their family income.....	34
Table 4.7 Distribution of the respondents according to their experience.....	35
Table 4.8 Distribution of the respondents according to their knowledge.....	36
Table 4.9 Distribution of the respondents according to their extension media contact	36
Table 4.10 Distribution of the respondents according to their Cosmopolitnness.....	37
Table 4.11 Distribution of the respondents according to their Training exposer.....	38
Table 4.12 Distribution of the respondents according to their attitude.....	38
Table 4.13 Distribution of the respondents according to their problems.....	39
Table 4.14 Distribution of the respondents according to their rate of adoption.....	39
Table 4.15 Co-efficient correlation of the selected characteristics of fish farmers and rate of adoption of Vietnamese koi.....	41
Table 4.16 Rank of order of the problems faced by the farmers during Vietnamese koi Farming.....	49

LIST OF FIGURES

Figure 2.1 Conceptual framework of the study.....	20
Figure 3.1 Map of Cumilla district showing Muradnagar Upazilla.....	23
Figure 3.2 Map of Muradanagar upazilla showing selected area.....	24

LIST OF APPENDIXES

Appendix-1 English version of the interview schedule for the research on,
“Adoption of Vietnamese Koi by the fish farmers at Muradnagar upazila under Cumilla
district”... 62-68

LIST OF ABBREVIATIONS AND GLOSSARY

BBS : Bangladesh Bureau of Statistics

DoF : Department of Fisheries

FY : Fiscal Year

GDP : Gross Domestic Products

GO : Government Organization

HA : Hectare

MT : Metric Ton

NGO : Non-Government Organization

SD : Standard Deviation

UFO : Upazilla Fisheries Officer

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ABSTRACT

The main objective of the study was to determine the adoption of Vietnamese Koi by the fish farmers in Cumilla district. The study area comprised three villages namely Jahapur, Dhamghar and Paschim nabipur under of Muradnagar upazila. The selected characteristics of the farmers were age, education, family size, pond size, annual family income, Fish farming experience, knowledge on Vietnamese koi culture, extension media contact, cosmopolitnss, training exposser on fish farming, attitude towards Vietnamese koi culture and problems faced by the farmers in Vietnamese Koi culture. Data were collected from randomly selected 105 Vietnamese Koi farmers during December, 2022 by using structured interview schedule. Correlation was used to measure the relationship between each of the selected characteristics of the farmers and their adoption of Vietnamese Koi. The findings indicate that 52.38 percent of the Vietnamese Koi farmers had medium adoption, 28.56 percent had low rate of adoption and 19.04 percent had higher adoption. Correlation analysis indicate that farm size, annual family income, fish farming experience, knowledge on Vietnamese koi culture and attitude towards Vietnamese Koi culture of the farmers had positive significant relationships with their adoption of Vietnamese Koi. On the other hand, age, education, family size, extension media contact, cosmopolitnss and training exposser of the fish farmers had no significant relationships with their adoption of Vietnamese Koi. The Problem Faced Index indicated that high price of feed ranked 1st followed by “lack of capital”, “high labor cost”, “high price of medicine”, “high production cost”, “high sensitivity to disease”, “lack of knowledge”, “natural disaster”, “lack of water exchange facilities”, “less security of fish food”, “poor transportation facilities”, Unavailability of Vietnamese koi seeds” and “Algal blooms on the pond”.

CHAPTER 1

INTRODUCTION

1.1 General Background of the Study

Bangladesh is a densely populated country. Major parts of the population of this country are directly and indirectly involved with fish or fish related business. It is blessed with huge open water resources with a wide range of aquatic diversity. 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 (DoF, 2020). Overall, Fisheries sector is the second in the economy of Bangladesh. Fisheries sector contributed 3.52 percent of the national GDP (Gross Domestic Product). Accordingly, Fisheries Resources Information on Bangladesh (BFRI, 2011) closed water body 0.6-million-hectare, open water body 0.4 million hectare and marine fisheries (territorial water 2,680 sq. n. miles, exclusive economic zone 41,040 sq. n. miles, continental shelf 24,800 sq. n. miles and coast line 710 km.). Total fish production 0.3 million mt. and per capita annual fish intake is 18.94 kg (DoF, 2013).

There is a proverb that “Mache Bhate Bangali” i.e, Bangladeshi people live on rice and fishes. The aquatic environment of Bangladesh is suitable for fish culture. There are 260 freshwater species, 475 marine fish species, 12 exotic species and 24 prawn species (DoF, 2013). Fish particularly small fish are rich in micronutrients and vitamins (Begume *et. al.* 2020). Furthermore, small fish also has specific important for the diets of children and lactating mothers to avoid child blindness and lessen infant mortality (Hasan, 2003). Among the small indigenous species (SIS) Koi fish (*Anabas testudineus*) is very popular in our country. Because it's taste and flavor are very delicious.

Koi fish culture is very easy to cultivate, popular and profitable. Koi is a popular fish to the people from the ancient time. Because it is very tasty and nutritious. Once upon a time Koi fish found in a plenty in the local canal, small rivers, swamp, inundation land of Bangladesh. Koi fish is the most popular and tasty fish among the all fish of Bangladesh. This fish is also very precious now-a-days. Koi fish is also known as climbing perch. It is a local fish breed of Bangladesh.

Koi fish is generally a freshwater fish. Due to declining the local Koi fish population the variety of climbing perch (Koi fish) was imported from Vietnamese into Bangladesh in 2002 and it locally bears the name of Vietnamese Koi. And then Vietnamese koi strain has been introduced

in Bangladesh in 2010 (Ahamed, 2013). Vietnamese koi which is originated from Vietnam is gaining attention to farmers at an increasing rate in South Asian countries. It contains very high amount of physiologically available iron and copper essentially needed for hemoglobin synthesis; besides, it possesses easily digestible fat of very low melting point and good many essential amino acids (Ahmed, 2013).

Vietnamese Koi plays an important role to meet the growing demand of fish thus human nutrition, food security can be greatly improved because the growth rate and productivity of this kind of Koi is much higher than other fish species cultured in Bangladesh, it is cultured twice in a year and Vietnamese koi normally becomes 300 – 350 gm within four months culture period (Ahmed. B, 2014)

Now-a-days, Vietnamese koi is one of the high commercial valued fishes and is getting more popular among farmers due to its taste and high market demand both at home and abroad. It is very much esteemed for its prolonged freshness. Vietnamese Koi culture is very easy and profitable. Vietnamese Koi is very demandable because it's similar as deshi (local or primitive) Koi, as a result its market value is always comparatively higher. It is able to survive in adverse environment and mortality rate is very low and become suitable for sale comparatively within short time (3 to 4 months). It can be cultivated in small pond with great density. Vietnamese Koi culture is economically profitable and can be cultivated multiple times per year. Vietnamese Koi can be cultured with other fishes.

Vietnamese Koi culture is very important to fulfill nutritional requirement and to generate livelihood opportunities of poor people. Poor people are improving their social and economic condition through Vietnamese Koi culture. It contains high level of iron and copper. These are very essential for hemoglobin synthesis. It is a balance diet for human, especially the patient diet. It is very effective for anemia patient. Because anemia patient needs hemoglobin contains food and Vietnamese Koi can fulfill this need. Vietnamese Koi can increase hemoglobin level very fast.

Various fish and fishery products are made from Vietnamese Koi, such as fish sauce, fish ball, fish finger, fish pickle, fish burger, smoke product, dry fish etc which are very demandable and popular in our country. In our country, people love to eat fish product as snacks. Our food habit also changed and thus fishery product covers around 60 percent of them (Begume *et. al.* 2020). Fish is a common item of our food menu. If Vietnamese Koi is present in our dish, it would be

very delicious. The Vietnamese koi product is also very demandable in abroad. We can earn a lot of foreign exchange by Vietnamese Koi products.

Having nutritional and higher economic profitability, the expansion of Vietnamese Koi culture in the country is still limited. Thus, the present study has been taken into consideration to know the rate of adoption of the Vietnamese Koi and its associated factors.

1.2 Statement of the Problems

Disease has become a major problem in fish production both in culture system and wild condition in Bangladesh. Common disease of freshwater fishes of Bangladesh are tail and fin rot, bacterial gill disease, hemorrhagic septicemia, dropsy, fungal disease, protozoa disease, fungal disease, nutritional disease and parasitic disease (Kulsom, 2005). Severe attack of disease can cause of death for fish. Disease is also an obstacle for fish production and as well as profit. In mono-culturing system, if any species is affected by disease the whole water body species is affected. The disease sensitivity of Vietnamese Koi is high. So, lack of proper knowledge about disease of Vietnamese Koi farmers faces a huge losses. Farmers faced so many problems during Vietnamese Koi cultivation due to lack of fund. Because Vietnamese Koi needs more protein contains feed. But farmers are not capable to supply available inputs. On the other hand, the price of feeds and aqua-drugs are also high. The good quality seeds and fry of Vietnamese Koi are not available for the farmers (Begume *et. al.* 2020). So, lack of good quality seed and fry the production would not good thus farmers do not get their desirable benefit.

Lack marketing facilities and due to high transportation cost farmers face a lot of problems. Farmer's face carrying problems of seeds, fry, inputs and products due to well road. Thus, transportation cost increases for the farmers. The farmers of Bangladesh are not well trained about Vietnamese Koi farming and they are not well educated. So, they cannot manage the undesirable situation. They do not know what environment is not suitable for Vietnamese Koi cultivation. Especially in summer season Vietnamese Koi is affected by disease. Farmers have little knowledge on aquatic environment. Some farmers also face water storage problem. In many areas water storage is high problem. Sometimes iron level of water is so high that hampers fish production adversely.

Production cost high than the lower profit. It is the main reason for the low adoption rate of Vietnamese Koi by the fish farmers. Farmers' do not know the technical way of profitable Vietnamese Koi production.

1.3 Objectives of the study

Considering all the aspects, the research was conducted with following objectives:

- To determine the adoption of Vietnamese koi in Muradnagar Upazilla;
- To describe some selected characteristics of the fish farmer;
- To determine the relationship between the selected characteristics of the fish farmers and their adoption of Vietnamese koi;
- To identify the problems faced by the fish farmers in adopting Vietnamese koi.

1.4 Justification of the Study

Economy of Bangladesh is considerably depending on the development of fisheries sector. In spite of sustainable agriculture production overall economic development of Bangladesh depends upon increasing productivity, environment protection and increase aquatic culture or aquaculture production. By Vietnamese Koi cultivation farmers can earn foreign exchange because Vietnamese Koi fish and fishery products of it are demandable in abroad. In spite of sustainable agriculture production overall economic development of Bangladesh depends upon increasing productivity, environment protection and increase aquatic culture or aquaculture production.

Air breathing fishes means those fishes which have evolved methods of extracting oxygen from air. These fishes live in poor oxygen concentration water. They can enable to alive an exploit environment, such as damp beaches. There are a number of fishes have present breathing organs that are used to extract oxygen from air. In Bangladesh, air-breathing fishes like Vietnamese Koi (*Anabas testudineus*), is very favorite for its delicious taste. The market demand and price of Vietnamese Koi is very high.

Vietnamese Koi culture is observed in some selected areas of Bangladesh, it is predominant in some several upazilas in Cumilla district. Vietnamese Koi is considered to be one of the most economic and important fishes of Bangladesh because of its high demand, good nutritional value, delicious taste, growth rate short duration of culture and easy marketing (Kulsum, 2005).

In recent, Vietnamese Koi is culture commercially at many of the upazila in Cumilla district, but farmers do not apply scientific management. So, they cannot reach the maximum production and net profit. Especially the middle-class farmers who culture by semi-intensive culture system but they do not have any scientific knowledge or any training about Vietnamese

koi culture (Begume *et. al.* 2020). So, when problem arise, they do not find out the cause or cannot take necessary steps immediately.

It is important to know the socio-economic characteristics of the fish farmers, input ability, production cost. Why they adopt Vietnamese Koi culture commercially. After considering the above facts, the present study was undertaken to determine the adoption rate of Vietnamese Koi by fish farmers and find out their problems during Vietnamese Koi cultivation.

1.5 Assumptions of the Study

An assumption is the supposition that an apparent fact or principle is true in the light of the available evidence (Goode, 1945). The following assumptions were in the mind of the researcher during conducting the study:

- The respondents included in the sample for this study were capable enough to furnish proper responses to the question set up in the interview schedule.
- The sampling procedure followed by the study was unbiased. If the researchers bias by the respondent the research result would be failure to achieve the objectives. So, researcher should be unbiased.
- The responses furnished by the respondents were reliable. Without reliable data the objectives of the study would not be complete.
- The researcher who acted as interviewer was very well adjusted to the social and cultural environment of the study area. Hence, the respondents furnished their correct opinions without any kind of hesitation.
- All the data concerning the independent and dependent variables were normally and independently distributed with their respective means and standard deviation.

1.6 Limitations of the Study

The purpose of the study was to determine the adoption of Vietnamese Koi by the fish farmers in Cumilla district. However, in order to make the study manageable and meaningful from the research point of view, it became necessary to impose certain limitation as noted below:

The data were collected in a small area of the country. Because time and money are a vital fact for data collection. Limited time and money could not cover the large area for the research.

- The study areas were three villages Jahapur, Dhamghar and Pashchim nabipur of Muradnagar upazila in Cumilla district.

- The sample size of the respondent was small. There are 105 respondents from the 135 Vietnamese Koi farmers were randomly selected. Thus, 77 percent respondents were selected for the study. Because time was short so all farmers could not be considered.
- The characteristics of the Vietnamese Koi farmers in the study areas were many and varied but only few of them were selected for the study. Because in short time all characteristics cannot be considered.
- Data collected from the Vietnamese Koi farmers were furnished by them from their memory during interview. Data were collected as both open and close questionnaire method.
- Adoption of Vietnamese Koi was measured on the basis of their responses to the selected statements.
- Fact and figures collected by the investigator were applied to the present situation in the selected areas.

1.7 Definition of some important terms

Certain “terms” have been used in this report that need to be defined properly so that the findings as well as other contents of the study report become well-clarified to its users.

Adoption: Adoption is the implementation of a decision to continue to use of an innovation. According to Rogers (1995) “Adoption is a decision to make full use of an innovation as the best course of action and practices if the phenomenon is known as adoption”.

Diffusion: Diffusion is the process by which an innovation is communicated through certain channels over time among the members of social systems (Rogers, 1995).

Adoption Process: According to Rogers (1995) the innovation decision is the process through which an individual (or other decision-making units) passes (1) from first knowledge of an innovation, (2) to forming an attitude toward the innovation, (3) to a decision to adopt or reject, (4) to implementation of a new idea and (5) to confirmation of this decision. This process consists of a series of actions and choices over time through which an individual (or an organization) evaluates a new idea and decides whether or not to incorporate to going practices.

Rate of Adoption of Vietnamese Koi: Means among the total cultivable lands of fish farmer's, how much land he /she use for Vietnamese Koi cultivation.

Aquaculture: "Aqua" meant 'water' and "culture" means "to farm". So the word aquaculture referred to the farming of any aquatic organisms including fish, mollusk and crustaceans in aquatic environment.

Knowledge on aquaculture: Literally knowledge means knowing or what one knows about a subject, fact, person etc. Knowledge on aquaculture referred to farmers' understanding of facts, phenomena and methods in different aspects of aquaculture

Agricultural extension: Agricultural extension is a general term meaning the application of scientific research and new knowledge to agricultural practices through farmer education. The field of 'extension' now encompasses a wider range of communication and learning activities organized for rural people by educators from different disciplines, including agriculture, agricultural marketing, health, and business studies.

Respondent: Respondent referred to the fish farmer being involved in fish farming activities and included in the sample.

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this Chapter is to review of literatures relevant to the present study. The researcher made an elaborate search of available literature for the above purpose. The researcher attempted to search the literatures on a number of studies have been conducted on the adoption of innovations by the farmers. Therefore, the findings of such studies related to the extent of the adoption of Vietnam Koi by the fish farmers and other partial studies have been reviewed in this Chapter.

This Chapter is divided into five major sections, the first section deals with the concept of diffusion and adoption of innovation, the second section deals with review of literature on general context of adoption, the third section deals with the relationship between the farmers characteristics and their adoption of innovation, the fourth section deals with the research gap of the study and the fifth section deals with the conceptual framework of the study.

2.1 Theoretical Basis of Adoption of Innovation

Adoption is the implementation of a decision to continue to use of an innovation. According to Rogers (1995) “Adoption is a decision to make full use of an innovation as the best course of action and practices if the phenomenon is known as adoption”.

Adoption is decision to use and continue to use for a certain period of time. Adoption is a decision to make full use of innovation as the best course of action available (Ray, 1991). When an individual takes up a new idea as the best course of action and practices it, the phenomenon is known as adoption.

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of social systems (Rogers, 1995). Rogers and Shoemaker (1971) stated the adoption process as: the traditional view of the innovation-decision process, called “adoption process” was postulated by a committee of rural sociologist in (North Central Rural Sociology Subcommittee for the study of diffusion of Farm Practice, 1995) as consisting of five stages.

Five stages of the adoption process:

Awareness Stage: The individual learns of the existence of the new idea but lacks detailed information about it.

Interest Stage: The individual develops interest in the innovation and seeks additional information about it.

Evaluation Stage: The individual makes mental application of the new idea to his present and anticipated future situation and decides whether or not to try it.

Trial Stage: The individual actually applies the new idea on a small scale in order to determine its utility in its own situation.

Adoption Stage: The individual uses the new idea continuously on a full scale.

According to Rogers (1995) the innovation decision is the process through which an individual (or other decision-making units) passes (1) from first knowledge of an innovation, (2) to forming an attitude toward the innovation, (3) to a decision to adopt or reject, (4) to implementation of a new idea and (5) to confirmation of this decision. This process consists of a series of actions and choices over time through which an individual (or an organization) evaluates a new idea and decides whether or not to incorporate to going practices. This behavior consists essentially of dealing with the uncertainty that is inherently involved in deciding about a new alternative to those previously in existence. The perceived newness of an innovation decision making compared to other types of decision making.

Rogers's present concept consists of five stages which are as follows:

Knowledge occurs when an individual (or other decision-making units) is exposed to the innovation existence and gain some understanding of how it functions.

Persuasion occurs when an individual (or other decision-making units) from a favorable or unfavorable attitude towards the innovation.

Decision occurs when an individual (or other decision-making units) engages in activities that leads to choose of either adoption or rejection of the innovation.

Implementation occurs when an individual (or other decision-making units) puts an innovation into use.

Confirmation occurs when an individual (or other decision-making units) seek reinforcement of an Innovation's decisions already made but he or she may reserve his or her previous decision if exposed to conflicting messages about the innovation.

There are five types of adopter categories are given below:

Adopter Categories:

Innovators: Innovators are willing to take risks, have the highest social status, have financial liquidity and have closest contact to scientific sources and with other innovators. They are 2.5 percent in the society.

Early Adopter: These individuals have the highest degree of opinion leadership among the adopter categories. Early adopters have a higher social status, have financial liquidity, have advanced education and are more involved with social media. The early adopter is approximately 13.5 percent in the society.

Early Majority: They adopt an innovation after a varying degree of time that is significantly longer than the early adopter. Early majority have above average social status, contact with early adopters and seldom hold positions with opinion leadership in a system. They are approximately 34 percent in the society.

Late Majority: They adopt an innovation after the average participation. Late majority are typically skeptical about an innovation, have below average social status, have little financial liquidity, in contact with others in late majority and early majority and little opinion leadership. They are approximately 34 percent in the society.

Laggards: They are the last to adopt an innovation. These individuals show little to no opinion leadership. Laggards are typically tended to focused on "tradition", lowest financial liquidity, oldest among adopter and contact with only family and close friends. They are approximately 16 percent in the society.

2.2 Review of Literature on General Context of Adoption

Rahman (2014) conducted a study on adoption of modern sesame production technologies in some selected areas. He concluded that majority proportion (51 percent) of the sesame growers had low adoption while 37 percent had medium adoption and 12 percent had high adoption of modern sesame production technologies.

Corales, et. al. (2006). Conducted a study on hybrid rice promotion in Nueva Ecija under Philippines. He stated that despite the national government's extensive promotion of the technology that adoption rate of low hybrid rice in some selected areas in Philippines was low.

Hossain (2006) conducted a study on adoption of selected high yielding variety of rice by the farmers of Rajpal union under Kasiani upazila in Gopalganj district. He revealed that the highest proportion ((49 percent) of the farmers tell under medium adoption category, while 26 percent had high adoption and 25 percent had low adoption of selected high yielding rice.

Hussain (2006) conducted a study on adoption of improved practices in soybean cultivation by the soybean growers in some selected areas of Noakhali district. He revealed that majority (61 percent) of the growers had medium adoption while 18 percent had low and 21 percent had high adoption of improved practices in soybean cultivation.

Islam (2005) conducted a study on adoption of poshupusti in cattle rearing at farmer's level, The study revealed that 71 percent of the farmers had medium adoption level while 18 percent had high adoption and 11 percent had low adoption of poshupusti in cattle rearing at farmer's level.

Hossain (2004) conducted a study on adoption of selected modern boro rice cultivation technologies by the farmers of Homna upazila in Comilla district, He revealed that majority (60 percent) of the farmers had medium adoption while 19 percent had low adoption and 21 percent had high adoption of selected modern boro rice cultivation technologies.

Hasan (2003) conducted a study on adoption of recommended potato cultivation practices by the farmers in some selected arca of Rajshahi district, He found that majority (60 percent) farmers had medium adoption while 33 percent had low adoption and 7 percent had high adoption of recommended potato cultivation practices.

Haque (2003) conducted a study on farmers' adoption of modern maize cultivation technologies. He found that the majority (47 percent) of the growers had medium adoption of modern maize cultivation technologies while 28 percent had high adoption and 25 percent had low adoption.

Hossain (2003) conducted a study on problems faced by the fish farmers in practicing aquaculture management. He found that majority (67 percent) of the boro rice farmers had medium adoption, 17 percent had low adoption and 16 percent had high adoption of modern boro rice cultivation practices.

Zegeye et. al. (2002) studied the determinants of adoption of improved maize technologies in major maize growing region of Ethiopia. He found that the rate of adoption of improved maize varieties and chemical fertilizer, factors affecting the adoption of improved maize varieties and the determinant factors affecting the adoption of chemical fertilizers are also highlighted.

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.

Hussen (2001) studied the farmers' knowledge and adoption of modern sugarcane cultivation practices. He concluded that majority proportion (91 percent) of the growers had medium adoption while 7 percent had low and only 2 percent had high adoption of modern sugarcane cultivation practices.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding Alok 6201 hybrid rice in sadar upazila of Cumilla district. He observed in his study that the highest proportion (75 percent) of farmers fell under medium adoption category while 18 percent had high adoption and 7 percent had low adoption of Aalok 6201 hybrid rice cultivation.

Podder and Kashem (2000) studied on use of extent of conduct media by the farmers in the adoption of mehersagar banana. They concluded that about half (47 percent) of the growers had medium adoption compare to 14 percent low adoption and 39 operations of mehersagar banana.

2.3 Relationship between Farmer's Characteristics and Adoption of Vietnam Koi

2.3.1 Age and adoption

Rahman (2014) conducted a study on adoption of modern sesame production technologies in some selected areas in Bangladesh. He found that the age of the sesame farmers had no significant relationship with their adoption of modern sesame production technologies.

Das (2013) conducted a study on adoption of conservation agriculture practices in Bangladesh. He found that the age of the farmers had no significance relationship with their adoption of conservation agriculture practices.

Uddin (2010) conducted a study on adoption of technologies by farmers for climate change adaptation. He observed that there was a negative significant relationship between the age of the farmers and their adoption of technologies for climate change adaptation.

Mondol (2009) conducted a study on adoption behavior of farmers regarding hybrid rice cultivation in Cumilla district. He found that there was no significant relationship between age and adoption of hybrid rice cultivation.

Reza (2007) conducted a research study on adoption of modern maize cultivation technologies by the farmers. The findings implied that the age of the farmers was not related to their adoption of modern maize cultivation technologies.

Hossain (2006) conducted a research study on adoption of improved practices in soybean cultivation by the soybean growers in some selected areas of Noakhali district. He found that age of the growers did not show any significant relationship with their adoption of improved practices in soybean cultivation.

Ali (2004) conducted a research study on adoption of aquaculture technologies by the fish farmers. He found that there was no relationship between age of the farmers and their adoption of aquaculture technologies.

Islam (2002) conducted a study on adoption of modern agricultural technologies by the farmers of Sandip. He found that age of the farmers was not related to their adoption of modern agricultural technologies.

Aurangozeb (2002) conducted a study on adoption of integrated homestead farming homestead farming technologies by the rural women in RDRS. He found that there was a significant negative relation between age of the farmers and their adoption of integrated homestead farming technologies.

Rahman (2001) conducted a study on knowledge, attitude and adoption of the farmers regarding Alok -6201 hybrid rice in sadar upazila of Cumilla district. He found that age of the farmers had no significant relationship with their adoption regarding Alok-6201 hybrid rice.

2.3.2 Education and adoption

Rahman (2014) conducted a study on adoption of modern sesame production technologies in some selected areas in Bangladesh. He found that the education of the sesame farmers' had positive significant relationship with their adoption of modern sesame production technologies.

Das (2013) conducted a study on adoption of conservation agriculture practices in Bangladesh. He found that there was a significant relationship of education with their adoption of conservation agriculture.

Uddin (2010) conducted a study on adoption of technologies by farmers for climate change adaptation. He observed that education of the farmers showed positive significant relationship with their adoption of technologies for climate change adaptation.

Akter (2007) conducted a study on adoption of improved tomato varieties by the farmers in a selected area of Bangladesh. He observed that the education of the farmers had significant relationship with their adoption of improved tomato varieties.

Islam (2003) conducted a study on adoption of organic manures for maximizing rice production. He found that there was a positive significant relationship between education of the farmers and their adoption of organic manures for maximizing rice production.

Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women in RDRS. He found that there was a positive relationship between education and their adoption of integrated homestead farming technologies by the rural women.

2.3.3 Farm size and adoption

Rahman (2014) conducted a study on adoption of modern sesame production technologies in some selected areas in Bangladesh. He found that the farm size of the sesame farmers' had positive significant relationship with their adoption of modern sesame production technologies.

Das (2013) conducted a study on adoption of conservation agriculture practices in Bangladesh. He found that farm size of the farmers had a significant relationship with their adoption of conservation agriculture.

Mondal (2009) conducted a study on adoption behavior of farmers regarding hybrid rice cultivation in Cumilla district. That farm size of the farmers had a positive significant relationship with their adoption of hybrid rice varieties.

Islam (2008) conducted a study on adoption of integrated plant nutrient system by the small farmers. He found that the farm size of the farmers had significant relationship with their adoption of integrated plant nutrient system by the small farmers.

Talukder (2006) conducted a study to determine the relationship of farmer's characteristics with their adoption of selected rice cultivation practices in Char Land of Gomoti River. He exported that farm size of the growers had positive significant relationship with the adoption of selected rice cultivation practices.

2.3.4 Annual income and adoption

Rahman (2014) conducted a study on adoption of modern sesame production technologies in some selected areas in Bangladesh. He found that the annual income of the sesame farmers' had significant relationship with their adoption of modern sesame production technologies.

Uddin (2010) conducted a study on adoption of technologies by farmers for climate change adaptation. He found that family income of the farmers had significant relationship with their adoption of technologies for climate change adaptation.

Kamal (2006) conducted a study on adoption of selected high yielding varieties of rice by the farmers. He found that family income of the farmers had significant relationship with their adoption of selected high yielding varieties of rice.

Reza (2007) conducted a study on adoption of modern maize cultivation technologies. He found that the annual income of the farmers had significant relationship with their adoption of modern maize cultivation technologies.

Miajy (2005) conducted a study on adoption on hybrid varieties of maize by the farmers. He found that the annual income of the farmers had no significant relationship with their adoption of hybrid varieties of maize.

Hossain (2004) conducted a study on adoption of selected modern boro rice cultivation technologies by the farmers of Homna upazila in Comilla district. He found that the annual income of the farmers had positive and significant relationship with their adoption of selected modern boro rice cultivation technologies.

Islam (2002) conducted a study on adoption of modern agricultural technologies. He found that the annual income of the farmers of Sandip had no significant relationship with their adoption of modern agricultural technologies.

Aurangozeb (2002) conducted a study on adoption of integrated homestead farming technologies by the rural women of RDRS. He found that there was a positive significant

relationship between the annual income of the respondent and their adoption of integrated homestead farming technologies by the rural women of RDRS.

Sardar (2002) reported a study on adoption of IPM practices by the farmers under PETRRA project of RDRS. He found that the annual income of the farmers had no relationship with their adoption of IPM practices.

2.3.5 Knowledge

Rahman (2014) conducted a study on adoption of modern sesame production technologies in some selected areas in Bangladesh. He found that the knowledge of the sesame farmers' had significant relationship with their adoption of modern sesame production technologies.

Mondol (2009) reported a study on adoption of hybrid rice varieties. He observed in his study that the agricultural knowledge of the farmers did not show any significant relationship with their adoption of hybrid rice varieties.

Akter (2007) conducted a study on adoption of improved tomato varieties in some selected areas. He found that the agricultural knowledge of farmers had significant relationship with their adoption of improved tomato varieties.

Hossain (2006) conducted a study on adoption of improved practices in soybean cultivation. He observed that the agricultural knowledge of the growers had significant relationship with their adoption of improved practices in soybean cultivation.

Sardar (2002) studied on adoption of IPM practices by the farmers under PETRRA project of RDRS. He found that agricultural knowledge had positive significant relationship with their adoption of IPM practices.

Koch (1995) conducted a study in the North western organize free state, South Africa concerning perception of agricultural innovation aspiration, knowledge and innovation adoption. He found that there was strong positive relationship between knowledge and practice adoption. This finding is very much agreed with Rogers Shoemaker (1971).

2.3.6 Training exposure and adoption

Rahman (2014) conducted a study on adoption of modern sesame production technologies in some selected areas in Bangladesh. He found that the training exposure of the sesame farmers had positive significant relationship with their adoption of modern sesame production technologies.

Das (2013) conducted a study on adoption of conservation agricultural practices in Bangladesh. He found that the technological support received by the farmers had a significant and positive relationship with their adoption of conservation agriculture.

Reza (2007) conducted a study on adoption of modern maize cultivation technologies by the farmers. He found that the agricultural training exposure of farmers had a significant and positive relationship with their adoption of modern maize cultivation technologies.

Sarder (2002) reported a study on farmer's knowledge and adoption of ecological agricultural practices under the supervision of Proshika. He found that agricultural training exposure of the farmers had no significant relationship with their adoption of ecological agricultural practices.

2.3.7 Extension media contact and adoption

Rahman (2014) conducted a study on adoption of modern sesame production technologies in some selected areas in Bangladesh. He found that the extension media contact of the sesame farmers had significant relationship with their adoption of modern sesame production technologies.

Das (2013) conducted a study on conservation agriculture in Bangladesh. He found that the farmer's extension media contact had a significant and positive relationship with their adoption of conservation agriculture.

Uddin (2010) conducted a study on adoption of technologies for climate change adaptation. He found that extension media contact of the farmers had significant relationship with their adoption of technologies for climate change adaptation.

Moldal (2009) conducted a study on adoption of hybrid rice. He observed that extension media contact of farmers did not show any significant relationship with their adoption of hybrid rice.

Islam (2008) conducted a study on adoption of integrated plant nutrient system by the small farmers. He found that there was no significant relationship between the extension media contact and adoption of integrated plant nutrient system.

Hossain (2006) conducted a study on adoption of improved practices in soybean cultivation. He observed that the extension media contact of the farmers had significant relationship with their adoption of improved practices in soybean cultivation.

Sardar (2002) conducted a study on adoption of IPM practices by the farmers. He concluded that the extension media contact had positive significant relationship with their adoption of IPM practices.

Hussen (2001) conducted a study on farmers' knowledge and adoption of modern sugarcane cultivation practices in some selected areas. He found that the extension media contact had positive significant relationship with their knowledge adoption of modern sugarcane cultivation practices.

2.3.8 Cosmopolitaness and adoption

Hossain (2003) revealed that cosmopolitaness of the farmers had significant and positive relationship with their adoption of modern Boro rice cultivation practices.

Rahman (2003) found that cosmopolitaness of the farmers had significant positive relationship with their adoption of intercropping in pineapple cultivation.

Ghosh and Maitra (2008) reported that cosmopolitaness of the growers showed positive and highly significant relationship with their adoption of dairy farming practices.

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

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

Goswami (2012) found that cosmopolitanisms of the farmers had positive and highly significant relationship with their adoption of scientific fish cultivation practices.

2.3.9 Attitude and adoption

Hossain (1981) conducted a study on relationships of selected characteristics of the Jute growers with their adoption of improved practices of Jute cultivation. He found that there is no relationship between attitude towards intensive Jute cultivations scheme of the Jute growers and their adoption of improved practices of jute cultivation.

Hasan (1996) conducted a study on adoption of some selected agricultural technologies among the farmers as perceived by the frontline GO and NGO workers. He found that there was strong positive relationship between attitude towards development and perceived adoption of selected technologies.

2.3.10 Problems faced during adoption

Sarker (2010) found that the problems faced by the farmers in organic vegetable farming had negative relationship with their adoption of organic vegetable farming.

Kashem and Hossain (2012) in his study observed adoption behavior of sugarcane farmers. The study revealed a positive relationship between community problem awareness and adoption of sugarcane farmers.

Rahman (2005) in his study identified problems faced by farmers in cotton cultivation. Non-availability of quality seed in time, unfavorable and high cost of fertilizer and insecticides, lack of operating capital, not getting fair weight and reasonable price according to grade, effects of cattle in cotton field, lack of technical knowledge, lack of storage facility, stealing from field at maturity stage, and late buying of raw cotton by Cotton Development Board were identified as major problems of cotton farmers in Cumilla district.

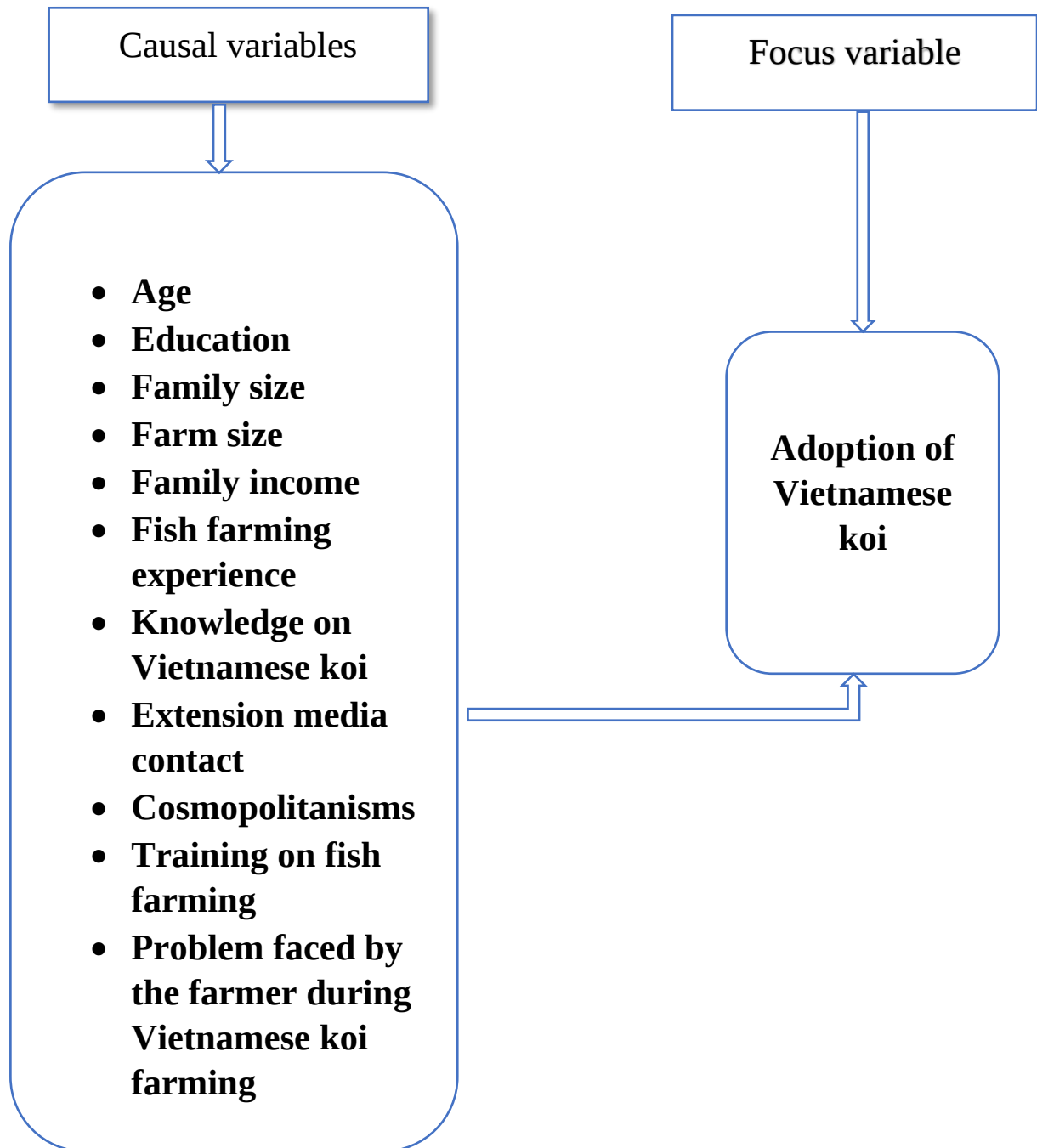


Fig 2.1: Conceptual framework of the study

CHAPTER 3

METHODOLOGY

Methodology plays a vital role in conducting any scientific research. The total research process based on methodology, so it can be called as foundation on which the research process rest upon. The methods and procedures followed which was conducting in this study have been described in this Chapter.

3.1 Research Design of the Study

A research design provides a framework for the collection and analysis of data. Research design is a comprehensive master plan of the research study to be undertaken. It sets up a framework for the test of relationship among variables, and helps to keep the research properly. The function of the research design is to ensure that requisite data in accordance with the study is collected accurately and economically. The research design of this study has been presented in Figure 3.1.

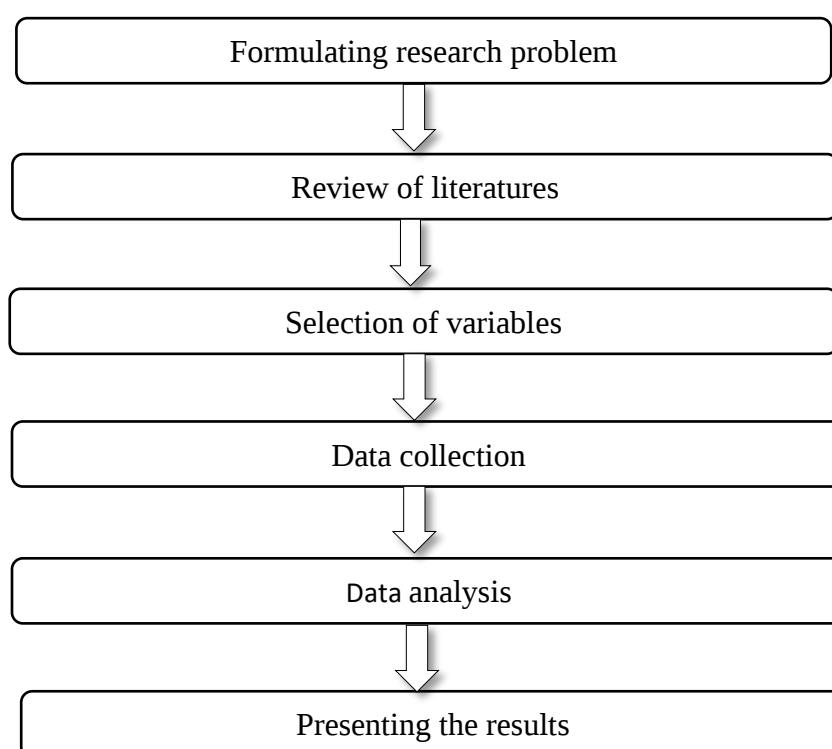


Fig 3.1 Research Design of the Study

3.2 Selection of the Study Area

The study was conducted in Jahapur, Dhamghar and Pashchim Nabipur union under Muradnagar upazila of Cumilla district. This area was selected as the study area because aquaculture is a common practice and Vietnamese Koi is commercially cultured in this village. The other reasons for selecting this area were:

- a) It was expected to have better cooperation from the people involved in Vietnamese Koi culture.
- b) These areas are favorable for Vietnamese Koi culture
- c) There are many fish farms in this area.
- d) Vietnamese Koi is popularly culture in this area. The numbers of Vietnamese Koi farmers are comparatively more than other area in Cumilla district.

3.3 Population and Sample Size

Jahapur, Dhamghar and Pashchim nabipur under Muradnagar upazila were purposively selected for this study. The total number of fish farmers was 450 and among them 140 fish farmers possessed Vietnamese Koi culture. The list of Vietnamese Koi farmers of the selected village was collected from Upazila Fisheries Office. Around 75 percent of them were selected randomly and thus 105 Vietnamese koi farmers were selected as sample.

3.4 Instrument for Data Collection

For the purpose of data collection, an interview schedule was prepared carefully keeping the study objectives in mind. The interview questions were prepared both open and close form of questions. The interview schedule contains direct and simple questions based on the variables. The questions were systematically arranged. The interview schedule was pre-test with 10 farmers in the study area. After pre-test the interview schedule was corrected and modified where ever necessary. The interview schedule was multiplied as per requirement to collect data from the respondents. A copy of interview schedule in English version has been presented in Appendix-A.

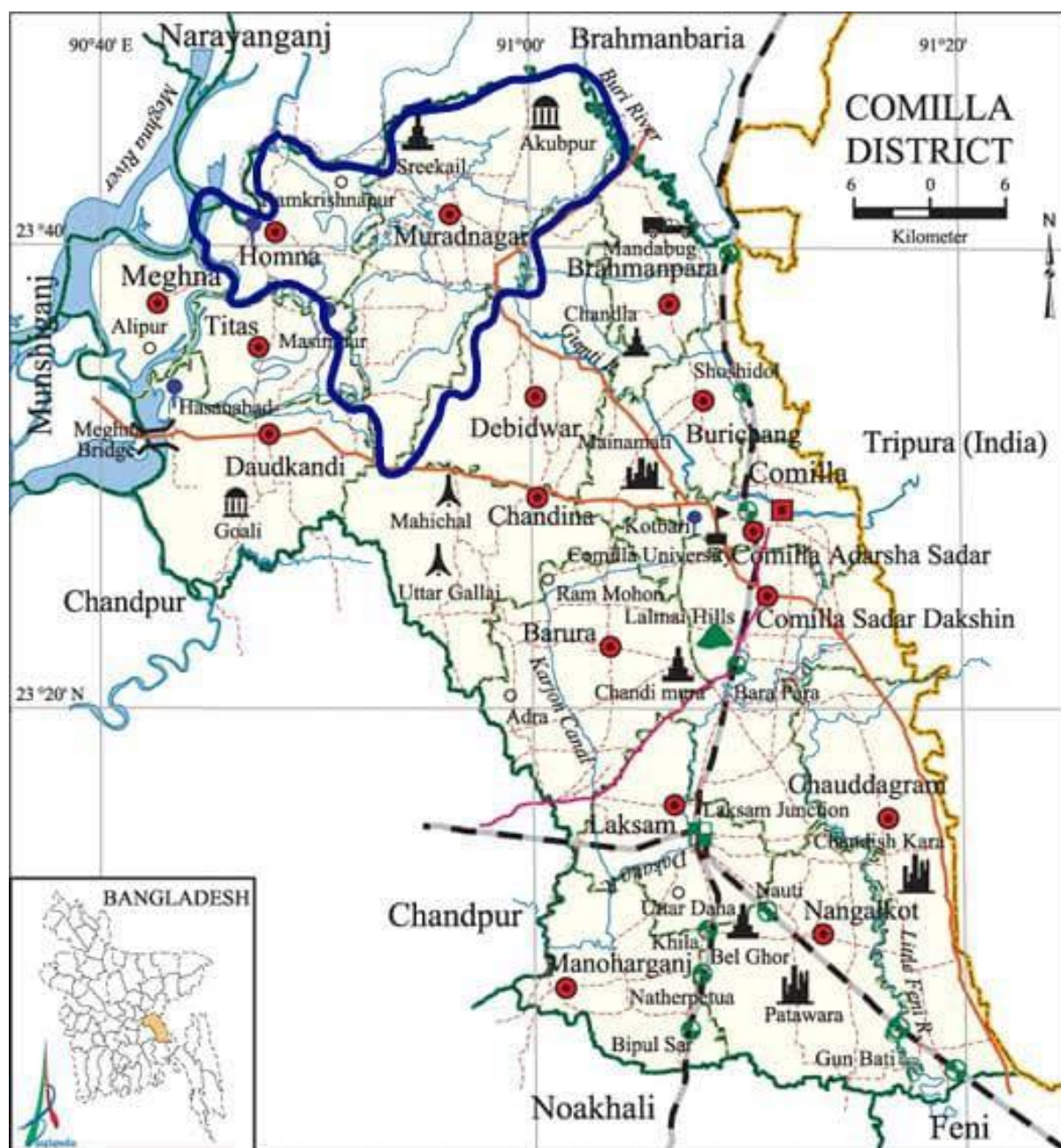


Fig 3.2 Map of Cumilla district showing Muradnagar upazilla

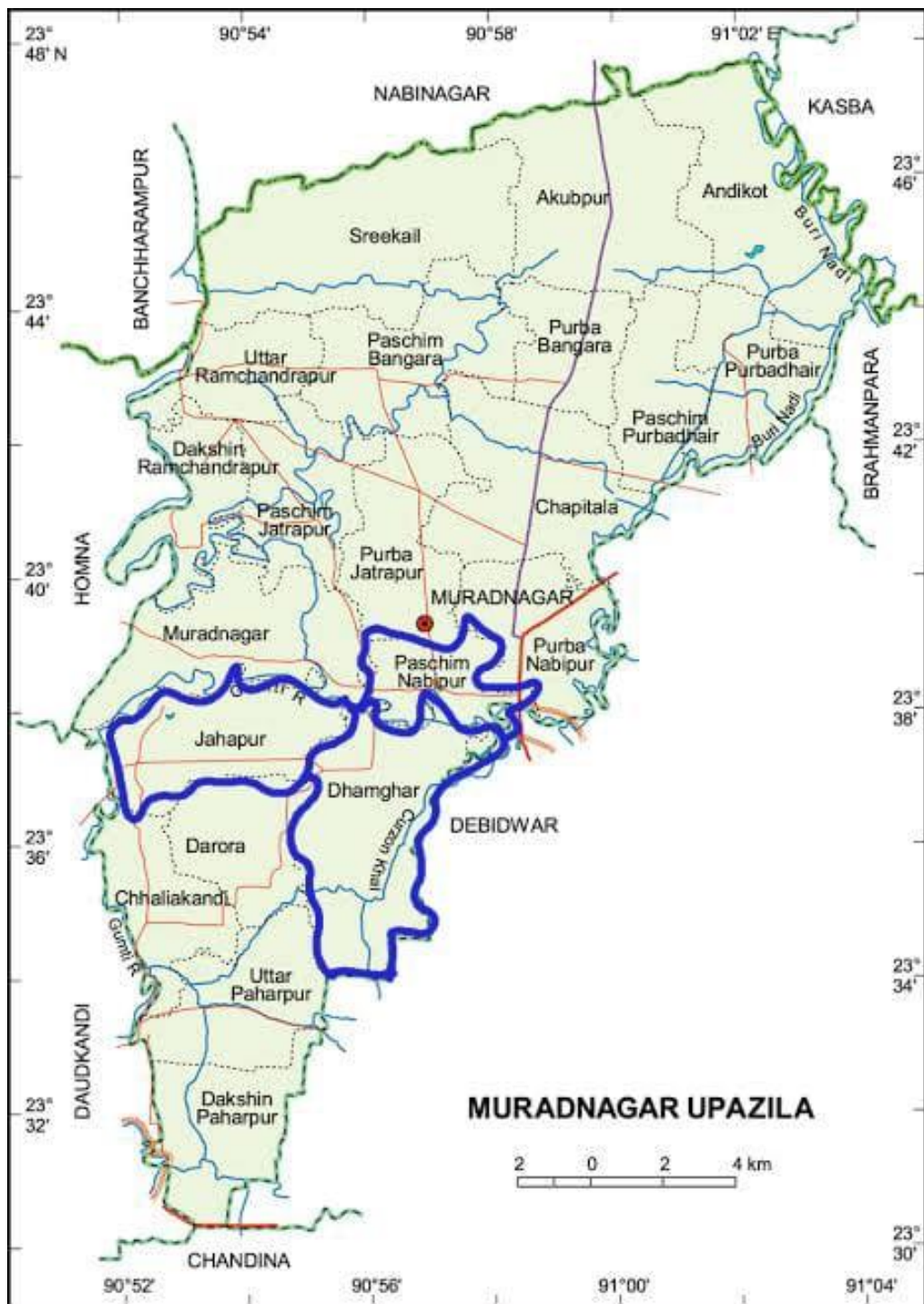


Fig 3.3. Map of Muradnagar upazilla showing selected unions

3.5 Measurement of Independent Variables

3.5.1 Age

The age of a respondent was measured in terms of actual years from his/her birth to the time of interview on the basis of his/her response. A score of one (1) was assigned for each year of his age. This variable appears in item no. 1 in the interview schedule (Appendix-A).

3.5.2 Education

The education of a respondent was measured in terms of year of schooling, he had completed in educational institute. It was expressed in scores. One score was assigned to passing each year in educational institute. For example, a score, of 1 was assigned for passing class 1, 5 for passing primary, 10 for passing S.S.C., 12 for passing H.S.C. and >12 for above H.S.C. This variable appears in item no. 2 in the interview schedule (Appendix-A).

3.5.3 Family size:

Family size refers to the total number of members including the respondent himself/herself, spouse, children and other permanent dependents who lived together as family unit. Family size was operationally measured by assigning a score of one (1) for each member of the family who jointly lived and ate together. Family size of a respondent was measured in terms of actual number of members in his family (including himself) during the interview period. This variable appears in item no. 3 in the interview schedule (Appendix-A).

3.5.4 Pond size

Farm size is the most important capital that has influence on many personal characteristics of the farmers. Farm size of a respondent was measured in terms of hectares using the following formula.

$$PS = A + B + C/2 + D/2$$

Where,

A= Own Pond under own cultivation

B= Pond taken from others on lease

C= Pond taken from others as share or barga

D= Pond given to others on share or barga

The respondent has given information of their farm size, pond area and others. Finally, it was converted into hectare and was considered as the farm size of a respondent in the item no. 4 of the interview schedule (Appendix-A).

3.5.5 Annual family income

Annual family income of a respondent was measured on the basis of total yearly earning from agriculture (crop, livestock, fish culture etc.) and other sources. It was measured in thousand '000° TK. This variable appears in item no. 5 in the interview schedule (Appendix-A).

3.5.6 Fish farming experience

This variable was measured on the basis of a respondent that how long he related with fish culture activities. It was measured in years. This variable appears in item no. 6 in the in the interview schedule (Appendix-A).

3.5.7 Knowledge on Vietnamese Koi cultivation

Knowledge on Vietnamese Koi cultivation of a farmer was measured by using a test that consists of 15 open questions. Total assigned mark was 30. The respondents asked to answer each question. He got full mark if he or she answered the question correctly. He got zero when he or she answered no or wrong answer. The total knowledge score of a respondent range was 0 to 30, while 0 indicating very knowledge and 30 indicating highest level of knowledge. This variable appears in item no. 7 in the interview schedule (Appendix-A).

3.5.8 Extension media contact

Extension media contact referred to the extent of contact of a respondent with different sources. It was measured on the basis of 13 selected media by assigning scores as 4, 3, 2, 1 and 0 respectively under four scored frequently, occasionally, rarely and not at all. Thus the possible range of extension media contact could be 0-54 where '0' indicates no contact and '54' indicates high extension media contact. It appears in item no. 8 in the interview schedule (Appendix-A).

3.5.9 Cosmopolitaness

Cosmopolitaness of a respondent was measured in terms of his nature of visits to the seven different places external to his own social system and as shown in item number 9 in the interview schedule (Appendix-1). The respondents indicated whether they visited those places regularly, often, occasionally, rarely and not at all. Weights assigned to these visits were 4, 3, 2,1 and 0 respectively. A respondent's cosmopolitaness score was obtained by adding the weights for his visits to all the places listed in the questionnaire. The cosmopolitaness score of the respondents could range from 0 to 20, where 0 indicating no cosmopolitaness and 20 indicating highest cosmopolitaness.

3.5.10 Training exposure

Training exposure was measured in total days of training received by the respondent from different organizations. It was measured in days. This variable appears in item no. 10 in the interview schedule (Appendix-A).

3.5.11 Attitude towards Vietnamese Koi farming

Ten relevant statements were carefully constructed to develop attitude scale. Attitude towards Vietnamese koi farming was measured by 5 positive and 5 negative statements in the scale. These statements were alternately arranged. A respondent was asked to indicate her/his degree of agreement about each of the statements with a five-point scale as, strongly agree, agree, undecided, disagree and strongly disagree. Scores were assigned to these five alternate responses as 5,4,3,2 and 1 respectively for each positive statement. In case of negative statement, the reverse scores were assigned. However, the score of a respondent was obtained by adding her/his scores for all the 10 statements. Thus, the attitude score of a respondent could range from 10 to 50 where, 10 indicates very low attitude towards Vietnamese Koi farming and 50 indicates very high favorable attitude towards Vietnamese Koi farming.

3.5.12 Problems faced by the farmer during Vietnamese Koi culture

Vietnamese Koi farmers could face a lot of constraints (such as lack of capital; high price of feed, fingerling, drugs, fertilizer; high labor cost; high sensitivity of disease etc.). These problems were measured by assigning scores as 3, 2, 1 and 0 for high problems, moderate problems, slight problem and not at all problem. This variable appears in item no. 12 in the interview schedule (Appendix-A). Thus, the possible range of problem faced score of the respondents was 0 to 48. This variable was measured by the following formula:

Problem Faced Index:

$$PFI = Ph \times 3 + Pm \times 2 + Pl \times 1 + Pn \times 0$$

Where,

PFI= Problem Facing Index

Ph= Number of respondents faced high problems

Pm= Number of respondents faced moderate problems

Pl= Number of respondents faced low problems

Pn= Number of respondents faced no problems

Problem Faced Index (PFI) for each problem faced strategies could range from 0 to 315, where 0 indicating no problem and 315 indicating highest extent of problem faced by the fish farmers.

3.6 Measurement of Dependent Variable

Adoption of Vietnamese Koi was measured by using the following formula:

$$\text{Adoption} = \frac{\text{Pond size under Vietnamese koi culture}}{\text{Total Pond}} \times 100$$

Thus, the adoption of Vietnamese koi could range from 0-100 where '0' indicated no adoption and 100 indicated full adoption of Vietnamese koi.

3.7 Collection of Data

Data were collected by the researcher himself through personal interviewing from the Vietnamese Koi farmers of the selected village. The interview was conducted with the respondent individually in their respective pond area. The researcher took all possible care to establish rapport with the respondent so that they would not hesitate to start the interview. Wherever the respondent felt any difficulty in understanding any questions, the researcher took utmost care to explain and clarify the same properly. Secondary data were collected from Upazila Fisheries Officer. Primary data were collected from fish farmers. The data were collected with respect to the factors of adoption of Vietnamese Koi. For the present study, personal interview was used. Data were collected during 1st December to 30th December, 2022.

3.8 Data processing

The collected raw data were analyzed thoroughly to detect errors and exclusions. Qualitative data were converted into quantitative data by means of suitable scoring whenever necessary. For this the collected data were given numerical coded values. The obtained data were then compiled on a master sheet and then tabulated and analyzed with keeping the objectives of the study in mind. A broad variety of related hypotheses and empirical studies have been compiled and reviewed. To create a specific research plan and to outline the research context, the researcher contacted numerous relevant outlets, such as books, journals, papers, theses, abstracts, and the internet.

3.9 Hypothesis of the Study

A hypothesis is an assumption, an idea that is proposed for the sake of argument so that it can be tested to see if it might be true. In the scientific method, the hypothesis is constructed before

any applicable research has been done, apart from a basic background review. A hypothesis is usually tentative; it's an assumption or suggestion made strictly for the objective of being tested. In broad sense hypotheses are divided into two categories: (a) Research hypothesis and (b) Null hypothesis.

3.9.1 Research hypothesis

Based on review of literature and development of conceptual framework, the following research hypothesis was formulated: “Each of the twelve (12) selected characteristics (Age, education, family size, farm size, annual family income, extension media contact, cosmopolitaness, knowledge on Vietnamese koi farming, training exposers, attitude towards Vietnamese koi farming, fish farming experience and problem faced by the farmers has significant relationship to adoption of Vietnamese koi farming. However, when a researcher tries to perform statistical tests, then it becomes necessary to formulate null hypothesis.

3.9.2 Null hypothesis

A null hypothesis states that there is no contribution between the concerned variables. The following null hypothesis used to be formulated to explore the contribution of the selected characteristics of farmers on their adoption extent of Vietnamese koi fish farming. Hence, in order to conduct tests, the earlier research hypothesis was converted into null form as follows: “There is no contribution of the selected characteristics of the farmers to their adoption of Vietnamese koi fish culture.”

3.10 Data analysis

Data collected from the respondents were analyzed and interpreted in accordance with the objectives of the study. The analysis of data was performed using statistical treatment with SPSS (Statistical Package for Social Sciences) computer program, version 25. Statistical measures such as number, range, mean, standard deviation and percentage were used in describing the variables whenever applicable. In order to explore the relationship between the characteristics of farmers and their rate of adoption of Vietnamese koi, Pearson's Product Moment coefficient of correlation (r) was used. Throughout the study, five percent (0.05) and one percent (0.01) level of significance was used as the basis for rejecting any null hypothesis.

CHAPTER 4

RESULT AND DISCUSSIONS

The findings of the study are presented in this Chapter according to the objectives of the study. Necessary explanations and interpretations have also been made showing possible and logical basis of the findings whenever necessary. However, for convenience of the discussions, the findings of the study are systematically presented.

4.1 Selected Characteristics of the Vietnamese Koi Farmers

This section deals with the classification of the farmers according to their various characteristics. Behavior of an individual is largely determined by his/her characteristics. These characteristics of an individual contribute to a great extent in the matter of shaping of his/her behavior. Therefore; the major hypothesis of the study was that the adoption of Vietnamese Koi farming would also be influenced by selected characteristics of the farmers. The selected characteristics have been described in this section. Range, mean and standard deviations of these characteristics of Vietnamese Koi farmer are also described in this section.

Table 4.1 The salient features of selected characteristics of Vietnamese koi farmers

Categories	Measuring Unit	Range		Mean	SD
		Possible	Observed		
Age	Years	-	19-58	40.72	10.07
Education	Year of Schooling	-	00-12	5.25	3.13
Family size	Number		2-12	5.76	2.11
Pond size	Hectare	-	0.39-3.78	1.83	1.06
Annual family Income	Thousand takas		90-2240	490.47	475.50
Experiences	Score		2-40	17.39	11.61
Extension media contact	Score	0-52	8-44	27.05	9.39
Knowledge on Vietnamese koi farming	Score	0-30	7-27	15.46	6.17
Training on fish Farming	No of days		0-21	14.95	8.14
Cosmopolitness	Score	0-36	9-34	9.93	4.62
Attitude Towards Vietnamese Koi Cultivation	Score	0-40	8-36	18.54	9.04
Problems faced by the farmers	Score	0-48	10-44	24.41	11.19

4.1.1 Age of the respondents

The age of the respondent fish farmers ranged from 19 to 58 years with an average age of 40.72 years and standard deviation is 10.07. The respondents were classified into three categories and presented in Table 4.2.

Table 4.2 Distribution of the respondents according to their age

Categories	Farmers		Mean	SD
	Number	Percent		
Young aged (up to 35)	32	30.47	40.72	10.07
Middle-aged (36-50)	49	46.66		
Old (>50)	24	22.85		
Total	105	100		

Results presented in Table 4.2 indicate that the highest proportion (46.66%) of the respondents were in middle aged categories compared to 30.47 percent young and 22.85 percent old aged category. However, Farmers with middle age has the decision-making power than other and young farmers have the higher trend to accept new technology. Rahman (2014) also reported that most of the farmers in the same study area were young to middle aged.

4.1.2 Education of the respondents

Education is the process of developing mind of an individual and increases his/her power of observation, integration, understanding, decision-making and adjustment to new situation. It is assumed that the higher educated farmers will have high performance on the farming. On the basis of observed data, the respondents were classified into four categories according to Akanda (2017). The categories and distribution of the respondents are shown in Table 4

Table 4.3 Distribution of the respondents according to their educational qualification

Categories	Farmers		Mean	SD
	Number	Percent		
Illiterate (0-0.5)	17	16.19	5.25	3.13
Primary level (1-5)	37	35.23		
Secondary level (6-10)	44	41.90		
Above secondary level (>10)	7	6.67		
Total	105	100		

Information presented in table 4.3 indicates that most of the respondents (41.90%) fall in the secondary level category, 16.19 percent of farmers were illiterate, about 35.23 percent of the farmers had primary level qualification and 6.67 percent had higher level of education. Therefore, it can be said that comparatively higher educated farmers were involved in Vietnamese koi farming in the study area. (Islam, 2014) found that more than 65 percent respondents had secondary and higher secondary level education in the study area.

4.1.3 Family size of the respondents

Family size referred to the total number of members including the respondent himself, spouse, children and other permanent dependents who lived together as family unit. Family size of a respondent was measured in terms of actual number (all dependents) of members in his family (including himself) during the interview period in Table 4.4 The families were divided into three categories according to Islam (2008).

Table 4.4 Distribution of the respondents according to their family size

Categories	Farmers		Mean	SD
	Number	Percent		
Small family (up to 4)	14	13.33	5.76	2.11
Medium family (5-7)	68	64.76		
Large family (above 7)	23	21.90		
Total	105	100		

Distribution of the respondents according to their family size in Table 4.4 indicate that two third of the respondents belonged to medium family while 13.33 percent of them found under small family and 21.90 percent of them rested under large family.

4.1.4 Farm size of the respondents

The farm size in the study area varied from 0.39 ha to 3.78 ha with the average 1.83 ha which was found higher than the national average 0.8 ha (DAE, 2010) the reason behind the result may that most of the farmer in the study area leased in water body for fish farming. Based on

farm size the respondents were classified into three categories according to BBS (2009) as presented in Table 4.5.

Table 4.5 Distribution of the respondents according to their farm size

Categories	Farmers		Mean	SD
	Number	Percent		
Marginal farm (0.02-0.20)	0	0	1.83	1.06
Small farm (0.21-0.99 ha)	24	22.85		
Medium farm (1.00-3.0 ha)	59	56.19		
Large farm (>3.00 ha)	22	20.95		
Total	105	100		

Findings indicate that, above half (56.9%) had medium size pond on the other hand 22.85 percent respondents had medium farm size and 20.95% percent found in small pond size.

4.1.5 Annual family income of the respondents

The annual family income of the Vietnamese koi farmers ranged from 90 to 2240 thousand taka with an average of 490.47 and standard deviation of 475.50. Based on their annual family income the respondents were classified into three categories as shown in Table 4.6.

Table 4.6 Distribution of the respondents according to their annual family income

Categories	Farmers		Mean	SD
	Number	Percent		
Low income (Up to 100)	20	19.04	490.47	475.50
Medium income (100.1-300)	60	57.14		
High income (above 300)	25	23.80		
Total	105	100		

Information exhibited in the Table 4.6 demonstrate that the most (57.14%) of the Vietnamese farmers had medium income, while 23.80 percent and 19.04 percent of them had high- and low-income classification, respectively.

4.1.6 Fish farming experience

The fish farming experience of the farmers ranged from 2 to 40 years with the average of 17.39 years and standard deviation of 11.61 years. Based on the farming experience of the fish farmers were classified into three categories such as low experience (up to 6), medium experience (7 to 22) and high experience (>22). These categories presented in Table 4.7. The data indicate that 18.09 percent of the fish farmers had low experience, 60 percent had medium experience and 21.90 percent had high experience. It may indicate that the majority of the fish farmers had medium to high farming experienced. Sometimes experience can play strong role for getting higher profit, but always it is not appropriate.

Table 4.7 Distribution of the farmers according to fish farming experience

Categories	Farmers		Mean	SD
	Number	Percent		
Low experience (Up to 6)	19	18.09	17.39	11.61
Medium experience (7-22)	63	60		
High experience (above 22)	23	21.90		
Total	105	100		

4.1.7 Knowledge on Vietnamese Koi cultivation

The knowledge score of the Vietnamese Koi fishes farmers could range from 0 to 30 where 0 indicates very poor knowledge and 30 indicate higher knowledge. The observed knowledge score of the fish farmers ranged from 7-27 with an average of 15.46 and standard deviation of 6.17 shown in Table 4.8. Based on the knowledge score, the fish farmers were classified into three categories such as low (0-10), medium (11-20) and high (>21-30). These categories presented in Table 4.8. Data indicate that 56.19 percent of the fish farmers had medium knowledge, 22.85 percent had low knowledge and 20.95 percent had high knowledge. Thus, indicate that the majority of the fish farmers had medium to high knowledge. Knowledge is

important for fish culture. Without appropriate knowledge fish farmers face so many problems they could not manage the undesirable condition.

Table 4.8 Distribution of knowledge on Vietnamese koi of the farmers

Categories	Farmers		Mean	SD
	Number	Percent		
Low knowledge (Up to 10)	24	22.85	15.46	6.17
Medium knowledge (11-20)	59	56.19		
High knowledge (21- 30)	22	20.95		
Total	105	100		

4.1.8 Extension media contact

The extension media contact score of the fish farmers could be ranged from 0 to 52 and observed range from 8 to 44 with an average of 27.05 and standard deviation of 9.39. Based on the extension media contact of the fish farmers were classified into three categories such as low (up to 18), medium (19-36) and high (>36). These categories presented in Table 4.9. The data indicate that 18.09 percent of the farmers were low extension media contact, 59.09 percent of the fish farmers had medium extension contact and 22.85 percent had high extension media contact. Thus, the majority of the farmers had medium extension media contact. As most of the fish farmers are operating their fish farm as commercial basis, they feel its necessity.

Table 4.9 Distribution of the Extension media contact of the fish farmers

Categories	Farmers		Mean	SD
	Number	Percent		
Low (Up to 18)	19	18.09	27.05	9.39
Medium (19-36)	62	59.09		
High knowledge (above 36)	24	22.85		
Total	105	100		

4.1.9 Cosmopoliteness

Cosmopoliteness scores of the respondents ranged from 2 to 18 with the average of 9.93 and a standard deviation of 4.62 against the possible range of 0 to 20. On the basis of their cosmopoliteness scores, the farmers were classified into three categories as shown in Table 4.10.

Table 4.10 Distribution of the farmers according to their cosmopoliteness

Categories	Farmers		Mean	SD
	Number	Percent		
Low Cosmopolite (1-7)	27	25.71	9.93	4.62
Medium Cosmopolite (8-14)	60	57.14		
High Cosmopolite (Above 14)	18	17.14		
Total	105	100		

The majority (57.14%) of the farmers were medium cosmopolite as compared to 25.71 percent of them being low cosmopolite and 17.14 percent highly cosmopolite.

4.1.10 Training exposure

The training exposure of the fish farmers ranged from 0 to 21 days with an average of 14.95 and standard deviation of 8.14. Based on the training exposure of the fish farmers were divided into three categories such as short duration training (up to 7), medium duration training (8-14) and long duration training (> 14). These categories presented in Table 4.11. Data indicate that 46.8 percent of the fish farmers had short duration training, 10.6 percent had long duration training and 42.6 percent had medium duration training. Training increases knowledge and skill of the fish farmers regarding fish farming activities. It enables them to solve their farming problems. They can manage diversified farming practices.

Table 4.11 Distribution of Training exposers on Vietnamese koi of the farmers

No. of training days	Farmers		Mean	SD
	Number	Percent		
Short training (up to 7)	49	46.8	14.95	8.14
Medium training (7-14)	45	42.6		
Long training (Above 14)	11	10.6		
Total	105	100		

4.1.11 Attitude towards Vietnamese koi farming

The attitude towards Vietnamese Koi farming scores ranged from 8 to 36 against the possible scores 10 to 50 with an average of 18.54 and a standard deviation of 9.04. Based on the possible attitude towards Vietnamese Koi farming scores, the respondents were classified into three categories as shown in Table 4.12.

Table 4.12 Distribution of the respondents according to their attitude towards Vietnamese koi farming

Categories (Scores)	Farmers		Mean	SD
	Number	Percent		
Unfavorable attitude (<30)	13	12.38	18.54	9.04
Neutral attitude (30)	18	17.14		
Low attitude (31-40)	52	49.52		
High Favorable attitude (>40)	22	20.95		
Total	105	100		

4.1.12 Problems faced by the farmers during Vietnamese koi farming

Problems faced by the farmer during adoption of Vietnamese koi farming of the respondents was quantified by computing scores for their problems during farming. The problems during farming scores ranged from 10 to 44 against the possible scores 0 to 48 with an average of 24.21 and a standard deviation of 11.19. Data presented in table 4.13 shows that (45.71%) of the Vietnamese koi farmer faced medium problems as compared to 32.38 percent faced low problems and 21.90 percent faced high problems. Based on the problems found in towards Vietnamese koi farming scores, the respondents were classified into three categories as shown in Table 4.13.

Table 4.13 Distribution of the respondents according to the problem faced during adoption of Vietnamese koi farming

Categories (Scores)	Farmers		Mean	SD
	Number	Percent		
Low problems (up to 16)	34	32.38	24.21	11.19
Medium problems (17-32)	48	45.71		
High problems (above 32)	23	21.90		
Total	105	100		

4.2 Rate of Adoption of Vietnamese Koi by the Fish Farmers

The rate of adoption of Vietnamese Koi of the fish farmers were classified into three categories such as low rate of adoption, medium rate of adoption and high rate of adoption, These Categories are given below in Table 4.14

Table 4.14 Distribution of the respondent's rate of adoption of Vietnamese koi farming

Categories (Scores)	Farmers		Mean	SD
	Number	Percent		
Low adoption (up to 33.33)	30	28.56	41.27	17.34
Medium adoption (33.4-66.67)	55	52.38		
High adoption (above 66.67)	20	19.04		
Total	105	100		

The possible range is could be 0-100. The rate of adoption of the Vietnamese Koi of the fish farmers ranged from 11.45 to 68.75 % with an average of 41.27 % and standard deviation of 17.34 percent. Based on the rate of adoption score of Vietnamese Koi of the fish farmers were classified into three categories such as low adoption (up to 33), medium adoption (34-66) and high adoption (>66). These categories indicate 28.56 percent of the fish farmers had low adoption, 52.38 percent of the fish farmers had medium adoption and 19.04 percent had high adoption. Thus, indicate that the majority of the fish farmers had medium adoption.

4.3 Relationship between the Selected Characteristics of the Fish Farmers and Their Rate of Adoption of Vietnamese Koi.

This section deals with the relationship between the selected characteristics of the fish farmers and their rate of adoption of Vietnamese Koi. Each of the selected characteristics of the fish farmers were causal variables and rate of adoption of Vietnamese Koi by the fish farmers was the focus variable. Pearson's product moment correlation co-efficient 'r' has been used to test the hypothesis concerning the relationships between two variables. Five percent and one percent level of significance was used as the basic for acceptance or rejection of a hypothesis. Results of Pearson's product moment correlation have been shown in Table 4.15

Table 4.15 Co-efficient of correlation of the selected characteristics of the fish farmers and their rate of adoption of Vietnamese koi.

Dependent variable	Independent variable	Computed value of r	Table value of r of 103 degree of freedom	
			0.05	0.01
Rate of adoption of Vietnamese koi	Age	-.071	0.195	0.254
	Education	-.023		
	Family size	-.033		
	Pond size	.905**		
	Family income	.634**		
	Fish farming experience	.950**		
	Knowledge on Vietnamese koi culture	.979**		
	Extension media contact	-.073		
	Cosmopolitanism	-.002		
	Training exposers	-0.035		
	Attitude towards Vietnamese koi culture	.956**		
	Problems faced by the farmer during Vietnamese koi culture	-0.165		

*=Correlation is significant at the 0.05 level (2-tailed)

**= Correlation is significant at the 0.01 level (2-tailed)

4.3.1 Relationship between age of the fish farmers and their rate of adoption of Vietnamese Koi

The relationship between age of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was no significant relationship between the age of the farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be -0.71 as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on co-efficient values.

Firstly, the relationship showed a negative trend. Secondly, a very low relationship was found between the two variables. Thirdly, the computed value of ' r ' (-0.071) was smaller than the table value ($r=0.195$) with 103 degree of freedom at 0.05 level of probability. Hence, the null hypothesis could not be rejected.

The findings indicate that the age of the farmers had insignificant relationship (-0.071) with their rate of adoption of Vietnamese Koi. It indicates that the age of the farmers was not an important factor for rate of adoption.

4.3.2 Relationship between the education of the fish farmers and their rate of adoption of Vietnamese Koi

The relationship between education of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was no significant relationship between the education of the farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be -0.023 as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient values.

Firstly, the relationship showed a negative trend. Secondly, a very low relationship was found between the two variables. Thirdly, the computed value of ' r ' (-0.023) was smaller than the table value ($r=0.195$) with 103 degree of freedom at 0.05 level of probability. Hence, the null hypothesis could not be rejected.

The findings indicate that the education of the farmers had insignificant relationship (-0.023) with their rate of adoption of Vietnamese Koi. It might be concluded that the education of the farmers was an important factor for rate of adoption of Vietnamese Koi.

4.3.3 Relationship between the family size of the fish farmers and their rate of adoption of Vietnamese Koi

The relationship between family size of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was no significant relationship between the family size of the fish farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be (-0.033) as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient values.

Firstly, the relationship showed a negative trend. Secondly, a moderate relationship was found between the two variables. Thirdly, the computed value of ' r ' (-0.033) was smaller than the table value ($r=0.195$) with 103 degree of freedom at 0.05 level of probability. Hence, the null hypothesis could not be rejected.

The findings indicate that the family size of the farmers had no significant relationship (-0.033) with their rate of adoption of Vietnamese Koi. It might be concluded that the family size of the farmers was not an important factor for rate of adoption of Vietnamese Koi.

4.3.4 Relationship between the pond size of the fish farmers and their rate of adoption of Vietnamese Koi

The relationship between Pond size of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was no relationship between the pond size of the fish farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be (0.905**) as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient values.

Firstly, the relationship showed a positive trend. Secondly, a high relationship was found between the two variables. Thirdly, the computed value of ' r ' (0.905**) was greater than the table value ($r=0.254$) with 103 degree of freedom at 0.01 level of probability. Hence, the null hypothesis was rejected.

The findings indicate that the pond size of the farmers had a positive significant relationship (0.905**) with their rate of adoption of Vietnamese Koi. It may be concluded that the pond size of the farmers was an important factor for rate of adoption of Vietnamese Koi. Because the farmer who have larger pond size, he would like to take risk for adopt new fish farming.

4.3.5 Relationship between the annual family income of the fish farmers and their rate of adoption of Vietnamese Koi

The relationship between annual family income of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was a no significant relationship between the annual family income of the fish farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be 0.634 as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient values.

Firstly, the relationship showed a positive trend. Secondly, a high relationship was found between the two variables. Thirdly, the computed value of ‘ r ’ (0.634) was greater than the table value ($r=0.254$) with 103 degree of freedom at 0.01 level of probability. Hence, the null hypothesis was rejected.

The findings indicate that the annual family income of the farmers had a positive significant relationship (634^{**}) with their rate of adoption of Vietnamese Koi. It might be concluded that the annual income of the farmers was an important factor for rate of adoption of Vietnamese Koi. Because the farmer who have enough annual income would like to take risk for adopt new fish farming.

4.3.6 Relationship between the fish farming experience of the farmers and their rate of adoption of Vietnamese Koi

The relationship between the fish farming experience of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was no significant relationship between the fish farming experience of the farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be 0.950 as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient values.

Firstly, the relationship showed a positive trend. Secondly, a strong relationship was found between the two variables. Thirdly, the computed value of ‘ r ’ ($.950^{**}$) was greater than the table value ($r=0.254$) with 103 degree of freedom at 0.01 level of probability. Hence, the null

hypothesis was rejected. The findings indicate that the fish farming experience of the farmers had significant relationship (.950**) with their rate of adoption of Vietnamese Koi. This means that the adoption of the fish farmers was related their farming experience.

4.3.7 Relationship between the knowledge of the fish farmers and their rate of adoption of Vietnamese koi

Relationship between the knowledge of the fish farmers and their rate of adoption Vietnamese Koi The relationship between the fish knowledge of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was no significant relationship between the knowledge of the fish farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be 0.979** as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient values.

Firstly, the relationship showed a positive trend. Secondly, a very strong relationship was found between the two variables. Thirdly, the computed value of ‘r’ (.979**) was greater than the table value ($r=0.254$) with 103 degree of freedom at 0.01 level of probability. Hence, the null hypothesis was rejected.

The findings indicate that knowledge of the fish farmers had significant relationship (0.979) with their rate of adoption of Vietnamese Koi. This means that the adoption of the fish farmers was related their knowledge.

4.3.8 Relationship between the extension media contact of the fish farmers and their rate of adoption of Vietnamese Koi

The relationship between the extension media contact of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was no significant relationship between the extension media contact of the farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be -0.073 as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient values.

Firstly, the relationship showed a negative trend. Secondly, a very low relationship was found between the two variables. Thirdly, the computed value of 'r' (-0.073) was smaller than the table value =0.195 with 103 degree of freedom at 0.05 level of probability. Hence, the null hypothesis could not be rejected.

The findings indicate that the extension media contact of the farmers had insignificant relationship (-0.073) with their rate of adoption of Vietnamese Koi.

4.3.9 Relationship between the cosmopolitnness of the fish farmers and their rate of adoption of Vietnamese Koi

The relationship between the cosmopolitnness of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was no significant relationship between the cosmopolitnness of the fish farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be -0.002 as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient values.

Firstly, the relationship showed a negative trend. Secondly, a very low relationship was found between the two variables. Thirdly, the computed value of 'r' (-0.002) was smaller than the table value (r=0.195) with 103 degree of freedom at 0.05 level of probability. Hence, the null hypothesis could not be rejected.

The findings indicate that the cosmopolitnness of the farmers had insignificant relationship (-0.002) with their rate of adoption of Vietnamese Koi. This means that the adoption of the fish farmers was independent of their cosmopolitanism.

4.3.10 Relationship between the training exposure of the fish farmers and their rate of adoption of Vietnamese Koi

The relationship between the training exposure of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was no significant relationship between the training exposure of the fish farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be -0.035 as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient values.

Firstly, the relationship showed a negative trend. Secondly, a very low relationship was found between the two variables. Thirdly, the computed value of ' r ' (-0.035) was smaller than the table value ($r=0.195$) with 103 degree of freedom at 0.05 level of probability. Hence, the null hypothesis could not be rejected.

The findings indicate that the training exposure of the farmers had insignificant relationship (-0.035) with their rate of adoption of Vietnamese Koi. This means that the adoption of the fish farmers was independent of their training exposure.

4.3.11 Relationship between the attitude towards Vietnamese koi of the fish farmers and their rate of adoption of Vietnamese Koi

The relationship between the fish attitude towards Vietnamese koi culture of the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

“There was no significant relationship between the attitude towards Vietnamese of the fish farmers and their rate of adoption of Vietnamese Koi”.

The computed value of co-efficient of correlation (r) between the concerned variables was found to be 0.956^{**} as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient value.

Firstly, the relationship showed a positive trend. Secondly, a very strong relationship was found between the two variables. Thirdly, the computed value of ' r ' (0.956^{**}) was greater than the table value ($r=0.254$) with 103 degree of freedom at 0.01 level of probability. Hence, the null hypothesis was rejected.

The findings indicate that the attitude towards Vietnamese of the fish farmers had significant relationship (0.956) with their rate of adoption of Vietnamese Koi. This means that the adoption of the fish farmers was related with their attitude.

4.3.12 Relationship between problems faced by the fish farmers and adoption of Vietnamese koi

The relationship between the problems faced by the fish farmers and their rate of adoption of Vietnamese Koi was examined by testing the following null hypothesis:

The computed value of co-efficient of correlation (r) between the problems of fish farmers and their rate of adoption was found to be 0.165 as shown in Table 4.15. The following observations are made regarding the relationship between these two variables, based on the co-efficient values.

Firstly, the relationship showed a negative trend. Secondly, a moderate relationship was found between the two variables. Thirdly, the computed value of ' r ' (0.165) was smaller than the table value ($r=0.195$) with 103 degrees of freedom at 0.05 level of probability. Hence, the null hypothesis could not be rejected.

4.4 Rank of order of problem faced by respondents during Vietnamese koi culture

During Vietnamese koi farming, fish farmers usually face of several problems. To determine the extent of problems the study ranked their problems according to its affect during farming. Rank order of the sixteen problem that faced by the respondents is presented in the following Table 4.16.

Table 4.16 Rank order of the problem faced by respondents during adoption of Vietnamese koi farming

Statement of the problem	High	Medium	Low	Not at all	Computed score	Rank order
High price of feed	52	25	15	13	221	1 st
Lack of capital	51	23	14	17	213	2 nd
High labor cost	51	20	14	20	207	3 rd
High price of medicine	48	20	21	16	207	4 th
Higher production cost	46	25	16	18	204	5 th
High sensitivity to disease	42	29	9	25	193	6 th
Lack of Knowledge about Vietnamese koi culture	33	26	14	32	165	7 th
Natural digester (flood)	24	21	38	22	152	8 th
Lack of water exchange facilities	28	30	6	41	150	9 th
Lack of oxygen concentration	9	43	31	22	144	10 th
Less security of fish food	11	45	14	35	137	11 th
Poor transportation facilities	7	47	17	34	132	12 th
Unviability of Vietnamese koi seeds	10	15	47	33	107	13 th
Social or political pressure	10	15	46	34	106	14 th
Algal blooms on the pond	10	15	45	35	105	15 th
Formation of nitrogen gas in pond bottom	4	20	49	32	101	16 th

As per Problem Faced Index (PFI), high price of feed positioned the 1st and poor formation of nitrogen gas in last position. The problems faced by the Vietnamese koi farmer during adoption of Vietnamese koi farming according to descending order through the analysis of the received data from respondents are high price of feed, diseases outbreak, lack of capital, unavailability of koi seeds, inadequate water exchange facilities, high labor cost and formation of nitrogen gas systems etc. Sheli *et al.* (2013) found that major constraints are high production cost that means higher material input cost reduces profit of the farmer. Ahmed, S. (2018) found that about 93.7 percent of the total cost constitutes the input cost where 71.8 percent cost for feeds.

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of findings, conclusions and recommendations of the study

5.1 Summary of findings

The summary of the major findings is presented in following four sub sections

5.1.1 Farmer's characteristics and related factors

Age

The age of the respondent fish farmers ranged from 19 to years with an average age of 40.72 years. The highest proportion (46.66%) of the respondents were in middle aged categories compared to 30.47 percent young and 22.85 percent old aged category.

Level of education

The respondents found (41.90%) fall in the secondary level category, 16.19 percent of farmers were illiterate, about 35.23 percent of the farmers had primary qualification and 6.67 percent had higher level of education. The average is found 5.25 with standard deviation of 3.13

Pond size

The family size is ranged from 2 to 12 where 64.76 percent of the respondents belonged to medium family while 13.33 percent of them found under small family and 21.90 percent of them rested under large family. The average was 5.76 and standard deviation was 2.11

Farm size

Farm size of the farmers ranged from 0.39 to 3.78 ha. With an average of 1.83 and standard deviation of 1.06 ha. 20.95% farmer had large size on the other hand 56.19 percent respondents had medium farm size and 22.85 percent found in small farm size.

Annual Family Income

Annual family income of the farmers ranged from 90 to 2240 thousand TK with an average of 490.47 thousand TK and standard deviation of 475.50 thousand TK. The highest Proportion (57.14 percent) of the farmers had medium income.

Fish farming experience

The fish farming experience of the farmers ranged from 2 to 40 years with an average of 17.39 years and standard deviation of 11.61 years where 18.09 percent of the fish farmers had low experience, 60 percent had medium experience and 21.90 percent had high experience.

Knowledge on Vietnamese koi culture

The knowledge score of the Vietnamese Koi fishes farmers ranged from 0 to 30. The observed knowledge score of the fish farmers ranged from 7-27 with an average of 15.46 and standard deviation of 6.17. The highest proportion 56.19 percent had medium knowledge

Extension media contact

The extension media contact score of the fish farmers ranged from 0 to 52 and observed range from 8 to 44 with an average of 27.05 and standard deviation of 9.39. the majority of the farmers (59.09) had medium extension media contact.

Cosmopoliteness:

Cosmopoliteness scores of the respondents ranged from 2 to 18 with an average of 9.93 and a standard deviation of 4.62 against the possible range of 0 to 20. The majority 62% of the farmers were "medium cosmopolite" as compared to 19 percent of them being "low cosmopolite" and 24 percent "highly cosmopolite".

Training Exposure

The training exposure of the Vietnamese Koi farmers ranged from 0 to 21 days. The average was 14.95 days with a standard deviation of 8.14 days. The majority of the fish farmers had short to long duration training.

Attitude towards Vietnamese koi farming:

The attitude towards Vietnamese koi farming scores ranged from 8 to 36 against the possible scores 0 to 40 with an average of 18.54 and a standard deviation of 9.04. About 49.52% of the

Vietnamese Koi farming belonged to low favorable attitude towards Vietnamese Koi farming as compared to 12.38 percent had unfavorable attitude, 17.14 percent had neutral attitude and 20.95 had high favorable attitude

Problems faced by the farmer during adoption:

The problems during Vietnamese koi farming scores ranged from 10 to 44 against the possible scores 0 to 48 with an average of 24.71 and a standard deviation of 11.19. About 45.71% of the farmer faced medium problems during farming as compared to 32.38 percent had low problems and 21.90 percent faced high problem.

5.1.2 Adoption of Vietnamese koi

The extent of adoption in Vietnamese koi farming is the depended variable of this study. Based on their adoption score, the respondents were classified into three categories. Low adoption (up to 33.3), medium adoption (33.4-66.67) and high adoption (above 66.67). About 52.38 percent of the respondents had medium adoption compared to 19.04 percent had higher adoption and 28.57% of them had low adoption on Vietnamese koi farming. It is clear that most of the farmers have medium adoption about Vietnamese koi farming.

5.2 Conclusion

It is very important to have satisfactory clarification about the findings of the study and to draw a meaningful conclusion. Based on the findings of the study and their logical interpretation, the following conclusions were drawn:

- i. The majority of the fish farmers had medium adoption of Vietnamese Koi. It could be concluded from the findings that there is scope to improve farmers' rate of adoption on Vietnamese Koi culture. The importance of Vietnamese Koi in our country is highly demandable for its test and nutrition.
- ii. The findings indicate that maximum number of farmers had medium income. They directly involved in earnings through Vietnamese koi culture and the study found a significant relationship between their income and adoption of Vietnamese koi.

- iii. The findings indicate that the majority of the farmers had small to medium sized pond who adopt Vietnamese Koi in the study area.
- iv. The majority of the farmers had medium fish farming experience that showed a significant relationship with the adoption of Vietnamese koi. They become interested in gaining Vietnamese koi fish farming experience.
- v. The knowledge on Vietnamese koi culture is found strongly significant in the study area. Maximum number of farmers had medium knowledge related to the culture of Vietnamese koi.
- vi. It could be concluded that the attitude towards the Vietnamese koi culture had significant relationship with the adoption of Vietnamese koi culture. The majority number of farmers had medium low favorable attitude towards Vietnamese koi.

5.3 Recommendations

Based on the findings of the study, some recommendations were put forward. Recommendations have been divided into two groups; these are recommendations for policy implication and recommendations for further study.

5.3.1 Recommendations for policy implication

Increase the rate of adoption of Vietnamese Koi is very important for meeting the national demand of nutrition. Many women of our country suffer from malnutrition. Vietnamese Koi can reduce malnutrition and increase nutrition at national level. The rate of adoption of Vietnamese Koi can improve our national economy because Vietnamese Koi is popular in also other countries. So, if we culture more than need, we can export to other countries. To achieve higher degrees of rate of adoption of Vietnamese Koi the fish farmers' knowledge, attitude and perception have to be increased. Hence DAE, DoF and other extension service providing organizations should be given more emphasis to take necessary steps to increase knowledge and perception level of the farmers to improve rate of adoption of Vietnamese Koi. On the basis of the findings and conclusions of the study, the following recommendations are presented below:

- i. The study found that majority of the farmers had medium adoption. To improve the adoption extension service providing organization should be given more emphasis on this aspect.
- ii. Several initiatives should be taken by both government and non- government organizations such as increasing knowledge, attitude, experience and training facilities.
- iii. Department of Fisheries (DoF) should have arranged improved Vietnamese Koi cultivation technology so that farmers face less constraints and become more interested in culturing Vietnamese koi.

5.3.2 Recommendations for further research

A short term and sporadic study being conducted in some specific location cannot provide the all information for the proper understanding about rate of adoption of Vietnamese Koi. The following recommendations might be helpful for further research:

- i. The present study was conducted in the Jahapur, Dhamghar and Pashchim nabipur union of Muradnagar upazila under Cumilla district. It is recommended that similar studies should be conducted in other Vietnamese Koi culture zones of the country to understand and generalize the findings.
- ii. In the present study, only twelve characteristics of the Vietnamese Koi farmers with their rate of adoption of Vietnamese Koi were studied. There are some other important characteristics that could not be included in this study. In future research, attempts should be to include more influential characters of the farmers.
- iii. This study reveals that farmers' age, education, family size, training exposure, cosmopolitnness and extension media contact had no significant relationship with their rate of adoption of Vietnamese Koi. In this situation further research should be conducted.
- iv. Research should be undertaken to identify the ways for overcoming the problems faced by the farmers to increase the rate of adoption of Vietnamese Koi.
- v. Adoption rate of Vietnamese Koi by the fish farmers as well as vital indicator of fisheries sector development; it is a continuous process due to change of social system, technologies, human behavior, adoption pattern etc. So, it is suggested that there should be continuous adoption research in various aspects of agricultural development.
- vi. The present study was conducted on the rate of adoption of Vietnamese Koi. Further studies should be conducted to determine the various activities of the government and non-government organizations.

CHAPTER 6

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Questionnaire
English version of the interview questionnaire
Department of Agricultural Extension and Information System
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Sher-e-Bangla Nagar
Dhaka-1207

An interview questionnaire on the study of

Adoption of Vietnamese Koi by the Fish Farmers

Respondent Questionnaire:

Date: Serial No. :

Name of the respondent:.....

Village: Upazila/Thana: District:.....

(Please answer the following questions. Your information will be used only for
academic purposes)

1. Age: How old are you?.....Years

2. Education: Please mention your educational qualification?

A. Cannot read or write []

B. Can sign only []

C. Study up to class []

3. Family Size:How many members in your family including you?.....

4(a). Farm Size:

SI. No	Particular	Local Unit (hectare)
A	Own pond under own cultivation	
B	Pond taken from other on lease	
C	Pond taken from others on share or barga	
D	Pond given to others on share or barga	
	Total (A+B+C/2+D/2)	

4(b) Pond under cultivation of Vietnamese koi (hectare):

5. Family Income:

SI No	Source of income	Amount (Tk/year)
1.	Agriculture Rice Vegetable Wheat Other	
2.	Fisheries (Vietnamese Koi & other fishes)	
3.	Livestock	
4.	Forestry	
5.	Business	
6.	Service	
7.	Others	
	Total	

6. Fish farming experience:

How many years are you engaged with fish culture?.....

7. Knowledge on Vietnamese koi culture: Please answer the following questions:

SI No	Questions	Marks obtained out of 2
1.	Do you know about Vietnamese koi is?	
2.	Do you know the stocking density of Vietnamese koi?	
3.	How to prepare pond for Vietnamese koi culture?	
4.	What do you mean by quality fry & fingerlings?	
5.	What is the best time for fry/fingerlings release?	
6.	How do you release fry & fingerlings in the pond?	
7.	What is the optimum feeding rate of Vietnamese koi?	
8.	How many times do you feed the koi in a day?	
9.	What is artificial and natural feed?	
10.	What do mean by fertilization in the pond?	
11.	Mention at least three fertilizer names those are used in Vietnam Koi cultivation?	
12.	What types of chemicals do you use in the culture pond?	
13.	Do you have any experience on fish gulping?	
14.	What types of disease occur in your pond and how do you manage that?	
15.	Mention the fishing gears and used during harvesting?	

8. Extension Media Contact: Please mention your extent of contact with the following extension media:

SI No	Name of media	Regularly 4	Often 3	Occasionally 2	Rarely 1	Not at all 0
1.	Neighbors and relatives	7-8 times/month	5-6 times/month	3-4 times/month	1-2 times/month	0
2.	Experienced farmers	7-8 times/month	5-6 times/month	3-4 times/month	1-2 times/month	0

3.	UFO	4-5 times/month	3-4 times/month	2-3 times/month	1-2 times/month	0
4.	NGO	4-5 times/3 month	2-3 times/3 month	2-3 times/month	1-2 times/3 month	0
5.	Group discussion	7-8 times/4 months	5-6 times/4 month	3-4 times/month	1-2 times/4 months	0
6.	Field day	7-8 times/years	5-6 times/year	3-4 times/year	1-2 times/year	0
7.	Result demonstration	7-8 times/year	5-6 times/year	3-4 times/year	1-2 times/year	0
8.	Participation in fisheries training course	7-8 times/year	5-6 times/year	3-4 times/year	1-2 times/year	0
10.	Internet	7-8 times/week	5-6 times/week	3-4 times/week	1-2 times/year	0
11.	Television for culture purpose	6 times/week	4-5 times/week	3-4 times/week	1-2 times/week	0
12.	Read fisheries related books/magazine	7-8 times/year	5-6 times/year	3-4 times/year	1-2 times/year	0
13.	Fish fare	4 times/4 year	3 times/4 year	2 times/4 year	1 times/4 year	0

9. Cosmopolitanisms: Please mention the frequency of your visit to the following places:

SI No	Name of visit	Regularly 4	Often 3	Occasionally 2	Rarely 1	Not at all 0
1.	Others village	7-8 times/month	5-6 times/month	3-4 times/month	1 -2 times/month	0

2.	Others union	5-6 times/month	3-4 times/month	2 times/month	1 times/month	0
3.	Upazila sadar	5-8 times/year	5-6 times/year	3-4 times/year	1-2 times/year	0
4.	Own district	7-8 times/year	5-6 times/year	3-4 times/year	1-2 times/year	0
5.	Regional fisheries research institute	4 times/year	3 times/year	2 times/year	1 time/year	0

10. Training on fish farming: Do you have received any training on fish farming? Yes/No. If yes, please answer the following questions:

SI No	Title	Duration (Days)	Conducted by

11. Attitude towards Vietnamese Koi Culture:

SI No	Statements	Strongly Agreed	Agreed	Undecided	Disagreed	Strongly disagreed
1. (+)	Vietnam koi culture is profitable					
2. (+)	Vietnam koi culture is easy					
3. (-)	It requires high initial investment					
4. (-)	Vietnamese koi is harmful for nature					

5. (-)	Easily affected by disease					
6. (+)	Vietnamese koi fingerlings are available					
7. (+)	Vietnamese koi can be easily cultured with other fish species					
8. (+)	Pond management system is easy					
9. (-)	Vietnamese koi production cost high compared to Vietnamese koi					
10. (-)	Vietnam koi market price is low compared to Vietnamese koi					

12. Problems faced by the farmer during Vietnam koi culture: What are the problems do you face during Vietnamese koi culture:

Sl.NO	Problems	Level of problem			
		High (3)	Medium (2)	Low (1)	Not at all (0)
1	Lack of capital				
2	Unavailability of Vietnamese koi seeds				
3	High price of feed				
4	Lack of Knowledge about Vietnamese koi culture				
5	High sensitivity to disease				
6	High labor cost				
7	High price of medicine				
8	Lack of water exchange facilities				

9	Formation of nitrogen gas in pond bottom				
10	Algal blooms on the pond				
11	Higher production cost				
12	Less security of fish food				
13	Social or political pressure				
14	Lack of oxygen concentration				
15	Poor transportation facilities				
16	Natural digester (flood)				

13. Adoption of Vietnamese koi by the farmers:

Total pond size (ha)	Pond under Vietnamese koi culture (ha)