STUDY ON FLOATING GARDEN IN SOME SELECTIVE AREA OF GOPALGANJ DISTRICT: A TOOL FOR INCOME GENERATING FARM PRACTICE

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JUNE, 2018

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REGISTRATION NO. 11-04430

A Thesis

Submitted to the Faculty of Agribusiness Management,

Sher-e-Bangla Agricultural University, Dhaka

in partial fulfillment of the requirements

for the degree of

MASTER OF SCIENCE

IN

DEPARTMENT OF DEVELOPMENT AND POVERTY STUDIES

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CERTIFICATE

This is to certify that thesis entitled, ***"STUDY ON FLOATING GARDEN IN SOME SELECTIVE AREA OF GOPALGANJ DISTRICT: A TOOL FOR INCOME GENERATING FARM PRACTICE "*** *submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* ***MASTER OF SCIENCE IN DEVELOPMENT AND POVERTY STUDIES,*** *embodies the result of a piece of bona fide research work carried out by* ***HIRONMOY BALA****, Registration No.* ***11-04430*** *under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

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

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DEDICATED TO
MY BELOVED
PARENTS

ACKNOWLEDGEMENT

At the beginning, I would wishes to acknowledge the immeasurable grace and profound kindness of the "Almighty GOD" without whose desire that I could not have materialized my dream to conclude this thesis.

My sincere gratitude and appreciation to my honorable supervisor ***Dr. Ashoke Kumar Ghosh,*** *Assiociate Professor, Department of Development and Poverty Studies, Sher-e-Bangla Agricultural University, Dhaka, for his scholastic supervision, valuable suggestions and constant encouragement from the very beginning to the end of the research work. Despite heavy pressure of academic preoccupation, he made himself available whenever I needed his help and suggestions.*

My sincere gratitude and earnest indebtedness to my co-supervisor ***Professor Dr. Mohammad Mizanul Haque Kazal****, Department of Development and Poverty Studies, Sher-e-Bangla Agricultural University, Dhaka, for his kind co-operation and generous help in completing this research.*

I would like to thank ***Fatema Sarker****, Assistant Professor, Department of Development and Poverty Studies, SAU, Dhaka and* ***Md. Hayder Khan Sujan****, Lecturer, Department of Development and Poverty Studies, SAU, Dhaka for their constant encouragement and valuable suggestions for completing this thesis timely.*

I would like to express my heartiest thanks to the farmers whose kind co-operation is never description during the data collection. I am, indeed, proud and delighted for my father and mother for their un-parallel affections and numerous sacrifices they have made for me.

Last but not the least, my heartiest thanks to my beloved siblings and friends for their never ending inspiration throughout the research.

Hironmoy Bala
June, 2019

STUDY ON FLOATING GARDEN IN SOME SELECTIVE AREA OF GOPALGANJ DISTRICT: A TOOL FOR INCOME GENERATING FARM PRACTICE

HIRONMOY BALA

ABSTRACT

Floating garden practice is now a profitable enterprise to the farmers, but the socio-economic data and information of this floating gardening are very scarce in Bangladesh. So, the present study was conducted to analyze the profitability of floating garden's crops and to explore the potentialities and constraints. Four upazilas of Gopalganj district were purposively selected for the study. A total 100 numbers of floating gardeners were selected randomly for conducting farm level survey during January to June 2018. Both descriptive and statistical tools were used to satisfy the objectives of the study. The average cost of floating garden's crops production were different in the different categories (marginal farmer, small farmer and medium farmer) farmer. For the marginal farmer, per acre total cost and variable cost were found Tk. 208,490 and Tk. 93,990 respectively. For the small farmer, per acre total cost and variable cost were found Tk. 219,900 and Tk. 111,400 respectively. For the medium farmer, per acre total cost and variable cost were found Tk. 225,950 and Tk. 125,450 respectively. The major share of total cost is for human labor, support materials and land use. The net return from floating garden crops cultivation Tk. 216,010, Tk. 193,100 and Tk. 198,050 are respectively marginal farmer, small farmer and medium farmer per acre floating garden. The benefit cost ratios were 4.02, 4.00 and 4.01 on variable cost basis and 2.50, 2.40 and 2.45 on full cost basis, respectively. Human labor, seed or seedling, fertilizer and insecticides have positive effect on the yield of vegetables. Lack of technical knowledge, unavailability of HYV seedling and infestation of diseases were found as the major problems in floating gardening. Respondents were urged for government intervention to overcome these problems.

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LIST OF ABBREVIATION

ANEP	Agriculture and Nutrition Extension Project
APEIS	Asia-Pacific Environmental Innovation Strategies
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BBS	Bangladesh Bureau of Statistics
BCR	Benefit Cost Ratio
BCCTF	Bangladesh Climate Change Trust Fund
BER	Bangladesh Economic Review
BRAC	Bangladesh Rural Advancement Committee
ASTER	Advanced Space-borne Thermal Emission and Reflection Radiometer
CBA	Community Based Adaptation
Contd.	Continued
et al.	et alia (for others)
etc.	et cetra
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
IFCAS	Integrated Floating Cage Aqua-geoponics System
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
m/f	Male/Female
MIS	Market Information System

MS	Master of Science
MWRD	Metropolitan Water Reclamation District
NEB	National Encyclopedia of Bangladesh
NAPA	National Adaptation Program of Action
NGO	Non-Government Organization
NO	Number
SAU	Sher-e-Bangla Agricultural University
SRDI	Soil Resources Development Institute

CHAPTER I

INTRODUCTION

1.1 Background

Floating gardens are rafts of aquatic weeds on which plants are used to construct a reasonable-sized floating platform or raft on which vegetables and other crops are cultivated, and seedlings are raised in the rainy season. It is an income generating tools in floodplain area because in that time in this area farmers have no others agricultural work for earn money. Floating garden practiced start not now a days, it started in ancient Aztec Empire.

The Aztec Empire in the year 1519, he found 200,000 people living on an island in the middle of a lake. Tenochtitlan, now Mexico City, was the biggest and best-fed city in the world, and this fortress city was completely surrounded by water. To feed their enormous population, the Aztecs ingeniously built chinampas or floating gardens, (Coe 1964) to convert the marshy wetlands of Lake Texcoco into arable farmland. These floating gardens were a masterpiece of engineering. Each garden was 300 feet long by 30 feet wide. To make a garden, workers weaved sticks together to form a giant raft, and then then piled mud from the bottom of the lake on top of the raft to create a layer of soil three feet thick. The rectangular gardens were anchored to the lake by willow trees planted at the corners. Each garden was lined on all sides by canals to allow canoes to pass with workers and materials. This network of gardens extended for 22,000 acres across the surface of the lake. The floating gardens were companion planted with corn, beans, squash, tomatoes, peppers, and flowers, and these incredible gardens yielded seven crops per year

The Aztec religion was a cult of sacrifice, and the gods were fearsome. The victims of sacrifice, standing on top of the great pyramid, could see the floating green gardens in the far distance, with the sun sparkling on the lake, and then their hearts were cut out and roasted in a fire. Tens of thousands of heads rolled down the stone steps of those pyramids, and the rivers that turned the temples red in the noonday sun were a plea to the gods to keep the gardens growing. But in the end, when the sky went dark over Tenochtitlan, and the earth shook beneath the feet of Montezuma, it was not the sun god who brought judgment; it was the Conquistadors.

The Spaniards' military advantages over the Aztecs—the swords, guns, and horses–were nullified in the sanctuary of the floating gardens, and Cortez was covetous of gold, not Indian corn, so he ordered the destruction of the chinampas. The floating gardens of the Aztecs, the key to their great civilization, were torn to pieces by the hands that built them, and thrown to the bottom of the lake, never to rise again.

1.2 History of Floating Garden Practiced in Bangladesh

The total area of the wetlands in Bangladesh has been variously estimated at seven to eight million hectares, or about fifty percent of the total land surface (Khan 1993). This includes 5.4 million hectares of open and closed lakes on floodplains that are inundated every year. At river peak flow during the rainy season, thirty percent of the floodplain area is flooded deeper than one meter for five months (June to October) and a particularly heavy monsoon may see this rise to sixty percent (Brammer et. al. 1996), restricting normal agricultural activities. The soilless cultivation method that we have described provides an opportunity for income generation during this normally slack season. Our waterlogged villages in the southern coastal wetlands of Bangladesh have proved its viability and the same or similar methods could be used elsewhere. Women seem to find it particularly advantageous, a progressive aspect of development that is generally agreed to be essential for the future of Bangladeshi society. A final thought is that Bangladesh is well-known to be prone to the sea-level rise that is predicted to be associated with global warming. The best estimate (Warrick et. al. 1996) is that by 2080 there will be a rise of 38 cm and that up to 22 percent of world's coastal wetlands will be inundated as a result (Nicholls et. al. 1999). Scholars and institutions such as the Intergovernmental Panel on Climate Change are attempting to evaluate the socio-economic and ecological implications of such a rise in sea-level (Hoozemans and Hulsbergen 1995) and it is clear that a portfolio of adaptive measures will be needed to cope with the situation. Some authors are proposing large-scale migration (Nicholls and Mimura 1998) and structural measures, which might not be feasible for a lower middle income country such as Bangladesh. Perhaps it is more realistic to propose that coastal populations might be best able to deal with sea-level rise if their vulnerability to economic shock is minimized. Floating bed cultivation

could be one such measure in those area that avoid salt water intrusion because it offers new opportunities using indigenous knowledge and techniques that are well adapted to local environmental conditions (Chowdhury 2004). Dhaps and kandis are not a panacea – just one amongst the many opportunities that are available from the ingenuity and entrepreneurship of Bangladeshi people.

For people who live in areas covered by water during the monsoon season, such as the riverine areas of Bangladesh, it is impossible to grow crops. Practical action has developed a technology to allow farmers to grow food on flooded land. The floating garden is a clever solution that employs the use of water hyacinth, which is collected to construct a raft. This is then covered with soil and cow dung, in which vegetables can be planted. A new raft needs to be built every year, but the old one can be used as fertilizer during the dry season.

The floating garden practice is a local indigenous production system most successful in the wetland/submerged area of selected southern district Gopalganj of Bangladesh. This area remain submerged for long periods, especially in the monsoon season. Floating garden agricultural practices have been adopted by local farmers for nearly centuries ago. They are amongst the many options developed by local farmers to provide a growing area for poor communities who lack access to land during the period when wetlands are submerged under water generally for 7-8 months of the year(IUCN Bangladesh, Baira: the Floating garden for sustainable livelihood,2008). One type of floating beds for floating garden agricultural practices is used mainly for seedling production of different vegetables (bottle gourd, pumpkin, cucumber, bitter gourd, amarantam etc.) and spices (chili, bombai chili etc.) for marketing during monsoon season (usually from June to October month). This system is traditionally practiced in the wetland/submerged area of Gopalganj (Muksudpur, Kashiani, Tungipara and Gopalganj Sadar Upazila) district. The seedlings produced under this method are generally used for subsequent vegetables/spices production on normal land in the southern and southwestern regions of Bangladesh.

The floating garden is a clever solution that employs the use of water hyacinth, which is collected to construct a raft. This is then covered with soil and cow dung, in which vegetables can be planted. A new raft needs to be built every year, but the old one can be used as fertilizer during the dry season. The floating gardens provide vital food for

people even during the annual monga (period of food shortages) and they can also provide an alternative source of income through sale of any surplus in the market (Islam and Atkins 2007). Indigenous floating gardens for sustainable agricultural practice in wetland of Bangladesh, Development in practice, 2007). The rafts can be moved from place to place so are also suitable for those that have temporarily or permanently lost their homes and land.

According to FAO, (2008) research, generally floating garden are practiced by the poor people who have no own land or small farmer in the wetland or submerge area where cultivable land under water more than 6 to 7 month. They rent land and practice floating garden to reduce their poverty or lead a better life. Some educated farmer also doing floating garden. Floating garden is very effect solution to eradicate poverty. It also create employment facility for the poor people when they have merely no work to do. And by those way floating garden increase income to the poor people and reduce poverty in Gopalganj district.

1.3. Objectives

i. To describe the socio-economic status of floating gardeners;
ii. To estimate the profitability and factors affecting floating garden's crops;
iii. To identify the problems faced by the floating gardeners;

1.4. Key Research Questions

i. What types of farmers are practicing floating garden?
ii. What is the socio-economic status of the respondent farmers?
iii. Why are the respondent farmers cultivating on floating garden?
iv. What type of input used in floating garden?
v. How much the profitability of cultivation on floating garden is?
vi. What is the pattern of floating garden cultivation?
vii. What are the factors affecting the cultivation?
viii. How policy implications are needed for developing the better management of floating garden?

1.5 Justification of the Study

Agricultural land is gradually converting to homestead and other uses to meet the demand of the vast and fast population growth. At this situation, we have to ensure maximum of the production from limited land area. For doing this, we should change our traditional agricultural practices. As far as the productivity is concerned there is a lot of scope for increasing the productivity and profit through adoption of the latest improved production and marketing technologies. There is a need to generate information regarding production and marketing aspects, the profile of cultivation on floating garden and the constraints in production and marketing of floating garden vegetables.

Commercial floating garden cultivation may be an important income generating sector for many developing countries like Bangladesh to ensure food security. Bangladesh has a tremendous potential for floating garden crops both for export and domestic market. There is a great opportunity for Bangladesh to earn a lot of foreign currency from the international market if the production and marketing of floating garden crops are well developed. Commercial production of floating garden crops in Bangladesh started since 20^{th} centuries as some of the innovative farmers in the country adopted floating garden cultivation as viable alternatives to traditional cash crops and field crops. According to (BBS, 2014) at present, the total area of the wetlands in Bangladesh has been variously estimated at seven to eight million hectares, or about fifty percent of the total land surface (Khan 1993). This includes 5.4 million hectares of open and closed lakes on floodplains that are inundated every year (Ali 1990). At river peak flow during the rainy season, thirty percent of the floodplain area is flooded deeper than one meter for five months (June to October) and a particularly heavy monsoon may see this rise to sixty percent (Brammer et. al. 1993), restricting normal agricultural activities. The soilless cultivation method that we have described provides an opportunity for income generation during this normally slack season. Our waterlogged villages in the southern coastal wetlands of Bangladesh have proved its viability and the same or similar methods could be used elsewhere. Women seem to find it particularly advantageous, a progressive aspect of development that is generally agreed to be essential for the future of Bangladeshi society. But it is very upset news for us the area coverage under commercial cultivation is approximately 5000 to 6000 hectares of land (BBS, 2011).

If we have used maximum of fallow wet-land in Bangladesh and this fallow wet-land may be used to meet up the domestic demand and also for exporting huge number of vegetables. It is a matter of hope that government already emphasis about this sector and different types NGO also working how to improve production level and the efficiency in marketing might be achieved within a short span of time. Beside this, floating garden crops cultivation can make a potential contribution to our Gross Domestic Product (GDP) and can create employment opportunity.

The Study is Justified on the Following Grounds:

- It would add new knowledge in the field of floating garden crops cultivation and build a foundation for further research.
- Floating garden farmers and traders at different levels will be benefited from the information generated through the study.
- The study might provide valuable information for the policy makers of Government and Non-Government Organizations to formulate policy in order to increase production and improvement of socio-economic status of the floating garden crops cultivators.
- The study might provide ideas about the potential factors for the floating garden crops cultivation.
- The study might provide ideas about profitability of floating garden crops cultivation in Bangladesh.

CHAPTER II
REVIEW OF LITERATURE

Review of literature in any research is essential because it provides a scope for reviewing the stock of knowledge and information relevant to the proposed research. But there is little information regarding knowledge and information relevant to the present research. Literature and research of the major past works in connection with the present study were searched because this knowledge and information provide guideline in designing the future research problem and validation of the new findings. Some studies relating to floating garden crops are reviewed here.

IPCC (2007) conduct a research, global warming could be more devastating by increasing coastal flooding, salinity intrusion and permanent inundation in many low-lying coastal areas by the end of 21st century. The southern, southwestern and the coastal areas of Bangladesh remain submerged for long periods every year, especially during the monsoon season. People in these areas have been coping with submerged/flooded conditions for generations. Although mitigation and adaptation are two ways of tackling the impact of climate change; realizing its huge population, and as a largely rural, least developed (Rahman, 2014) as well as to accommodate unavoidable climate change (IPCC, 2001; Ayres and Huq, 2009) adaptation would be the priority option to restrained the adverse impacts of climate change. The analysis of climate change adaptation practices in thirty agro-ecological Zones of Bangladesh and certain agriculture adaptation practices in selected publications revealed that vegetables in floating bed have huge potentials to mitigate croping problems against flood in south-western parts of Bangladesh.

Islam and Atkins (2007) research work showed that floating-bed cultivation has proved a successful means to produce agricultural crops in various wetland areas of the world. In freshwater lakes and wetlands, vegetables, flowers, and seedlings are grown in Bangladesh using this floating cultivation technique, without any additional irrigation or chemical fertilizer. No detailed study of this indigenous cultivation technique has been published to date, although the laboratory method, hydroponics, is well documented in the professional literature. This study is focused on the nature and characteristics of the Bangladeshi system, where local farmers have demonstrated the

potential for the sustainable use of such common-property local water resources. They seek to establish a reference point for further research into this technique for its possible refinement and an assessment of its suitability for replication. Indigenous floating cultivation: a sustainable agricultural practice.

Byomkesh *et. al*. (2008) conduct a research work on wetlands are a vital link between land and water in Bangladesh. A majority of the people of Bangladesh are critically dependent on wetlands. In this paper, the values of wetlands, causes and effects of wetlands degradation, as well as the present wetlands management approach, are analyzed and recommendations for wetlands management are suggested based on participatory rural appraisal (PRA), field visit, personal experience, and existing literature and information. Wetlands play a crucial role in maintaining the ecological balance of ecosystems, but wetlands habitat of Bangladesh is under constant threat due to increase of population, intensive agriculture, overfishing, siltation, pollution, ill-planned infrastructures, lack of institutional coordination, lack of awareness, etc. As a result biodiversity is reducing, many species of flora and fauna are threatened, wetlands-based ecosystem is degenerating, and the living conditions of local people are deteriorating as livelihoods, socioeconomic institutions and cultural values are affected. Wetlands management is not addressed separately in water management activities of Bangladesh. In order to balance human needs and wet-lands conservation, a mainly community-based wetlands management approach has been taken in Bangladesh, but this is not enough to prevent the degradation of wet-lands. Therefore, Bangladesh now needs a comprehensives strategy combining political, economic, social, and technological approaches to stop further degradation of wetlands. Therefore, wetlands management should be incorporated into a system of integrated land and water use and indeed into the socioeconomic system of the country. Policies, strategies, and management plans for sustainable use and conservation of wetlands of Bangladesh must be based on solid knowledge and understanding of their eco-logical and socioeconomic functions and process in the wetlands of Bangladesh

Irfanullah *et. al.* (2009) research work showed that floating gardening is a form of hydroponics or soil-less culture. It is an age-old practice of crop cultivation in the floodplains of southern Bangladesh, where aquatic plants such as water hyacinth (*Eichhorni acrassipes*) are used to construct floating platforms on which seedlings are raised and vegetables and other crops cultivated in the rainy season. The platform

residue is used in the preparation of beds for winter vegetable gardening. Floating gardening was introduced in 2006 on a pilot-scale in the north-east wetlands of the country, as a contribution to food security and as a supplementary income for the marginalized community. The overall experience of floating cultivation in three selected villages was encouraging. Local people became aware of this new farming system and their level of knowledge improved. Communities were mobilized into groups to make floating platforms, and platform residues were later used to establish winter gardens. Cultivation was successful on both types of plot, and vegetables were both consumed by the producers and sold in the market. The input–output analysis revealed floating gardening to be a feasible alternative livelihood option for the wetland dwellers. The method provided targeted landless people with parcels of land in the monsoon, enabling them to grow vegetables. Floating gardening and associated winter gardening appear to have the potential for introduction to other parts of the world where aquatic weed management is a major problem.

Saha (2010) conduct a research work on speckled across this Loktak Lake, the several thousand phumdis and its surrounding waters are vital for irrigation, drinking water, food supplies, thus the lake has been referred as the "lifeline of Manipur" state. Thousands of fishermen make their livelihood in the waters, catching about 1,500 tons (6.6 million pounds) of fish every year. Children and illiterate adults also attend a school located on one of the floating is lands. The top satellite images of Loktak Lake were acquired on March 19, 2018, by the Advanced Space-borne Thermal Emission and Reflection Radiometer (ASTER) on the Terra satellite. The phumdis support around 200 species of aquatic plants and 400 species of animals, including the rare Indian python. The largest island is home to the Keibul Lamjao, the world's only floating national park. It serves as a habitat for the endangered brow-antlered sangai, or "dancing deer," whose hooves have adapted to the island's spongy ground. The park, covering 15 square miles (40 km2), was specifically created to preserve the deer, which were once thought to be extinct. The habitat is composed of floating meadows and a raised strip of hard ground that separates the park into northern and southern zones.

Parsons *et al.* (2012) Remnants of pre- Hispanic raised fields are found throughout North and South America, though they are most common in Central and South America. Raised fields had virtually disappeared by the arrival of the Spaniards with

the exception of the floating gardens of the Aztecs in Mexico. The two connected lakes to the south, Lake Chalco and Lake Xochimilco, were freshwater lakes. Probably starting about 800 years ago, the people living along their edges began to create raised beds for growing maize, squashes, and vegetables. These beds were called chinampas and they were made by scooping up the mucky soil from the swampy areas on the edge of the lake and piling it up into rectangular mounds. Around the edge of these mounds, the farmers planted trees to hold the raised soil. When the water levels rose, as they did every year during the rainy season, the areas where they had removed the chinampa soil became irrigation canals. The nutrients that had collected on the bottom of the lake from silt and rotted plants meant that these beds were extremely fertile. But their fertility was a fragile state: the three lakes that lay to the north, Tetzcoco, Xaltocan and Zumpango, were salty, and if saltwater washed into the southern lakes during floods, it would kill plants and ruin soil. Thus, the peoples of the southern lakes joined together to create a short (about three kilometer) dike and causeway (or raised road that functioned as a dike) across a natural bottleneck in the lake system. This so-called dike of Mexicaltzinco ran from the flanks of Huixachtitlan (Hill of the Star) near Culhuacan to Huitzilopochco (now called Churubusco), thereby sealing off and protecting their sweet water system.

Yellin (2013) showed floating gardens were an effective habitat solution in urban rivers: Co-founder of Urban Rivers**,** installed 50 square feet of floating gardens in the Chicago River in June of 2013, which served as the basis for his Master's research study monitoring urban fish populations. Results indicated a nearly 100% increase in the fish abundance in the river immediately surrounding the floating gardens when compared to traditional docks. To expand on Josh's pilot study, Urban Rivers is working with the MWRD (Metropolitan Water Reclamation District) on a four-year study to monitor fish populations at our installation site. This research is already underway, and our measurements include: fish counts, water quality and macro-invertebrate counts. The money raised here will go directly toward our floating gardens. For every $50 donation, we can add another foot of habitat. Our goal is $10,000, but every dollar exceeding this goal will only extend the gardens, becoming part of our larger vision of eventually rehabilitating an entire one-mile stretch of river, which we hope to turn into an urban wildlife sanctuary. Urban Rivers is a Chicago-based nonprofit and this our pilot project. Our plan is to rehabilitate urban rivers in

cities across the globe. By recovering habitat space in city waterways, we can provide a home for fish and other animals, while creating a nature destination for people to enjoy.

APEIS (2014) conduct a research work on floating agriculture is not a new practice in Bangladesh; it has traditional roots in practices dating back to the country's forbearers, although the scientific component is a recent addition. According to their needs, people in different parts of Bangladesh have adopted, modified and named this practice differently (Islam and Atkins 2007; Irfanullah *et al*. 2007, Islam *et al.*, 2015), such as baira, boor, dhap, gathua, gatoni, geto, kandi and vasomanchash and floating agriculture; all these names represent this same traditional cultivation practice that can be scientifically referred to as hydroponics. Actually, this practice is most successful in the coastal areas that are adjacent to the sea-bank areas, which remain submerged for long periods, especially in the monsoon season, as well as the wetland haor areas (flood at lowland spreading across the middle of the Meghna River basin) (Yoshini and Merabtene, 2007), which also remain flooded for long periods. The practice helps mitigate land loss through flooding, by allowing cultivation of these areas to continue. In this way, the total cultivatable area can be increased and communities can become more self-sufficient. In addition to this, the area under floating cultivation is up to 10 times more productive than traditionally farmed land (Haq *et al*. 2004) and no additional chemical fertilizers or manure is required. When the crops have been harvested and floating rafts are no longer required, they can be used as organic fertilizers in the fields or incorporated into the following years floating beds as a fertilizer (AEPIS & RIPSO, 2004; Saha, 2010).The approach uses water hyacinth, a highly invasive weed with prolific growth rates, in a highly beneficial way. By harvesting water hyacinth, areas covered by the weed are cleared, with the beneficial side-effect of reducing breeding grounds for mosquitoes and improving conditions for open water fishing.

Haque (2014) showed that people practicing floating-bed cultivation are enjoying a better life economically, than those in other flood-affected areas who have not yet adopted this practice (Saha, 2010). Because the system is fairly labor intensive, it also has the capacity to provide employment opportunities within communities. As both men and women can carry out the floating agriculture practices, it can also lead to improvements in gender equity. In the context of increased vulnerabilities due to

changes in climate, more areas of the south-western coastal parts of the country will be susceptible to increased flood and submergence. Unfortunately, there is dearth of information regarding status and determinants of profitability of floating agriculture. Hence, potentialities of this locally innovated 'floating agriculture' practice need to be assessed for adaptation as a profitable farming practices with the changing climate.

Pavel *et al.* (2014) conducted an economic evaluation of the floating garden as a means of adapting to climate change in Bangladesh. The study showed that the monthly income of some farmers using such gardens increased from US$12.02 to US$48.08. These folk farmers lacked alternative work especially during the monsoon period. The floating garden uses available natural resources, adjusts to wet conditions and helps the flood-prone people to earn a living, and can be an adaptive response to frequent disaster events in Bangladesh.

Pavel (2015) research work showed that practiced for adapting to climate change in Bangladesh to reduce vulnerability of expected climate change. The analysis is based on national reviews of climate change adaptation practices, especially in Bangladesh. This review shows that Bangladeshi different communities and stakeholders are already using adaption practices related with climate risks. Good adaptation practices adopted by national and international NGOs in Bangladesh found quite fit for our environment. Tidal River Management (TRM), Green Afforestation Belt, Community Based Adaptation (CBA), floating agriculture, homestead vegetable gardening, caged-fish culture, raised flood-proof houses, elevated tube wells and latrines, diversified salt and flood tolerant crop varieties, etc. were some examples of good adaptation practices in Bangladesh.

Haque *et. al.* (2016) research work showed that Integrated floating cage aquageoponics system (IFCAS): An innovation in fish and vegetable production for shaded ponds in Bangladesh. Farmer participatory action research was carried out from July to December 2013 to design and construct a technology known as IFCAS (integrated floating cage aquageoponics system) for growing fish and vegetables in shaded ponds in the Barisal region of Bangladesh under the EU funded ANEP (Agriculture and Nutrition Extension Project). Here the terms aqua, geo and ponics means pond water, pond mud/soil and cultivation, respectively. Producing and regularly harvesting fish in shaded ponds and growing vegetables on surrounding

dykes for household consumption was constrained. To overcome the difficulties, an IFCAS (3.66 m × 2.44 m = 9 m 2) was set in each of 9 shaded ponds – 5 highly shaded ponds (HSP) and 4 moderately shaded ponds (MSP) – in which GIFT tilapia strain (*Orechromis niloticus*) was stocked at the rate of 100 m −3 cage. In the ponds, carp species (*Catla catla, Labeo rohita, Cirrhinus cirrhosus* and *Cyprinus carpio*) were stocked at the ratio of 1:2:2:1, and at the rate of 14,820 ha −1. Tilapia were fed floating feed and the carp were fed with supplementary feed. Vegetables were grown on the IFCAS scaffold, and tilapia were grown in the net-cage constructed underneath. Women members of HSP households participated fully in the action research in the production of vegetables and fish in IFCAS. Participating households started consuming vegetables and tilapia from IFCAS within 1.5 and 1 month of the start of the experiment, respectively. Average fish consumption of 20 kg household −1 was recorded within four months, of which more than 50% was tilapia from IFCAS. Overall fish and vegetable production was higher in MSP as compared to HSP. A financial analysis showed the benefit-cost ratio of IFCAS was >1, indicating the investment efficiency of IFCAS for farmers.

BCCTF (2017) conducted a study titled, "Floating Gardens of Bangladesh: A Community Based Adaptation for Combating Climate Change". Impacted by our innovation the national government in Bangladesh has come forward to implement the technique, for example, the National Adaptation Program of Action (NAPA, 2005) of Bangladesh identified promotion of floating gardening as one of its 15 adaptation projects. The revised NAPA (2009) also recognized the potential of this traditional practice. But it was only in early 2013 that the Government of Bangladesh approved a US$ 1.6 million project under its to promote floating gardening for climate change adaptation. This 3-year project will be implemented by the Government's agricultural extension wing in 40 sub-districts of 8 districts all over the country. Challenges lies in the areas identified for the project were poor and water logged ones, getting the people for the initial arrangements were quite difficult for us in the formative months. Once they realized the potential of the farming technique, the skepticism has evaporated. One of the important lessons learnt in this process is that, small Ideas can have the potential to bring in remarkable change in the lives of poor.

Ojha and Chaudhary (2017) conduted a study to determine Incremental Cost-Benefit Ratio (ICBR) of certain bio-pesticides and insecticide against 2nd larval instar of Helicoverpa armigera in chickpea, an experiment was conducted during winter 2011. Certain pesticides as sole treatments were tested with standard, low and high doses and in treatment combinations with one half of standard doses of two respective pesticides only once at 50% flowering and podding stage of the crop. Upon crop maturity; total grain yield, additional yield, increased income and net income were obtained for each respective treatment to determine its ICBR. Overall, the treatment combination of ½ Btk + ½ Azadirachtin had the highest ICBR of 1:27.57. The lowest ICBR of 1:5.25 was obtained with Azadirachtin-0.05 %, when other treatments had ICBR from 1:8.51 to 1:23.28.

CHAPTER III

METHODOLOGY

Methodology is a crucial and integral part of any study. The reliability of a specific study finding depends to a greater extent on the appropriate methodology used in the study. Improper methodology very often leads to misleading result. So careful consideration are needed by an author to follow a scientific and logical methodology for carrying out the study. The author has great responsibility in describing clearly what sorts of method and procedure is to be followed in selecting the study area, the source of data and the analysis as well as interpretation to arrive the conclusion**.**

3.1 Selection of the Study Area

Gopalganj district of the Southeast region of Bangladesh was purposefully selected. There are five upazilas under Gopalganj district. Among these upazilas: four upazilas namely Muksudpur, Tungipara, Kotalipara, and Gopalganj Sadar Upazilaare selected purposively.

3.2 Sample Size and Sampling Procedure

All the floating garden farmers of these four Upazila of Gopalganj district constitute the population of the study. There are many farmers in these four Upazila constitute the population of the study. The population are proportionately randomly selected as the sample of the study by using random number table. Thus, sample size of the study is 100.

3.3 Data Collection

Primary data were collected through structured interview schedule which were filled up by the researcher. A simple random sampling technique was used to collect data from respondent farmer. Data was collected January to June 2018.

Additionally, secondary data were also collected from various sources like Bangladesh Bureau of Statistics (BBS) and Ministry of Agriculture.

3.4 Data Processing and Analysis

In this study, a statistical tool and technique both descriptive and inferential was used to analyze the data. Besides, a descriptive tool and technique tabulation was also used in the study. Primary data were recorded into Statistical Package for Social Science (SPSS) and economic analysis was carried out for determining costs and returns. In this study, cost and return analysis were done on both variable and total cost basis. To achieve the objective of the study a simple tabular analysis was completed. The following profit equation was developed to assess the profitability of floating garden crop cultivation.

3.5 Analytical Technique

In this study, a statistical tool and technique both descriptive and inferential was used to analyze both tabular and functional methods.

3.5.1 Tabular Technique

Collected data will be edited, summarized, tabulated and analyzed to fulfil the purposes of the study. Descriptive statistics like averages, percentages and ratios will be used in presenting the results in a tabular form. The profitability of floating garden crops cultivation will be examined on the basis of gross return (GR), gross margin (GM), net return (NR) and benefit cost ratio (BCR) analysis. Besides, the imputed value of family labour will be taken into account in the time of total cost approximation. Per year lease value of land will be considered for determining the land use cost. Benefit Cost Ratio (BCR) will be calculated with the following formulas (Chauhan, 2014; Gittinger, 1982 and Sujan, et. al., 2017):

Benefit Cost Ratio (BCR): The benefit cost ratio (BCR) of an investment is the ratio of the undiscounted value of all cash inflows to the undiscounted value of all cash outflows during the life of the project. It can be estimated using the following formula:

$$\mathrm{BCR} = \sum_{i=1}^{n} \frac{B_i}{C_i}$$

Where, Bi = Total benefit (BDT/acre)

Ci = Total cost (BDT/acre)

i = Number of output (t =1, 2, 3 …….n)

3.5.2 Profitability analysis

Profitability of floating garden crops will be analyzed to compare the return received by the cultivators. The following algebraic equation will be used to assess the costs and returns from different crops (Sarker, et al. 2014 and Sujan, *et al.* 2017):

Equations for cost analysis are as follows-

$$BCR = \sum_{i=1}^{n} \frac{B_i}{C_i}$$

TVCij = VCij + IOCij

TCij = TVCij+ TFCij

Where, TCij = Total Cost (Tk/acre)

TVCij= Total Variable Cost (Tk/acre)

TFCij = Total Fixed Cost (Tk/acre)

VCij= Variable Cost (Tk/acre)

IOCij= Interest of Operating Capital (Tk/acre)

Xij = Quantity of Inputs (kg)

Pij = Price of Inputs (Tk/kg)

i = Number of Farmers (1.2.3……..n)

Equations for profitability analysis-

Gross Return, GRij = YijPij

Net Return = GRij - TCij

Gross Margin = GRij - VCij

Where, GRij = Gross Return (Tk/acre)

Pij = Price (Tk/acre) of jth Crops Received by ith Cultivator

Yij = Quantity (kg/acre) Produced

3.5.3 Cobb-Douglas Production Function

Cob-Douglas production function analysis was used to estimate the productivity and resource use efficiency of floating garden crops cultivation. To determine the contribution of the most important variables in the production process, the following specification of the model was applied:

$$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}e^{ui}$$

The empirical production function was the following:

$$\ln Y = a + b_1\ln X_1 + b_2\ln X_2 + b_3 \ln X_3 + b_4\ln X_4 + b_5\ln X_5 + Ui$$

Where, Y = Yield (Production Unit/acre);

X_1 = Human Labor (Man-day/acre);

X_2 = Seed/Seedling (kg/acre);

X_3 = Fertilizer (kg/acre);

X_4 = Insecticides and Pesticides (kg/acre);

X_5 = Support material (Tk/acre),

a = Intercept; b_1, b_2 ------- b_5 Coefficients of the Respective Variables to be Estimated

Ui = Error term.

CHAPTER IV
DESCRIPTION OF THE STUDY AREA

Study area is very important for any study. This chapter focuses on the demography geography, location climate and economy of this area. It indicates the reliability of the study. Climate, land and soil condition are important factors of any study area because the production depends on these.

Background, Area and Location: Gopalganj was a sub-division of former Faridpur district. It was up-graded to a district on the 1st February, 1984. The original name of the district was Rajganj. In 1793, the local Zamindar renamed Rajgang to Gopalganj after the name his grandson who was popularly known as Gopal. Gopalganj is bounded on the north by Faridpur district, on the east by Madaripur and Barisal districts, on the south by Pirojpur and Bagerhat districts and on the west by Narail district. It lies between 22º50' and 23º01' north latitudes and between 89º40' and 90º02' east longitudes. The total area of the district is 1,468.74 sq. km. (567.08 sq. miles).

Temperature and Rainfall: The maximum and minimum average temperature in Gopalganj district varies from 23.3°C to 8.6°C. Total rainfall of the district is recorded as 1620 mm.

Administration: Gopalganj district was established in 1984. Earlier it was a sub-division under Faridpur district. Gopalganj municipality was established in 1972. The total area of the district headquarters' town is 8.59 sq km. The district consists of 5 upazilas, 68 unions, 618 mauzas, 889 villages, 4 paurashavas, 36 wards and 84 mahallas. The upazilas are Gopalganj Sadar, Kashiani, Kotalipara, Muksudpur and Tungipara.

Historical Events: A battle between Babor (the Mughal Emperor) and Nusrat Shah (Sultan of Bengal) was held on the bank of the river Ghargara (presently known as Ghagar). Fakir Sannyasi Resistance took place in the region during the early part of the British rule. Mr. Dhirendra Nath Bishwas of Kotalipara was killed in Anti British Movement and Mr. Mahananda Bishwas Jalilparwas killed during the mass upsurge of 1969.

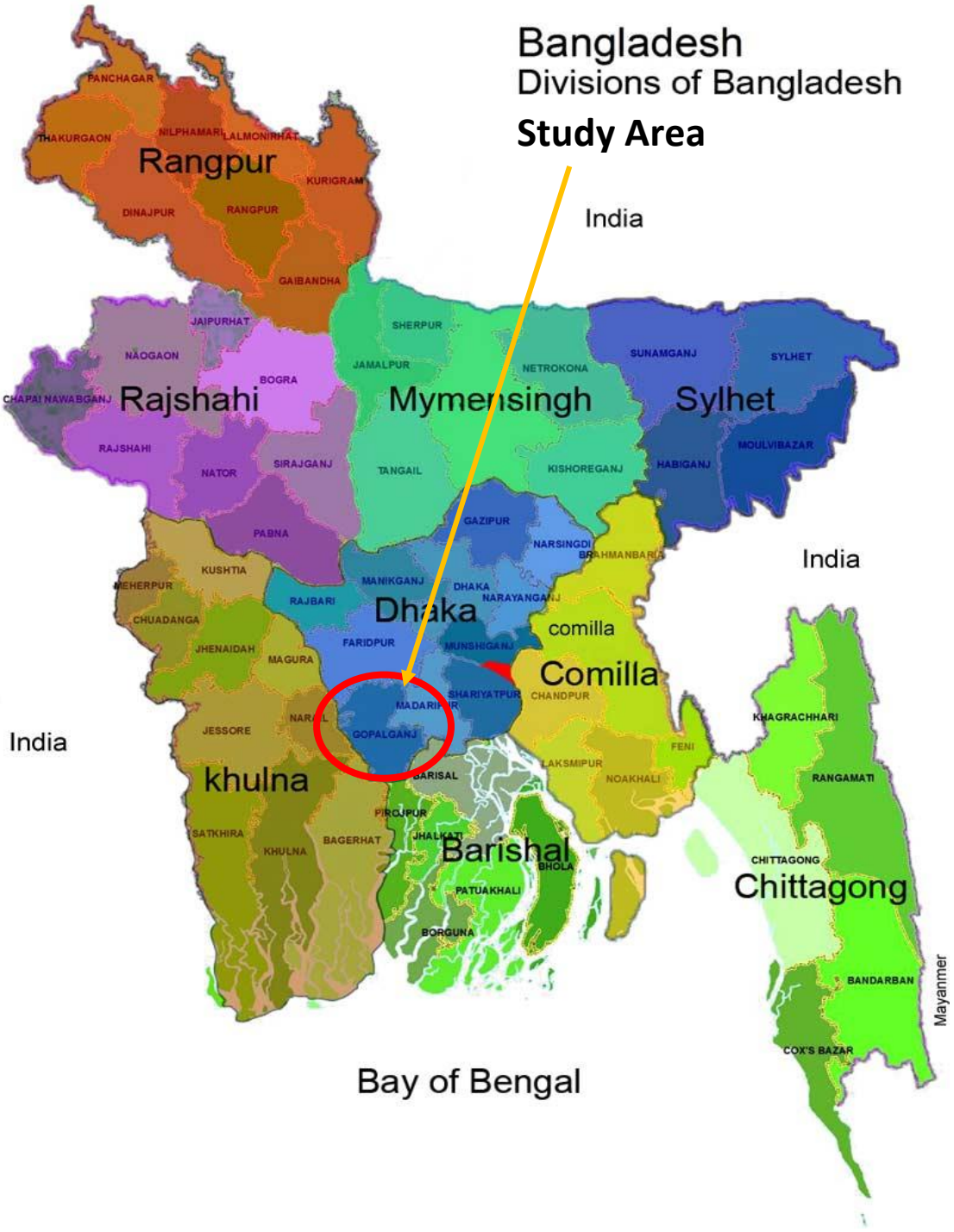

Figure: 4.1 Map of Bangladesh Showing Study Area in Gopalganj District.

Source: https://www.mediabangladesh.net/map-of-bangladesh.

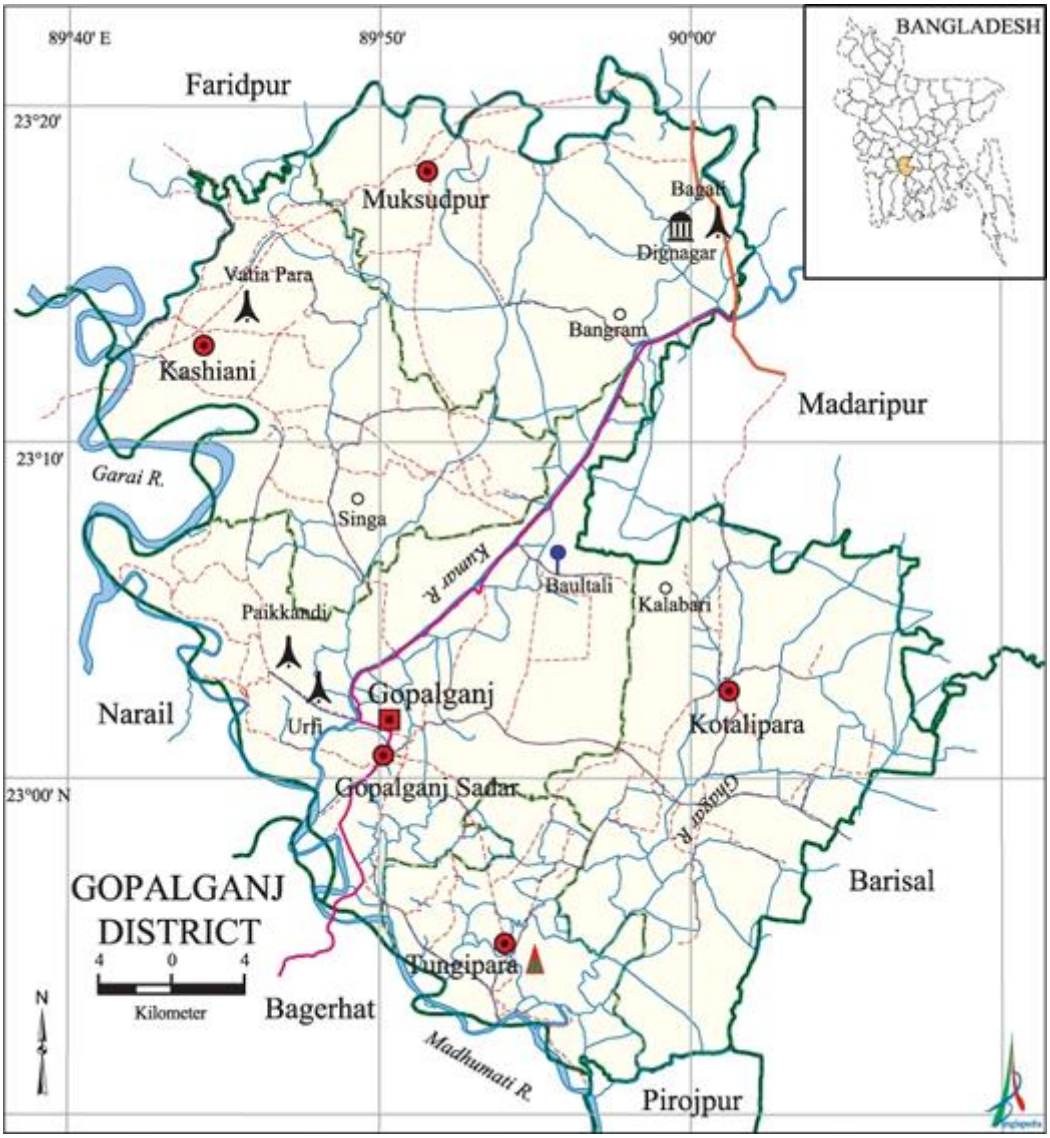

Figure: 4.2 Gopalganj District Map

Source: NEB, 2014.

Historical Place: The Mazar (graveyard) of Bangabandhu Sheikh Mujibur Rahman, the father of the nation, is located at Tungipara, upazila of Gopalganj district.

Famous Personalities of the District: Gopalganj is the motherland of so many illustrious and noble personalities of which the great leader, the father of the nation Bangabandhu Sheikh Mujibur Rahman is the heroic son of this soil. His long cherished dream of independence came into existence with the emergence of Bangladesh as an independent state in 1971. He was the first President and later on, Prime Minister of the new born Bangladesh. Honourable Prime Minister Sheikh

Hasina, daughter of Bangabandhu Sheikh Mujibur Rahman, was born in this district. Marks of the War of Liberation: There are two mass graves, one mass killing site, two memorial monuments in Gopalganj district.

Population: Total population of Gopalganj district is 1172415 persons of which male is 577868 and female is 594547**.** Their household, population and density per square kilometer are given below (Table 4.1).

Table 4.1: Number of Household, Population and Density 2011

Upazila	Household	Population			Sex ratio(M/F)	Average of household	Density per sq. km
		Male	Female	Total			
Gopalganj Sadar	73126	172991	171017	344008	101	4.67	883
Kashiani	46335	99912	107703	207615	93	4.47	725
Muksudpur	61807	140956	148450	289406	95	4.65	939
Kotalipara	48029	113492	117001	230493	97	4.79	648
Tungipara	20575	50517	50376	100893	100	4.82	785
Total	249872	577868	594547	1172415	97	4.66	798

Source: BBS, 2011.

Literacy: Literacy rate of Gopalganj district is total 58.1%, male 60.3% and female 56.0%. Population and literacy rate of 1981, 1991, 2001 & 2011 and number of voter 2011 (Table 4.2).

Table 4.2: Literacy Rate of Gopalganj District

Upazila	Population (000)				Literacy rate (%)				Number of voter (000)		
	1981	1991	2001	2011	1981	1991	2001	2011	Male	Female	Total
GopalganjSadar	274	291	320	344	33.8	44.7	54.5	61.8	99	103	202
Kashiani	204	206	229	208	31.3	39.7	53.5	59.2	61	68	129
Kotalipara	180	206	227	231	29.1	34.8	49.8	59.2	69	69	138
Muksudpur	246	269	288	288	26.6	34.3	47.1	52.5	88	90	178
Tungipara	77	88	99	101	27.7	33.3	52.2	56.6	29	30	59
Total	981	1060	1163	1172	30.1	38.2	51.4	58.1	346	360	706

Source: BBS, 2011.

Main Rivers: The Garai, the Madhumati, the Kaliganga and the Ghagar are the notable rivers of Gopalganj district.

Main Crops: Paddy, jute, sugarcane and ground nut are the main crops of Gopalganj district.

Main Fruits: Mango, black berry, palm, banana are the main fruits of Gopalganj district.

Economic Situation: The economy of Gopalganj is predominantly agricultural. Out of total 230494 holdings of the district, 67.88 holdings are farms that produce varieties of crops namely local and HYV paddy, sugarcane, wheat, vegetables, spices, jute, pulses, and other minor cereals. Various fruits like mango, banana, jackfruit, guava, coconut etc. are grown in the district. Almostall kinds of vegetables are cultivated particularly; bitter guard (karala), pumpkin (mistikumra), potato and brinjal are abundantly grown. Pisciculture and rearing of livestock and poultry adds an additional income to the rural households. Fish of different varieties abounds in the district. Moreover, varieties of fish are caught from rivers, tributary channels, even from paddy field during the rainy season. Non-farm activities also play an important role in the economic development of Gopalganj district

CHAPTER V

SOCIO-ECONOMIC CHARACTERISTICS OF THE FLOATING GARDEN FARMERS

Socio-economic condition of the sample farmers is very important in use of research planning because there are numerous interrelated and constituent attributes characterizes an individual and profoundly influences development of his/her behaviors and personality. People differ from one another for the variation of socio-economic aspects. However for the present research a few of the socio-economic characteristics have been taken into consideration for discussion.

5.1 Age Distribution of the Sample Farmers

The age structure of the farmers was examined by classifying into three age groups that were Young age (<35 years), Middle age (35-50 years), and Old age (>50 years). The different age groups of the farmer are shown in Figure 5.1.There are three groups because almost all respondent cover these three categories. It was found that the highest number of the respondents (54%) belongs to the Middle age (35-50 years) followed by the Old age (>50 years) (26%) and (20%) respondents are in the Young age (<35 years). It is evident from the Figure 5.1 that 100 percent were floating garden farmers in the study area.

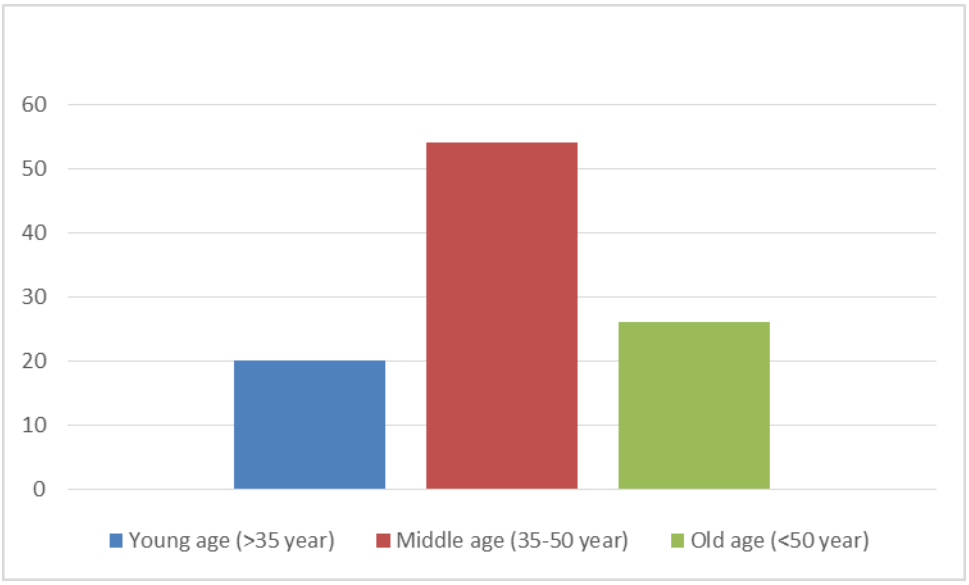

Figure 5.1: Age Wise Categorization of Floating Garden Farmers

Source: Field Survey, 2018.

5.2 Level of Education of the Floating Garden Farmers

On the basis of education the respondents were classified into five categories as shown in Figure 5.2. It was revealed that highest portion of the respondents (37%) has achieved primary level of education followed by, illiterate (32%) secondary level (17%) higher secondary level (10%) and Degree/Honor's (4%) . Only four respondent was graduate and above. In the national level 71(%) people literate (BER 2018) but here 68 (%) farmers are literate and 32 (%) farmers are illiterate.

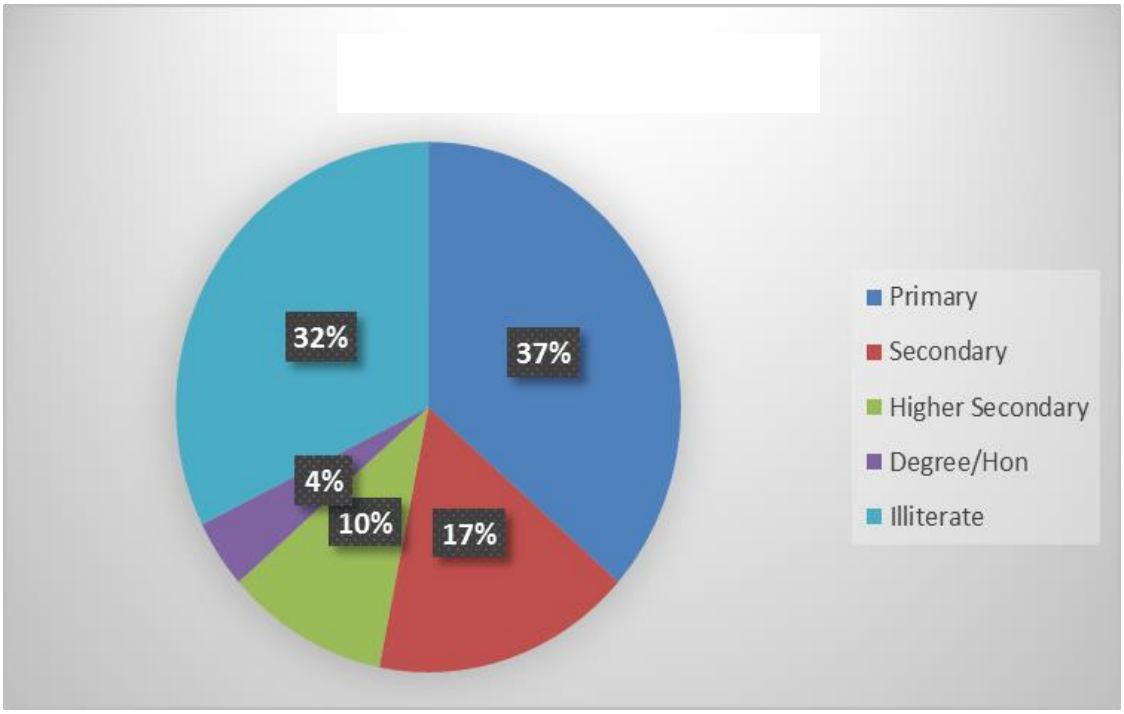

Figure 5.2: Level of Education of the Floating Garden Farmers

Source: Field Survey, 2018.

5.3 Family Size of the Floating Garden Farmers

Data presented in Figure 5.3 indicate that most of the respondents' family (47%) belonged to small size family categories followed by medium size family (34%) while about 19% of the respondents belonged to large family size category. On the basis of the report of national household survey average family size in total is 4.35(BER 2018) where in rural it is 4.36 and urban is 4.29. In this study most of the respondent hold small family belonging to the members of 3 to 10.

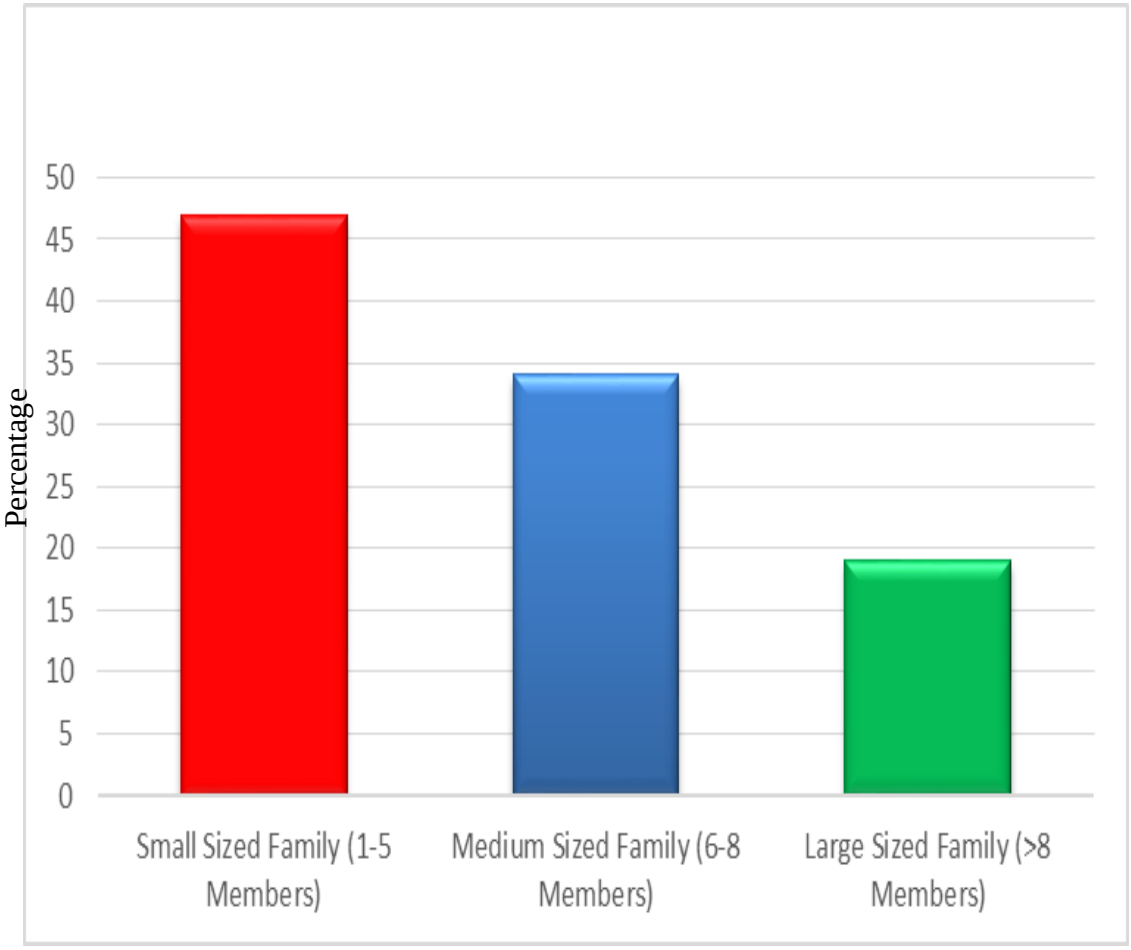

Figure 5.3: Family Size of the Floating Garden Farmers

Source: Field Survey, 2018.

5.4 Distribution of Family Member by Literacy and Sex

The literacy levels of the farm family members of the floating garden cultivators are given in Table 5.1. It appears from the table that 15 percent family members were not enrolled of which 8 percent were male and 7 percent were female. It also reveals that 39, 20, 17 and 09 percent of the family members had primary, secondary, higher secondary and graduate and above respectively (Table 5.1).

Table 5.1: Distribution of Family Member by Literacy and Sex

Level of education	Male (%) (Number)	Female (%) (Number)	Total (%) (Number)
Not Enrolled	8(36)	7(27)	15(63)
Primary	16 (73)	23 (105)	39 (178)
Secondary	9 (41)	11 (50)	20 (91)
Higher Secondary	10 (45)	7 (32)	17 (77)
Graduate and above	6 (27)	3 (18)	09 (45)
Total	49 (222)	51 (232)	100 (454)

Source: Field Survey, 2018.

5.5 Amount of Land Ownership of Floating Garden Farmers

On the basis of farmers total land the respondents were classified into four categories as shown in Table 5.2. From the table we can notice that the amount of land ownership of floating garden farmers. In the floating garden crops cultivation 21% are Marginal farmer and their average land 0.40 acre, 56% small farmers and their average land 1.85 acre and 23% Medium farmer their and average land 3.15 acre, and not found any large farmers in the field survey.

Table 5.2: Amount of Land Ownership of Floating Garden Farmers

Amount of land ownership	Amount of land ownership (%)	Average land(acre)
Marginal farmer (0-0.49 acre)	21	0.40
Small farmer (.50-2.49 acre)	56	1.85
Medium farmer (2.50-7.49 acre)	23	3.15
Large farmer (> 7.50 acre)	0	0
Total	100	1.80

Source: Field Survey, 2018.

5.6 Land Ownership Patterns of Floating Garden Crop Cultivation Farmers

In this study, the land holding of the sample farmers was defined as the sum total land where floating garden crop cultivation. Land size is measured by the entire land area operated by the farmers. The land ownership patterns of floating garden cultivators were 54%own land, lease in 0%, own and lease in 22%, borga in 0%, own and borga in 13% and mortgage in 0% and own and mortgage in 11%. That's mean most of the floating garden farmers are cultivated their own land.

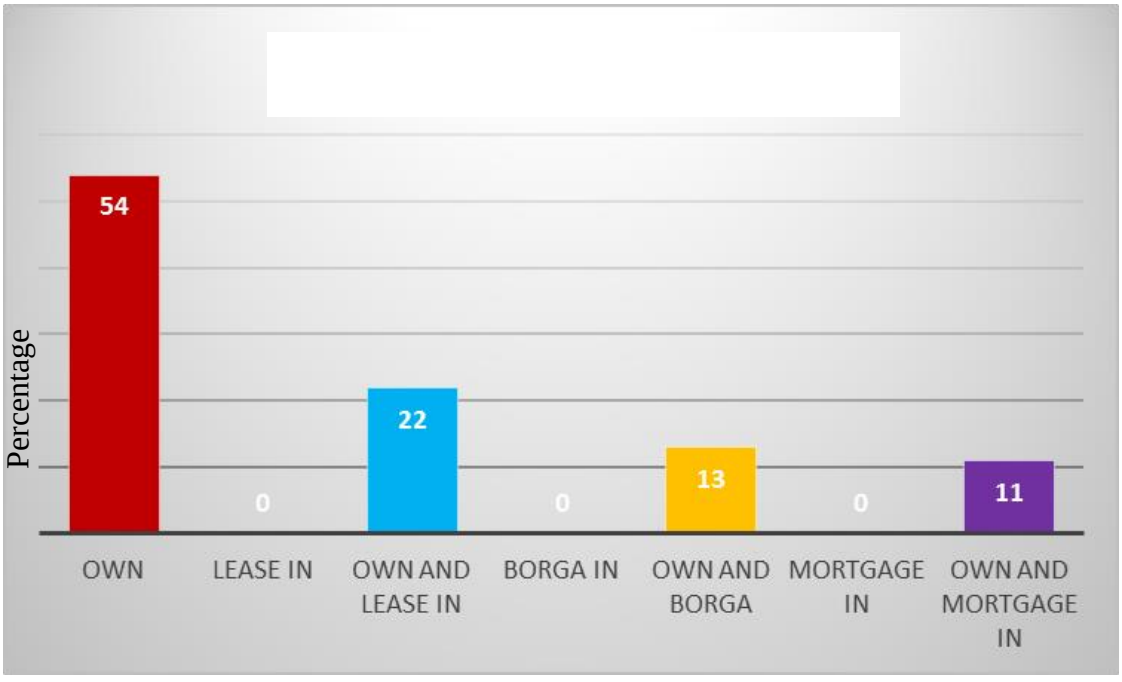

Figure 5.4: Land Ownership Patterns of Floating Garden Crop Cultivation Farmers.

Source: Field Survey, 2018.

5.7 Sources of Fund of the Floating Garden Farmer

Source of fund of the farmers are categories' according to the types of the farmers (marginal farmer, small farmer and medium farmer). In the marginal farmer 52% cultivate their own fund, 38% of the marginal farmer cultivated from local NGOs (BRAC, Grameen Bank) fund and 10% of the marginal farmer cultivated crops taking fund from money lender. In the small farmer 61% cultivate their own fund, 9% used Bank loan fund, 22% of the small farmer cultivated from local NGOs (BRAC, Grameen Bank) fund, 5% lend money from money Lander and only 3% taking fund from relatives. . In the medium farmer 57% cultivate their own fund, 31% used Bank loan fund, 8% of the small farmer cultivated from local NGOs (BRAC, Grameen Bank) fund and only 4% taking fund from relatives (Table 5.3).

Table 5.3: Sources of Fund of the Floating Garden Farmer

Sources of Fund Name	Marginal Farmer		Small Farmer		Medium Farmer	
	Respondent Farmers	(%)of the Farmer	Respondent Farmers	(%)of the Farmer	Respondent Farmers	(%)of the Farmer
Own	11	52	34	61	13	57
Bank	0	0	5	9	7	31
NGO	8	38	12	22	2	8
Money Lender	2	10	3	5	0	0
Relatives	0	0	2	3	1	4
Total	23	100	56	100	23	100

Source: Field Survey, 2018.

5.8 House Condition of the Floating Garden Farmers

Data presented in Figure 5.5 indicate the respondents' farmers house condition (32%) belonged to Pakka categories, Semi Pakka (44%) while about (24%) of the respondents belonged to Tin Shade / Mud made house.

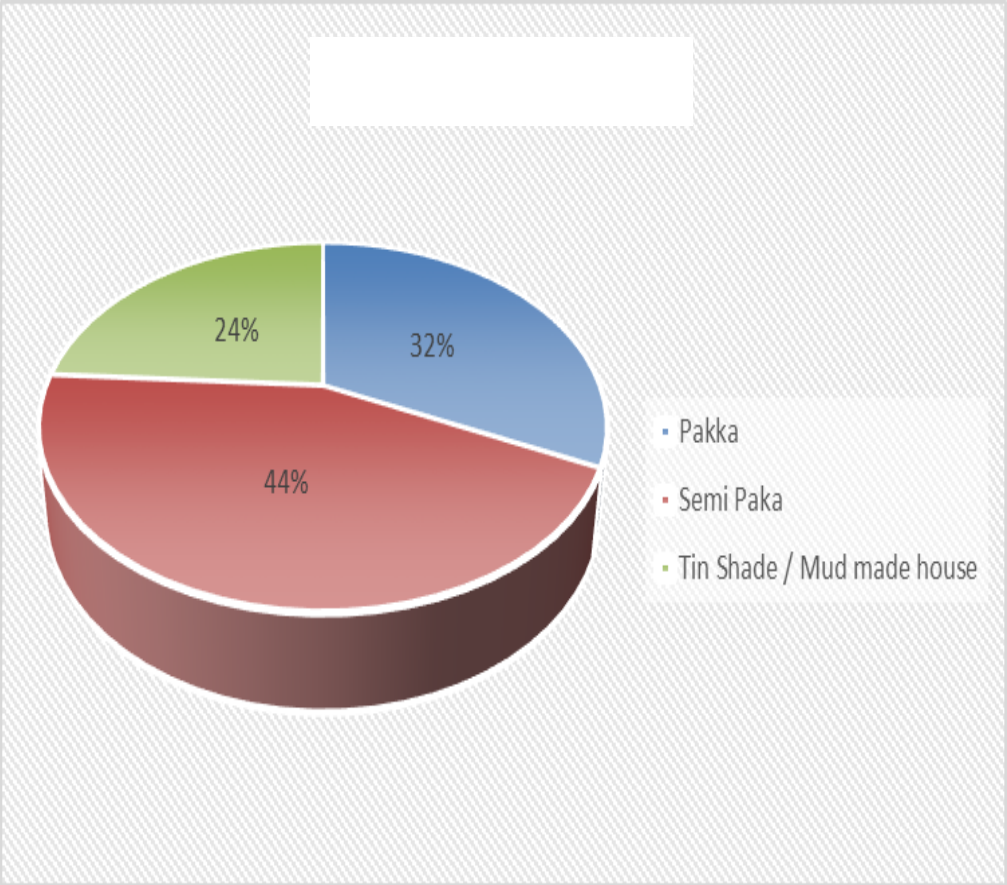

Figure 5.5: House Condition of the Floating Garden Farmers

Source: Field Survey, 2018.

5.9 Capability to Take Desired Food of the Floating Garden Farmers

In the bar-diagram we see that 52% floating garden farmers take nutritious food, partial nutritious 31%, 15% are not know about nutrition and only 2% take Unhygenic food. It is revealed from the present study that capability to take desired food has changed positively due to their better income after floating garden crops cultivation, said by the respondent farmers.

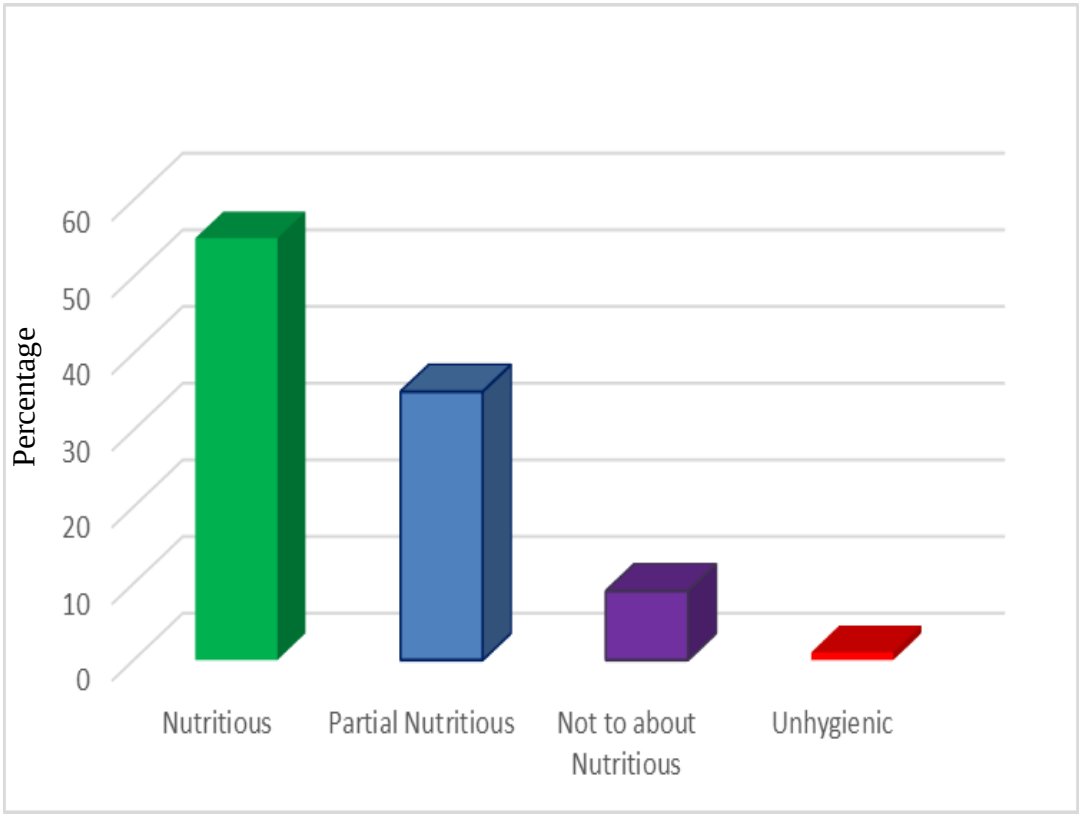

Figure 5.6: Capability to Take Desired Food of the Floating Garden Farmers.

Source: Field survey, 2018

5.10 Source of Drinking Water of the Floating Garden Farmers.

Data presented in Figure 5.7 indicate that the most of the respondents' families (94%) have drinking deep tube-well water while only 6% have swallow Tube-well water. None of these families drinking well or river water**.** That's mean almost 100% drink safe water whereas national level 98% drink safe water (BER 2018).

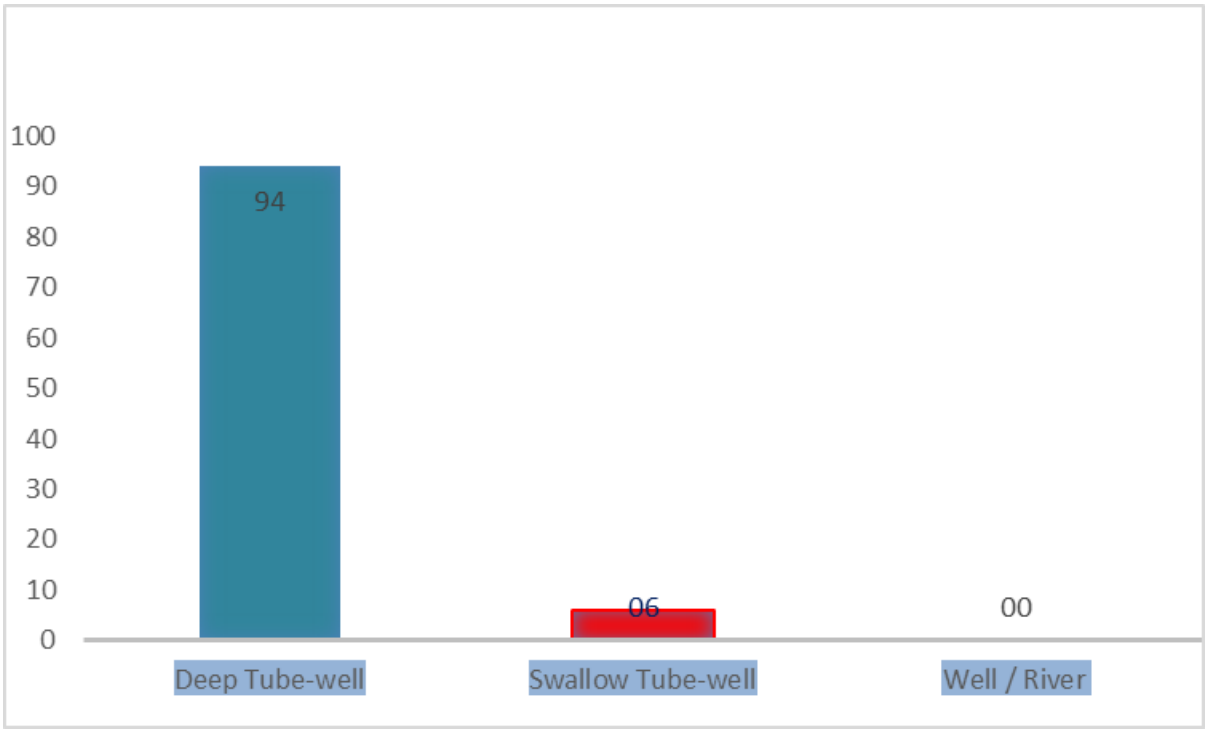

Figure 5.7: Source of Drinking Water of the Floating Garden Farmers.

Source: Field survey, 2018.

5.11 Condition of Sanitation of the Floating Garden Farmers.

Data presented in Figure 5.8 indicate that most of the respondents' families (79%) have good sanitation while 21% have modern sanitation. None of these families use open space on this purpose whereas in the nation level 75% people used healthy or good sanitation facilities (BER 2018).

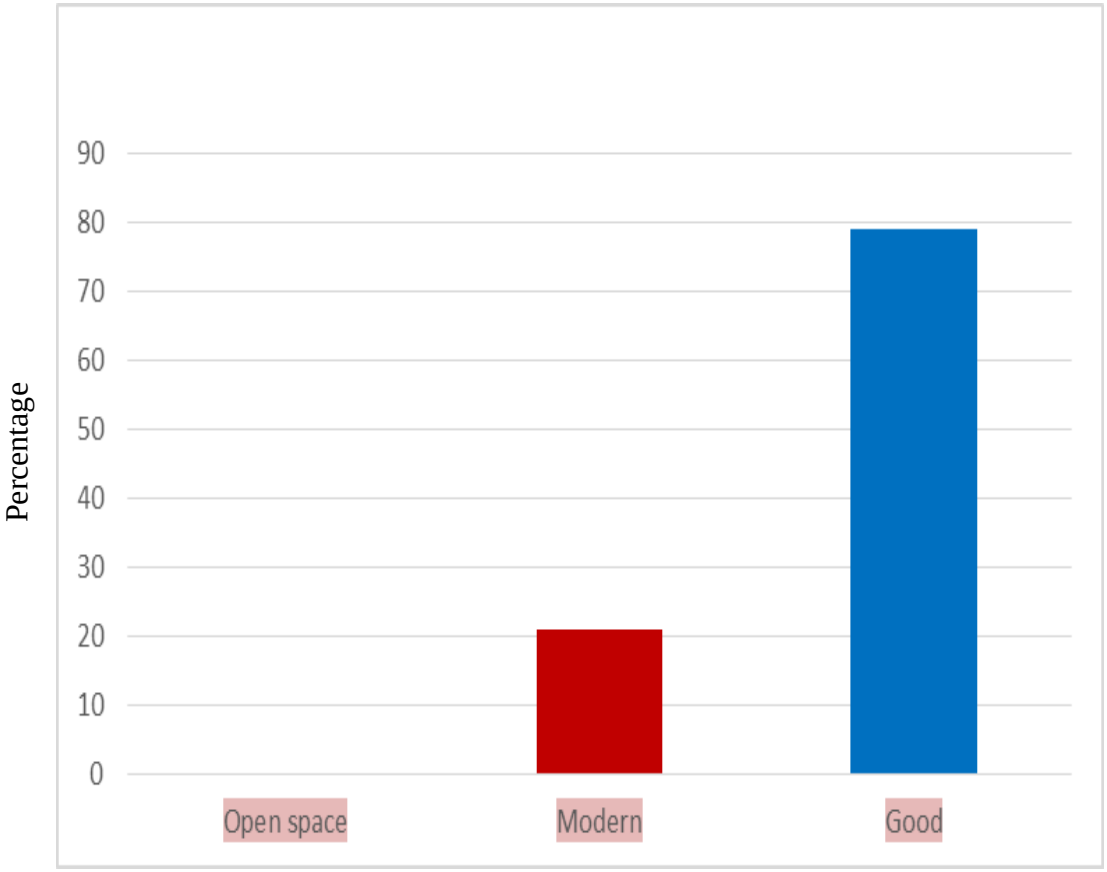

Figure 5.8: Condition of Sanitation of the Floating Garden Farmers.

Source: Field Survey, 2018

5.12 Income from Floating Garden Crop Cultivation of the Farmers

Income has increased greatly after floating garden crops cultivation. Only 17% farmers' income from floating garden crop cultivation of the farmer was less than Tk. 0.5 lac. 69% farmers' income was between TK. 0.5 lac to TK. 1 lac. 14% farmers' income was greater than TK. 1 lac.

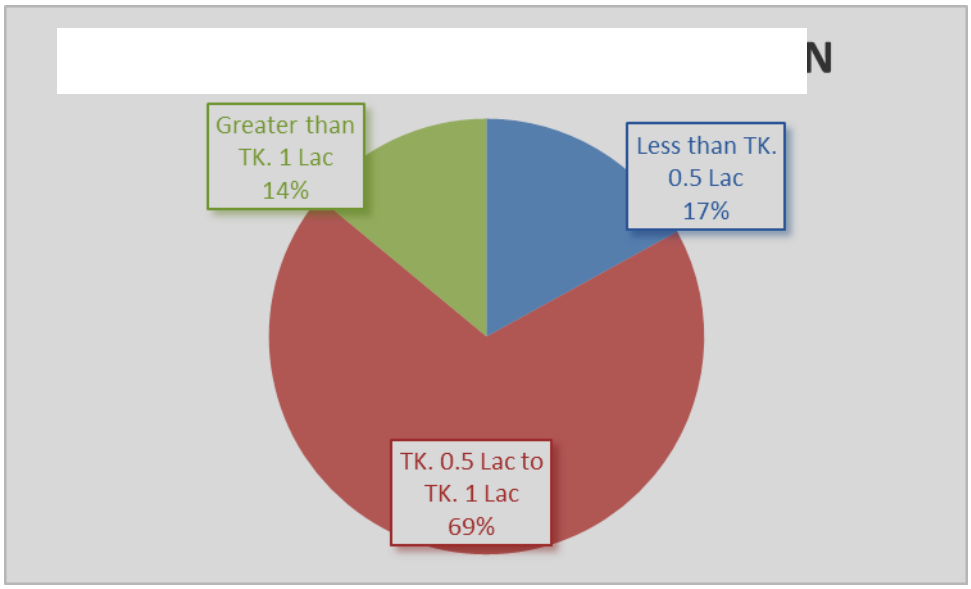

Figure 5.9: Income from Floating Garden Crop Cultivation of the Farmers

Source: Field Survey, 2018

CHAPTER VI

PROFITABILITY ANALYSIS OF FLOATING GARDEN CROPS

Profitability analysis of the floating garden crops cultivation according to farmers' categories. In the survey area mainly found three categories farmers such as marginal farmer, small farmer and medium farmer. Bellow analysis the profitability of those three categories farmer.

6.1 Marginal Farmer Profitability

6.1.1 Input Use Pattern of Marginal Farmers Floating Garden Crops Cultivation

The number of human labor used for floating garden crop cultivation was 356 man-days per acre. The cost of human labor was Tk. 142400 per acre. The average seed or seedling cost was Tk. 4200 per acre. The respondent farmers used 108 kg of fertilizer (Urea, TSP, MOP, Zipsum, Zinc sulphate and Boron) per acre. The cost of fertilizer was Tk. 3240.The respondent farmers used Insecticides & Pesticides 12 bottles/packets of insecticides and pesticides per acre which price Tk. 5400.The respondent farmers used support materials which cost is Tk. 36750 per acre (Table 6.1).

Table 6.1: Input Use Pattern of Marginal Farmer Floating Garden Crops Cultivation in Study Area

Items	Amount	Tk./ per Unit	Total Cost(Tk.)
Human labour (man days/acre)	356	400	142400
Family labour (man days/acre)	245	400	98000
Hired labour (man days/acre)	111	400	44400
Seeds or Seedling (per acre)			4200
Fertilizers (per acre)	108 kg	30	3240
Insecticides and Pesticides (per acre)	12 (bottles)	450	5400
Support materials			36750

Source: Field Survey, 2018.

6.1.1.1 Variable Cost

Variable cost is an important part for any economic analysis. To compute the profitability we need to calculate variable cost. The items include in variable cost are labour cost is Tk. 142400 per acre where haired labor is Tk. 44400 which contribute 21 percent of total cost. Seedling or seed cost is Tk. 4200 which contributes 2 percent of total cost. Fertilizer cost Tk. 3240 which contribute 1.5 percent of total cost. Pesticides and insecticides Tk. 5400 which contribute 2.5 percent of total cost. Support materials cost is Tk. 36750 which contribute 18 percent of total cost. Total variable cost is 45 percent of total cost (Table 6.2).

6.1.1.2 Fixed Cost

Fixed cost is also an important part for economic analysis. Here land use cost is Tk.10000 which contributes 5 percent of total cost. The cost of land use calculated on the basis of prevailing local lease value of land. Family labor cost is Tk. 98000 which contributes 47 percent of total cost. Interest on capital is tk. 6500 which contributes 3 percent of total cost (Table 6.2).

6.1.1.3 Total Cost

Total cost is calculated on the basis of variable cost and fixed cost. Total variable cost is Tk. 93990 per acre and total fixed cost is Tk. 114500 per acre. So the total cost is Tk. 208490 per acre (Table 6.2).

Table 6.2: Total Cost and Variable Cost of the Floating Vegetables Cultivation for Marginal Farmer

Items	Cost of cultivation(Tk./acre)	(%) of the Total Cost(Tk.)
A. Variable cost	**93990**	**45**
Hired Labour	44400	21
Seed or Seedling	4200	2
Fertilizer	3240	1.5
Insecticides & Pesticides	5400	2.5
Support Materials	36750	18
B. Fixed Cost	**114500**	**55**
Land use	10000	5
Family Labour	98000	47
Interest of operating Capital	6500	3
Total Cost	**208490**	**100**

Source: Field survey, 2018.

6.1.2 Gross Return from Floating Garden Crops Cultivation for Marginal Farmer

In the survey area mainly Red-Amaranth, Lady's Finger, seedling of different crops are cultivated per year in a single floating bed and here Red-Amaranth and Lady's Finger cultivated as mixed crops. When that crops harvested Seedling of Vegetables are cultivated in the same bed. Other crops and vegetables also cultivated. Here calculation gross return only the main cultivated crops. The farmers harvested averagely 17500 bundle of Rea-Amaranth per acre which price Tk. 262,500, average yield of Lady's Finger 4500 kg per acre and which price is Tk. 90,000 and also harvested 7200 pieces of vegetables seedling which price is Tk. 72,000 per acre of floating garden land (Table 6.3).

Table 6.3: Gross Return from Floating Garden Crops Cultivation for Marginal Farmer

Vegetables Name	Amount (per acre)	Per Unit Price(TK.)	Total Price(Tk.)
Red-Amaranth	17500 (bundle)	15	262500
Lady's Finger	4500 kg	20	90000
Seedling of Vegetables	7200 (piece)	10	72000
Total			424500

Source: Field Survey, 2018.

6.1.3 Gross Margin

Gross margin is calculated by the subtraction from gross return to variable cost. Gross return is Tk. 424500 and the variable cost is Tk. 93990 in per acre. So the gross margin is Tk. 330500 per acre of floating garden land.

6.1.4 Net Return

Net return is calculated by the subtraction from gross return to total cost. Gross return is Tk. 424500 and total cost is Tk. 208490. So the net return is Tk. 216010 per acre of floating garden land.

6.1.5 Benefit Cost Ratio (Undiscounted)

Benefit cost ratio is calculated from the gross return and total cost on the full cost basis. Gross return is Tk. 424500 and total cost is Tk. 208490 per acre. So the Benefit cost ratio (BCR) on full cost basis is 2.50. Here variable cost is Tk. 93990 per acre. So the benefit cost ratio on variable cost basis is 4.02 per acre of floating garden land.

6.2 Small Farmer Profitability

6.2.1 Input Use Pattern of Marginal Farmers Floating Garden Crops Cultivation

The number of human labor used for floating garden crop cultivation was 356 man-days per acre. The cost of human labor was Tk.152000 per acre. The average seed or seedling cost was Tk. 4500 per acre. The respondent farmers used 115 kg of fertilizer (Urea, TSP, MOP, Zipsum, Zinc sulphate and Boron) per acre. The cost of fertilizer was Tk. 3450.The respondent farmers used Insecticides & Pesticides 12 bottles/packets of insecticides and pesticides per acre which price Tk. 5400.The respondent farmers used support materials which cost is Tk. 38500 per acre (Table 6.4).

Table 6.4: Input Use Pattern of Small Farmer Floating Garden Crops Cultivation in Study Area

Items	Amount	Tk./ per Unit	Total Cost
Human labour (man days/acre)	380	400	152000
Family labour (man days/acre)	230	400	92000
Hired labour (man days/acre)	150	400	60000
Seeds or Seedling (per acre)			4500
Fertilizers (per acre)	115 kg	30	3450
Insecticides and Pesticides (per acre)	11 (bottles)	450	4950
Support Materials (per acre)			38500

Source: Field Survey, 2018.

6.2.1.1 Variable Cost

Variable cost is an important part for any economic analysis. To compute the profitability we need to calculate variable cost. The items include in variable cost are labour cost is Tk.152000 per acre where haired labor is Tk. 60000 which contribute 27 percent of total cost. Seedling or seed cost is tk.4400 which contributes 2 percent of total cost. Fertilizer cost Tk. 3450 which contribute 1.5 percent of total cost. Pesticides and insecticides Tk. 5400 which contribute 2.5 percent of total cost. Support materials cost is Tk.38500 which contribute 18 percent of total cost. Total variable cost is 51 percent of total cost (Table 6.5).

6.2.1.2 Fixed Cost

Fixed cost is also an important part for economic analysis. Here land use cost is Tk.10000 which contributes 4.5 percent of total cost. The cost of land use calculated on the basis of prevailing local lease value of land. Family labor cost is Tk.92000 which contributes 41.5 percent of total cost. Interest on capital is Tk.6500 which contributes 3 percent of total cost (Table 6.5).

6.2.1.3 Total Cost

Total cost is calculated on the basis of variable cost and fixed cost. Total variable cost is Tk.111400 per acre and total fixed cost is Tk. 108500 per acre. So the total cost is Tk.219900 per acre (Table 6.5)

Table 6.5: Total Cost and Variable Cost of the Floating Vegetables Cultivation for Small Farmer

Items	Cost of cultivation(Tk./acre)	(%) of the Total Cost(Tk.)
A. Variable cost	**111400**	**51**
Hired Labour	60000	27
Seed or Seedling	4400	2
Fertilizer	3450	1.5
Insecticides & Pesticides	5050	2.5
Support Materials	38500	18
B. Fixed Cost	**108500**	**49**
Land use	10000	4.5
Family Labour	92000	41.5
Interest of operating Capital	6500	3
Total Cost	**219900**	**100**

Source: Field Survey, 2018.

6.2.2 Gross Return from Floating Garden Crops Cultivation for Small Farmer

In the survey area mainly Red-Amaranth, Lady's Finger, seedling of different crops are cultivated per year in a single floating bed and here Red-Amaranth and Lady's

Finger cultivated as mixed crops. When that crops harvested Seedling of Vegetables are cultivated in the same bed. Other crops and vegetables also cultivated. Here calculation gross return only the main cultivated crops. The farmers harvested averagely 17500 bundle of Rea-Amaranth per acre which price Tk. 262500, average yield of Lady's Finger 4500 kg per acre and which price is Tk. 90000 and also harvested 7200 pieces of vegetables seedling which price is Tk. 72000 per acre of floating garden land (Table 6.6).

Table 6.6: Gross Return from Floating Garden Crops Cultivation for Small Farmer

Vegetables Name	Amount (per acre)	Per Unit Price(TK.)	Total Price(Tk.)
Red-Amaranth	17000 (bundle)	15	255000
Lady's Finger	4400 kg	20	88000
Seedling of Vegetables	7000 (piece)	10	70000
Total			413000

Source: Field Survey, 2018.

6.2.3 Gross Margin

Gross margin is calculated by the subtraction from gross return to variable cost. Gross return is Tk.413000 and the variable cost is Tk.111400 in per acre. So the gross margin is Tk.301600 per acre of floating garden land.

6.2.4 Net Return

Net return is calculated by the subtraction from gross return to total cost. Gross return is Tk.413000 and total cost is Tk.219900. So the net return is Tk.193100 per acre of floating garden land.

6.2.5 Benefit Cost Ratio (Undiscounted)

Benefit cost ratio is calculated from the gross return and total cost on the full cost basis. Gross return is Tk. 413000 and total cost is Tk. 219900 per acre. So the Benefit cost ratio (BCR) on full cost basis is 2.40. Here variable cost is Tk.93990 per acre. So the benefit cost ratio on variable cost basis is 4.00 per acre of floating garden land.

6.3 Medium Farmer Profitability

6.3.1 Input Use Pattern of Marginal Farmers Floating Garden Crops Cultivation

The number of human labor used for floating garden crop cultivation was 390 man-days per acre. The cost of human labor was Tk.156000 per acre. The average seed or seedling cost was Tk.4500 per acre. The respondent farmers used 120 kg of fertilizer (Urea, TSP, MOP, Zipsum, Zinc sulphate and Boron) per acre. The cost of fertilizer was Tk.3600. The respondent farmers used Insecticides & Pesticides 12 bottles/packets of insecticides and pesticides per acre which price Tk.5850.The respondent farmers used support materials which cost is Tk.39500 per acre (Table 6.4).

Table 6.7: Input Use Pattern of Medium Farmer Floating Garden Crops Cultivation in Study Area

Items	Amount	Tk./ per Unit	Total Cost
Human labour (man days/acre)	390	400	156000
Family labour (man days/acre)	210	400	84000
Hired labour (man days/acre)	180	400	72000
Seeds or Seedling (per acre)			4500
Fertilizers (per acre)	120 kg	30	3600
Insecticides and Pesticides (per acre)	13 (bottles)	450	5850
Support Materials (per acre)			39500

Source: Field Survey, 2018.

6.3.1.1 Variable Cost

Variable cost is an important part for any economic analysis. To compute the profitability we need to calculate variable cost. The items include in variable cost are labour cost is Tk.156000 per acre where haired labor is Tk. 72000 which contribute 32 percent of total cost. Seedling or seed cost is Tk. 4500 which contributes 2 percent of total cost. Fertilizer cost Tk. 3600 which contribute 1.5 percent of total cost. Pesticides and insecticides Tk. 5850 which contribute 3 percent of total cost. Support materials cost is Tk. 39500 which contribute 17.5 percent of total cost. Total variable cost is 56 percent of total cost (Table 6.8).

6.3.1.2 Fixed Cost

Fixed cost is also an important part for economic analysis. Here land use cost is Tk.10000 which contributes 4.5 percent of total cost. The cost of land use calculated on the basis of prevailing local lease value of land. Family labor cost is Tk.84000 which contributes 41.5 percent of total cost. Interest on capital is Tk.6500 which contributes 3 percent of total cost (Table 6.8).

6.3.1.3 Total Cost

Total cost is calculated on the basis of variable cost and fixed cost. Total variable cost is Tk.125450 per acre and total fixed cost is Tk. 100500 per acre. So the total cost is Tk.225950 per acre (Table 6.8)

Table 6.8: Total Cost and Variable Cost of the Floating Vegetables Cultivation for the Medium Farmer

Items	Cost of cultivation(Tk./acre)	(%)of the Total Cost(Tk.)
A. Variable cost	**125450**	**56**
Hired Labour	72000	32
Seed or Seedling	4500	2
Fertilizer	3600	1.5
Insecticides & Pesticides	5850	3
Support Materials	39500	17.5
B. Fixed Cost	**100500**	**44**
Land use	10000	4
Family Labour	84000	37
Interest of operating Capital	6500	3
Total Cost	**225950**	**100**

Source: Field Survey, 2018.

6.3.2 Gross Return from Floating Garden Crops Cultivation for the Marginal Farmer

In the survey area mainly Red-Amaranth, Lady's Finger, seedling of different crops are cultivated per year in a single floating bed and here Red-Amaranth and Lady's Finger cultivated as mixed crops. When that crops harvested Seedling of Vegetables are cultivated in the same bed. Other crops and vegetables also cultivated. Here calculation gross return only the main cultivated crops. The farmers harvested averagely 17200 bundle of Rea-Amaranth per acre which price Tk. 258000, average yield of Lady's Finger 4600 kg per acre and which price is Tk. 92000 and also harvested 7400 pieces of vegetables seedling which price is Tk. 74000 per acre of floating garden land (Table 6.9).

Table 6.9: Gross Return from Floating Garden Crops Cultivation for the Medium Farmer

Vegetables Name	Amount (per acre)	Per Unit Price(TK.)	Total Price(Tk.)
Red-Amaranth	17200 (bundle)	15	258000
Lady's Finger	4600 kg	20	92000
Seedling of Vegetables	7400 (piece)	10	74000
Total			424000

Source: Field Survey, 2018.

6.3.3 Gross Margin

Gross margin is calculated by the subtraction from gross return to variable cost. Gross return is Tk.424000 and the variable cost is Tk.125450 in per acre. So the gross margin is Tk.298550 per acre of floating garden land.

6.3.4 Net Return

Net return is calculated by the subtraction from gross return to total cost. Gross return is Tk.424000 and total cost is Tk.225950. So the net return is Tk.198050 per acre of floating garden land.

6.3.5 Benefit Cost Ratio (Undiscounted)

Benefit cost ratio is calculated from the gross return and total cost on the full cost basis. Gross return is Tk. 224000 and total cost is Tk. 225950 per acre. So the Benefit cost ratio (BCR) on full cost basis is 2.45. Here variable cost is Tk.125450 per acre. So the benefit cost ratio on variable cost basis is 4.01 per acre of floating garden land.

6.4 Relative Economic Performance of the Different Categories of Floating Garden Farmers

Table 6.10 show that the relative economic performance of the different categories of floating garden farmers. Here variable cost Tk.93990, Tk.111400 and Tk. 125450 are respectively marginal farmer, small farmer and medium farmer. Their total cost are Tk.208490, Tk.219900 and Tk.225590 respectively and their gross return are Tk.424500, Tk.413000 and Tk.224400. So, their gross margin are Tk.330500, Tk.301600, Tk. 298550 respectively and net return are Tk.216010, Tk.193100 and Tk.198050 respectively. According to farmers categories (marginal farmer, small farmer and medium farmer) cost benefit ratio are 2.50, 2.40 and 2.45 respectively.

Table 6.10: Relative Economic Performance of the Different Categories of Floating Garden Farmers

Categories of Farmer	A. TVC (Tk.)	B. TC (Tk.)	C. GR (Tk.)	GM(C-A) (Tk.)	NR(C-B) (Tk.)	BCR
Marginal	93990	208490	424500	330500	216010	2.50
Small	111400	219900	413000	301600	193100	2.40
Medium	125450	225950	424400	298550	198050	2.45

Note: TVC = Total Variable Cost, TC = Total Cost, GR = Gross Return, GM = Gross Margin, NR = Net Return and BCR = Benefit Cost Ratio

Source: Field Survey, 2018.

6.5 Farm Categories Wise Average Income of Floating Garden Farmers

Table 6.11 show that the income of the farmer according to the farm categories with average land. Marginal farmer income according their farm size is Tk.86404. Small farmer income according their farm size is Tk. 347580 and the medium farmer income according their farm size is Tk. 623858.

Table 6.11 Farm Categories Wise Average Income of Floating Garden Farmers

Farm Categories	Per Acre Net Return (Tk.)	Average Land (acre)	Total Net Return (Tk.)
Marginal	216010	0.40	86404
Small	193100	1.80	347580
Medium	198050	3.15	623858

Source: Field Survey, 2018.

6.6 Factors Affecting the Yield of Floating Garden Crops Cultivation for Farmer

Here an attempt has been made to identify and measure the effects of different factors on yield of floating garden cultivation in the framework of production function analysis. Five explanatory variables were taken into consideration for production function analysis. The effects of each of the variables on the yield of vegetables are interpreted below.

6.6.1 Effect of Human Labor (X_1):

From the Table 6.12 it can be seen that the value of the coefficient was positive and significant at 1 percent level of significance. One percent level of significant indicates that the 1 percent increase in the use of human labor keeping others factor remaining constant would increase the yield of floating garden crops by 0.01 percent.

6.6.2 Effect of Seed or Seedling (X_2):

From the Table 6.12 the value of coefficient of seed or seedling was positive and significant at five percent level of significance. Five percent level of significant indicates that the one percent increase in the cost of seedling keeping other factor

remaining constant would increase the yield of floating garden crops by 0.001 percent.

6.6.3 Effect of Fertilizer (X_3)

From the Table 6.12 the value of coefficient of the use of fertilizer was positive and significant at five percent level of significance. Five percent level of significant indicates that the one percent increase in the use of fertilizer keeping other factor remaining constant would increase the yield of floating garden crops by 0.043 percent

6.6.4 Effect of Insecticides & Pesticides (X_4)

From the Table 6.12 it can be seen that the value of the coefficient was positive and insignificant at five percent level of significance. Five percent level of significant indicates that the one percent increase in the use of insecticides and pesticides keeping others factor remaining constant would not increase the yield of floating garden practiced by 0.057 percent

6.6.5 Effect of Support Material (X_5)

From the Table 6.12 the value of coefficient of support material was positive and insignificant at one percent level of significance. Five percent level of significant indicates that the one percent increase in the cost of support material keeping other factor remaining constant would not increase the yield of floating garden practiced by 0.054 percent.

Table 6.12: **Estimated Coefficients and Their Related Statistics of Production Function for Floating Garden Cultivation**

Explanatory	Co-efficient	t-value
Intercept	12.64***	3.38
Human labor (X_1)	0.01***	4.05
Seed or Seedling (X_2)	0.001	0.65
Fertilizer (X_3)	0.043***	2.62
Insecticides & Pesticides(X_4)	0.057**	2.45
Support material (X_5)	0.054***	3.58
R^2	0.69	
F-value	19.76***	

Note: ***and ** indicate significant at 1% and 5% level

6.6.6 Value of R^2 square

In the table 6.12 the multiple co-efficient of determination (R^2) is a summary measure which tells how the sample regression line fits with the data (Gujarati, 1995). In this table the value of R^2 was 0.69 that means the variables considered in the models can explain 69 percent of the variation in yield explained by independent variables include in the model.

6.6.7 Value of F

In the table 6.12 the F value was found 19.76 which is significant at one percent level implying that the variation of yield mainly depends on the explanatory variables include in the model.

CHAPTER VII

PROBLEMS FACED BY THE FARMERS

The problems of production and marketing arise when the objectives of production and marketing are constrained to be achieved. For the sake of convenience, the constraints faced by the selected farmers in the study area have been categorized under three general groups such as economic, technical and marketing. Those problems are describe according to the farmers categories (Marginal, Small & Medium).

7.1 Marginal Farmer Problems

7.1.1 Economic Problems

In the survey, farmers were asked to identify some economic problems related to growing floating garden crops. The problems that were identified and faced by them are discussed below.

7.1.1.1 Low Selling Price

Low selling price is a great problem for farmers because they do not get their anticipated price. In the marginal farmer 54% of the floating garden crops producers had to face this problem (Table 7.1).

7.1.1.2 Insufficient Credit Facilities

Insufficient credit is a big problem for farmers. Floating garden cultivation needs a lot of credit. In the study area farmers do not get sufficient loan from the banks. Banks are reluctant to give loan to farmers. In the marginal farmer 38% of the producers had to face this problem (Table 7.1).

7.1.1.3 High Input Price

The cultivation mostly depends on some important inputs. Seed or Seedling, fertilizer, insecticide and support materials are some of them. In the marginal farmer 18% face this problem (Table 7.1). But high price of input affect floating gardeners negatively.

7.1.2 Technical Problems

Technical problems are related to production techniques and technology such as lack of scientific knowledge, lack of quality seeds or plants, attack by pest and diseases, lack of storage facilities and lack of extension work (Table 7.1).

7.1.2.1 Attack by Pests and Diseases

In the survey, the producers mentioned that considerable amount of loss in yield of their floating crop was caused by the attack of pest and diseases. During the present investigation, 51% of the marginal farmers faced this problem (Table 7.1).

7.1.2.2 Lack of Scientific Knowledge and Training

Commercial floating farming is a new practice in Bangladesh. There is a shortage of trained manpower to handle commercial activities such as production, post-harvest handling and etc. Most of the farmers keep a little knowledge about modem technology. It is evident from the table that 46% of farmers faced the problem of proper knowledge and training (Table 7.1).

7.1.2.3 Lack of proper Environment

Floating crops cultivation need proper environment because of without proper environment crops not grow well. Only 3% of marginal farmers claimed that there is lack of proper environment for cultivation seasonal crops and vegetables (Table 7.1).

7.1.3 Marketing Problems

In the survey area, the floating garden cultivators face several marketing problems which are discussed below

7.1.3.1 Low Selling Price

Low selling price is a great problem for Marginal farmers because they do not get their anticipated price. 55% of the marginal floating garden farmers had to face this problem (Table 7.1).

7.1.3.2 Lack of Market Information

Proper market information is essential for floating garden farmers because without proper marketing information they don't get accurate crops price. In the marginal farmers about 27% had faced this problem (Table 7.1)

7.1.3.3 Transportation and Communication Problems

Transportation is the life blood of modem marketing system. The communication network in the study areas was properly developed for the movement of agricultural products from the producer's field to different markets. So, only 18% said they faced this problem (Table 7.1).

Table 7.1: Problems faced by the Marginal Farmers in Floating Garden Crops Cultivation

Problems Name	(%) of Respondents	Ranking
Economic		
i. Low Selling Price	54	1
ii. Insufficient Credit Facilities	38	2
iii. High Input Price	8	3
Technical		
i. Attack by Pests and Diseases	51	1
ii. Lack of Scientific Knowledge and Training	46	2
iii. Lack of proper Environment	3	3
Marketing		
i. Low Selling Price	55	1
ii. Lack of Market Information	27	2
iii. Transportation and Communication Problems	18	3

Source: Field survey, 2018.

7.2 Small Farmer Problems

7.2.1 Economic Problems

In the survey, farmers were asked to identify some economic problems related to growing floating garden crops. The problems that were identified and faced by them are discussed below.

7.2.1.1 Low Selling Price

Low selling price is a great problem for farmers because they do not get their anticipated price. In the marginal farmer 44% of the floating garden crops producers had to face this problem (Table 7.2).

7.2.1.2 Insufficient Credit Facilities

Insufficient credit is a big problem for farmers. Floating garden cultivation needs a lot of credit. In the study area farmers do not get sufficient loan from the banks. Banks are reluctant to give loan to farmers. In the marginal farmer 38% of the producers had to face this problem (Table 7.2).

7.2.1.3 High Input Price

The cultivation mostly depends on some important inputs. Seed or Seedling, fertilizer, insecticide and support materials are some of them. In the marginal farmer 18% face this problem (Table 7.2). But high price of input affect floating gardeners negatively.

7.2.2 Technical Problems

Technical problems are related to production techniques and technology such as lack of scientific knowledge, lack of quality seeds or plants, attack by pest and diseases, lack of storage facilities and lack of extension work.

7.2.2.1 Attack by Pests and Diseases

In the survey, the producers mentioned that considerable amount of loss in yield of their floating crop was caused by the attack of pest and diseases. During the present investigation, 41% of the marginal farmers faced this problem (Table 7.2).

7.2.2.2 Lack of Scientific Knowledge and Training

Commercial floating farming is a new practice in Bangladesh. There is a shortage of trained manpower to handle commercial activities such as production, post-harvest handling and etc. Most of the farmers keep a little knowledge about modem

technology. It is evident from the table that 45% of farmers faced the problem of proper knowledge and training (Table 7.2)**.**

7.2.2.3 Lack of Proper Environment

Floating crops cultivation need proper environment because of without proper environment crops not grow well. Only 4% of marginal farmers claimed that there is lack of proper environment for cultivation seasonal crops and vegetables (Table 7.2).

7.2.3 Marketing Problems

In the survey area, the floating garden cultivators face several marketing problems which are discussed below

7.2.3.1 Low Selling Price

Low selling price is a great problem for Marginal farmers because they do not get their anticipated price. 53% of the marginal floating garden farmers had to face this problem (Table 7.2).

7.2.3.2 Lack of Market Information

Proper market information is essential for floating garden farmers because without proper marketing information they don’t get accurate crops price. In the marginal farmers about 25% had faced this problem (Table 7.2)

7.2.3.3 Transportation and Communication Problems

Transportation is the life blood of modem marketing system. The communication network in the study areas was properly developed for the movement of agricultural products from the producer's field to different markets. So, only 22% said they faced this problem (Table 7.2).

Table 7.2: Problems faced by the Small Farmers in Floating Garden Crops Cultivation

Problems Name	(%) of Respondents	Ranking
Economic		
i. Low Selling Price	44	1
ii. Insufficient Credit Facilities	38	2
iii. High Input Price	18	3
Technical		
i. Lack of Scientific Knowledge and Training	45	1
ii. Attack by Pests and Diseases	41	2
iii. Lack of proper Environment	4	3
Marketing		
i. Low Selling Price	53	1
ii. Lack of Market Information	25	2
iii. Transportation and Communication Problems	22	3

Source: Field survey, 2018.

7.3 Medium Farmer Problems

7.3.1 Economic Problems

In the survey, farmers were asked to identify some economic problems related to growing floating garden crops. The problems that were identified and faced by them are discussed below**.**

7.3.1.1 Low Selling Price

Low selling price is a great problem for farmers because they do not get their anticipated price. In the marginal farmer 38% of the floating garden crops producers had to face this problem (Table 7.3).

7.3.1.2 Insufficient Credit Facilities

Insufficient credit is a big problem for farmers. Floating garden cultivation needs a lot of credit. In the study area farmers do not get sufficient loan from the banks. Banks are reluctant to give loan to farmers. In the marginal farmer 14% of the producers had to face this problem (Table 7.3).

7.3.1.3 High Input Price

The cultivation mostly depends on some important inputs. Seed or Seedling, fertilizer, insecticide and support materials are some of them. In the marginal farmer 48% face this problem (Table 7.3). But high price of input affect floating gardeners negatively**.**

7.3.2 Technical Problems

Technical problems are related to production techniques and technology such as lack of scientific knowledge, lack of quality seeds or plants, attack by pest and diseases, lack of storage facilities and lack of extension work.

7.3.2.1 Attack by Pests and Diseases

In the survey, the producers mentioned that considerable amount of loss in yield of their floating crop was caused by the attack of pest and diseases. During the present investigation, 47% of the marginal farmers faced this problem (Table 7.3).

7.3.2.2 Lack of Scientific Knowledge and Training

Commercial floating farming is a new practice in Bangladesh. There is a shortage of trained manpower to handle commercial activities such as production, post-harvest handling and etc. Most of the farmers keep a little knowledge about modem technology. It is evident from the table that 40% of farmers faced the problem of proper knowledge and training (Table 7.3).

7.3.2.3 Lack of Proper Environment

Floating crops cultivation need proper environment because of without proper environment crops not grow well. Only 13% of marginal farmers claimed that there is lack of proper environment for cultivation seasonal crops and vegetables (Table 7.3).

7.3.3 Marketing Problems

In the survey area, the floating garden cultivators face several marketing problems which are discussed below

7.3.3.1 Low Selling Price

Low selling price is a great problem for Marginal farmers because they do not get their anticipated price. 51% of the marginal floating garden farmers had to face this problem (Table 7.3).

7.3.3.2 Lack of Market Information

Proper market information is essential for floating garden farmers because without proper marketing information they don't get accurate crops price. In the marginal farmers about 39% had faced this problem (Table 7.3)

7.3.3.3 Transportation and Communication Problems

Transportation is the life blood of modem marketing system. The communication network in the study areas was properly developed for the movement of agricultural products from the producer's field to different markets. So, only 10% said they faced this problem (Table 7.3).

Table 7.3: Problems faced by the Medium Farmers in Floating Garden Crops Cultivation

Problems Name	(%) of Respondents	Ranking
Economic		
i. High Input Price	48	1
ii. Low Selling Price	38	2
iii. Insufficient Credit Facilities	14	3
Technical		
i. Attack by Pests and Diseases	47	1
ii. Lack of Scientific Knowledge and Training	40	2
iii. Lack of proper Environment	13	3
Marketing		
i. Low Selling Price	51	1
ii. Transportation and Communication Problems	39	2
iii. Lack of Market Information	10	3

Source: Field survey, 2018.

CHAPTER VIII

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter focuses on the summary in the light of the discussion made in the earlier chapters. Conclusion has been made on the basis of experimental result. Policy recommendations are drawn for improvement of the existing inefficiency of floating garden crop cultivation in Gopalganj district**.**

8.1 SUMMARY

The economic performance of floating garden crop cultivation in selected areas of Bangladesh has been evaluated in this study. The results revealed that floating garden crop cultivation is highly profitable at farm level. Its cultivation is the most profitable in the marginal farmer compared to its competitive other farmers (small farmer and medium farmer). Because marginal farmer human labors cost is lower than other farmers. Human labor and seed had positive effect on the yield of floating garden crop cultivation. The study also revealed that due to various socio-economic constraints, the floating garden farmers cannot receive expected yield and price of their crops and vegetables.

Specifically Findings from the Study are as Below:

The floating garden crops cultivators face several economic, technical and marketing. The problems found in the study area regarding floating garden crops cultivation were various from different types of farmers (marginal farmer, small farmer and medium farmer) such as in the marginal farmers low selling price (54%) is their most acute economic problem whereas in the medium farmer high input price (48%) is the most acute economic problem. The average cost of floating garden crops cultivation were various from different types of farmers (marginal farmer, small farmer and medium farmer). In the marginal farmer their total cost Tk. 208,490 and variable cost Tk. 93,990 per acre floating garden. In the small farmer their total cost Tk.219,900 and variable cost Tk. 111,400 per acre floating garden. In the medium farmer their total cost Tk. 225,950 and variable cost Tk. 125,450 per acre floating garden. The major share of total cost is for human labor, support material and land use. The net return from floating garden crops cultivation Tk. 216,010, Tk. 193,100 and Tk. 198,050 are

respectively marginal farmer, small farmer and medium farmer per acre floating garden. The benefit cost ratios are 4.02, 4.0 & 4.01 and 2.50, 2.40 & 2.45 respectively those three types farmers on variable cost and full cost basis.

This study found that floating-farming shows encouraging results to improve farmer's socioeconomic condition, increases self-employment opportunity, promotes entrepreneurship in rural areas, it proves to be a potential tool for poverty alleviation and sustainable growth in the economy of Bangladesh.

For our country, accelerated agricultural growth through crop diversification offers considerable opportunity for expanding income and employment of rural people. Floating garden cultivation is being considered as the best option for crop diversification, employment generation and improvement of socio-economic conditions of people. This study shows that floating garden crops cultivation is a prospective business which ensures higher profit. Bangladesh has a very favorable climate to turn the vegetables business into booming industry. Gopalganj is regarded as commercial zone of floating garden crops cultivation. It can not only play a vital role in employment generation but also can contribute in the national economy through earning valuable foreign currency. But the commercial development of the business is still at very early stage. The present floating garden cultivators are facing several economic, technical, marketing and social problems mentioned above. If we can solve it, this sector must play a great role to economic growth because it has a great prospects like favorable condition, need lower investment, development partners are keen on this area and development assistance support to be available, growing concern over skill requirements among the traders, farmers, and other stakeholders.

The findings of the present study indicate that production of floating garden is a profitable business for farmers. The return over cost is almost double, which indicates high profitability. Also, trading of crops and vegetables is a profitable venture for different intermediaries. It can be said that floating garden crops cultivation and marketing has wider scope in Bangladesh, so the farmers and intermediaries could certainly be benefited financially if performance of marketing system of floating garden becomes well developed. The growing demand of crops in the domestic as well as in the export market requires a concerted effort on the part of the government as well as the private entrepreneurs to develop industry on scientific lines.

8.2 CONCLUSION

The results revealed that floating garden crops cultivation is highly profitable at farm level. Human labor and seed or seedling had positive effect on the yield of floating crops cultivation. Lack of technical knowledge, non-availability of HYV seed or seedling, and infestation of insects and diseases were major problems found in floating garden crops cultivation. Government should take necessary steps to overcome these problems. Goplaganj is regarded as commercial zone of floating garden crops cultivation. It can not only play a vital role in employment generation but also can contribute in the national economy through earning valuable foreign currency. But the commercial development of this still at very early stage.

8.3 RECOMMENDATIONS

Based on the findings of the study, the following recommendations were put forward for the improvement of floating garden crops cultivation at farm level.

Farmers training should be conducted by the BARI scientists to develop technical knowledge about improved cultivation practices. High yielding varieties crops seedling/seed should be made locally available to the farmers at proper time. For this reason, government should encourage researcher and private seed companies for producing HYV seedling/seed of various crops. More intensive research should be undertaken by BARI scientists to develop disease and insect-pest resistant HYV varieties of crops in the near future. Market infrastructure should be developed in terms of quick transportation, proper storage and other physical facilities to reduce spoilage and damage.

i. Input price should be reduced or subsidized for lowering the cost of production.
ii. Pure pesticide and pest management knowledge should supply to the floating garden crops cultivators.
iii. Proper transportation and communication system should be ensured.
iv. Farmers need to be trained in the scientific production practices and technology related to this new enterprise.
v. Skill development training on Post-harvest Management of floating garden crops is required for the farmers.

8.4 LIMITATION OF THE STUDY

1. Most of the data collected through interview of the farmers. So sometimes they were not well co-operated with the interviewer.
2. The information gathered mostly through the memories of farmers which are not always correct.
3. Sometimes respondents are reluctant to provide information to the authors.
4. For the resource and time constraints broad and in depth study got hinder to some extent.

REFERENCES

Ali, A. S. (1990). Nexus between Wetland Resources and Climatic Security and Management Strategies of Wetlands in Bangladesh; http:// www.researcehgate.Net/..../ 22333033. State and Management of Wetland in Bangaladesh.

APEIS. (2014). Asia-Pacific Environmental Innovation Strategies; Floating Agriculture is not a New Practice in Bangladesh; https:// www. researchgate.net/.../233762713_Indigenous_Floating_Cultivation_a_Sustain in Bangladesh.

Ayres, and Haq, (2009). Accommodate Unavoidable Climate Change in the Southern Region in Bangladesh. Received 21 March 2009, Revised 12 June 2009, Accepted 26 June 2009, Published Online 30 June 2009.

BBS. (2011). Community Report, Population and Housing Census Bangladesh. Bureau of Statistics and Information Division (SID). Ministry of Planning Government of People's Republic of Bangladesh.

BBS. (2011). District Statistics, Bangladesh Bureau of Statistics and Information Division (SID) Ministry of Planning Government of People's Republic of Bangladesh.

BBS. (20016). Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics, Statistical Division, Ministry of Planning. Government of the People's Republic of Bangladesh.

BBS. (2017). Yearbook of Agricultural Statistics Bangladesh Bureau of Statistics and Information Division (SID) Ministry of Planning Government of People's Republic of Bangladesh.

BCCTF. (2017). Floating Gardens of Bangladesh: A Community Based Adaptation for Combating Climate Change in Wetland Area.

BER. (2018). National Education Level and Drinking Water Condition Bangladesh Economic Review Ministry of Finance Government of People's Republic of Bangladesh.

Brammer, H. Asaduzzaman, M. and Sultana P. (1993). The Geography of Soils of Bangladesh, Dhaka: University Press Ltd.

Brammer, H., Asaduzzaman M., and Sultana P. (1996). Effects of Climate and Sea-Level Changes on the Natural Resources of Bangladesh, Dhaka: Bangladesh Unnayan Parisad.

Byomkesh, T. ,Nakagoshi, N. and Shahedu, M.R. (2008). State and Management of Wetlands in Bangladesh; International Consortium of Landscape and Ecological Engineering and Springer.20: 154-42.

Chauhan, R. (2014). Response of different chickpea genotypes to Helicoverpa armigera at Hisar. *Indian J. Plant Protection*. 22: 170-72.

Chowdhury, K.R. (2004). 'A Glimmer of Hope for Victims of Climate Change', the Independent (Dhaka).

Coe, M. E. (1964). 'The chinampas of Mexico', Scientific American 211: 90-98.

Darch, J. P. (ed.) (1983). Drained Field Agriculture in Central and South America, British Archaeological Reports, International Series 189.

Duyne, J.E. (2004). Local Initiatives: Collective Water Management in Rural Bangladesh, New Delhi: D.K. Printworld Ltd.

FAO. (2008). Floating Garden Agricultural Practices in Bangladesh; www.fao .org/ 3/a-bp777e.pdf.

Gittinger, J. P. (1982). Economic Analysis of Agricultural Projects, Second Edition. Johns Hopkins University Press, Baltimore.

Gujarati, N. D. (1995). Basic Econometrics. University Press Limited. 5th Edition. 6: 203-205.

Haque, M. M. and Miah, M.I. (2016). Integrated Floating Cage Aquageoponics System (IFCAS): An Innovation in Fish and Vegetable Production for Shaded Ponds in Bangladesh.

Haque, M. M. (2014) Conduct an Innovation in Fish and Vegetable Production for Shaded Ponds in Bangladesh-NC-ND License.

Hoozemans, F.M.J., and Hulsbergen C.H. (1995). 'Sea-level Rise: A World-Wide Assessment of Risk and Protection Costs', in Eisma, D. (ed.). Climate Change: Impact on Coastal Habitation, London: Lewis Publishers.

Infanullah, M. H., Azad, M. A. K., Kamruzzaman, M. & Wahed, M. A. (2009).Floating gardening in Bangladesh (IUCN, UNFP, UNU, Dhaka, Bangladesh).

IPCC. (2007). Intergovernmental Panel on Climate Change. Global Warming Could be More Mevastating by Increasing Coastal Flooding, Salinity Intrusion and Permanent Inundation in Many Low-Lying Coastal Areas by the End of 21st Century.

IPCC. (2015). Intergovernmental Panel on Climate Change; Climate Change and Bangladesh; The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for assessment of ... Published at 04:51 am February 16th, 2015.

Islam, J. and Atkins, P. (2012).Indigenous floating Gardens for Sustainable Agricultural Practice in Wetland of Bangladesh Development in Practice.

IUCN. (2008). Bangladesh Baira: the Floating Garden for Sustainable Livelihood. www.apan-gan.net › Projects.

Khan, A. A. (1993). 'Freshwater Wetlands in Bangladesh: Opportunities and Options', in Nishat, A. Hussain, Z., Roy, M.K., and Karim, A. (eds.) Freshwater Wetlands in Bangladesh – Issues and Approaches for Management. Dhaka: IUCN, the World Conservation Union.

Morris, A. (2004). Raised field technology: the Raised Fields Projects Around Lake Titicaca Aldershot: Ashgate.

Nicholls, R. J. and Mimura, N. (1998). Regional Issues Raised by and Their Policy Implications, Climate Research, Vol.11, pp. 5-18.

Nicholls, R.J., Hoozemans, F.M.J. and Marchand, M. (1999). Increasing Flood Risk and Wetland Losses due to Global Sea-Level Rise: Regional and Global Analyses, Global Environmental Change, Vol. 9, pp. 69-87.

Ojha, P. K. and Chaudhary, R. S. (2017). Incremental Cost-Benefit Ratio of Certain Bio-pesticides Against Helicoverpa Armigera Hubner (Noctuidae: Lepidoptera) in chickpea.

Parsons, *et al.* (2012). Remnants of pre- Hispanic Raised Fields are Found Throughout North and South Americ.

Pavel, M. A. A. (2015). A Review of Good Adaptation Practices on Climate Change in Bangladesh, Conference Paper.

Pavel, M.A., Chowdhury, M.A. and Mamun, M.M.A. (2014). An Economic Evaluation of the Floating Garden as a Means of Adapting to Climate Change in Bangladesh**.**

Rahman, M.M. (2014). Mainstreaming Climate Change Adaptation into Development in Bangladesh.

Rashid, M. H. (1981). Bangladesh District Gazetteers: Bakerganj, Dhaka: Bangladesh Government Press.

Saha, G. S. (2010). Speckled across this Loktak Lake, the Several Thousand Phumdis and its Surrounding Waters are Vital for Irrigation, Drinking Water, Food Supplies, thus the Lake.

Sarker,. L Faheemah, T. Humayra, R.,Jannatul F., Zia U. A. Z. M. and Zahedul I. (2014). Climate Change Adaptation and Economic Profitability in Wetland Area in Bangladesh;

Sujan, H., Barton, A., Weitz and Sujan, M. (2017). Increasing Sales Productivity By Getting Salespeople to Work Smarter. *Journal of Personal Selling & Sales Management,* 8(2): 9-19.

Warrick, R. A., Oerlemans, J., Woodworth, P. L., Meier M. F. and Provost C. L. (1996). 'Changes in Sea-level', in Houghton, J.T., Meira Filho, L.G., and Callander, B.A. (eds.) Climate Change 1995: The Science of Climate Change, Cambridge: Cambridge University Press.

Wilken, G.C. (1985). 'A Note of Buoyancy and Other Dubious Characteristics of the 'Floating' Chinampas of Mexico', in Farrington, I.S. (ed.) Prehistoric Intensive Agriculture in the Tropics, British Archaeological Reports, International Series 232.

Yellin, J. (2013). Showed Floating Gardens were an effective habitat solution in urban rivers. Retrieved at: https://www.kickstarter.com/projects/wildmile/floating-gardens-in-the-chicago-river.

Yoshini, M. A. and Merabtene, K. (2007) Flood at Lowland Spreading Across the Middle of the Meghna River Basin in Bangladesh.

Appendix-I

ক্রমিকনং:.....

গবেষণার জন্য প্রশ্নবালী
বিভাগ: ডেভেলপমেন্ট অ্যান্ড পোভার্টি স্টাডিজ বিভাগ।
শেরেবাংলা কৃষি বিশ্ববিদ্যালয়, ঢাকা-১২০৭।

নাম: .....

গ্রাম: .....ইউনিয়ন:.....উপজেলা:.....

বয়স: .....শিক্ষা:.....মোবাইল নং:.....

১। পরিবারের সদস্য সংখ্যা:

পুরুষ: .....মহিলা: ..... মোট সদস্য:.....

২.কৃষি কাজের অভিজ্ঞতা.....বছর।

৩. ভাসমান বাগানে সবজির চাষের অভিজ্ঞতা.....বছর।

৪. পরিবারের আর্থ-সামাজিক তথ্য:

ক্রমিক নং	তথ্য প্রদানকারীর সাথে সম্পর্ক	লিঙ্গ	বয়স (বছর)	শিক্ষাগত যোগ্যতা	পেশা	
					প্রধান	সহায়ক

কোড:
সম্পর্ক: প্রধান কৃষক=১, স্বামী/স্ত্রী=২, ছেলে/মেয়ে=৩, মা/বাবা=৪, ভাই/বোন=৫, ছেলে বৌ=৬, ভাই এর স্ত্রী=৭, ভাই এর ছেলে/মেয়ে=৮, অন্যান্য=৯,
লিঙ্গ:পুরুষ=১, মহিলা=২
শিক্ষাগত যোগ্যতা: স্বাক্ষর=১, প্রাথমিক=২, মাধ্যমিক=৩, উচ্চ মাধ্যমিক=৪, ডিগ্রী/অনার্স=৫, অশিক্ষিত=৬
পেশা: কাজ করেনা=০, কৃষি=১, মাছচাষ=২, পশুপালন=৩, শ্রমিক=৪, ব্যবসা=৫, ছোট ব্যবসা/দোকান=৭, গৃহিনী=৮, ছাত্র=৯, অন্যান্য=১০

৫. নিজস্ব উৎপাদিত ফসলে সারা বছরের খাদ্যের চাহিদা পুরন হয় কি?

হ্যা ☐ না ☐

যদি না হয় তাহলে কিভাবে তা পুরন করা হয়?

☐ ১. নিজেস্ব টাকায় বাজায় থেকে ক্রয়
☐ ২আত্নীয়ের কাছে থেকে ধার
☐ ৩. ঋনের টাকায় ক্রয়
☐ ৪. অন্যান্য.....

৬. বাড়ি/ঘরের অবস্থা:

☐ ১. পাকা ঘর
☐ ২. আধাপাকা ঘর
☐ ৩. মাটির/টিনের ঘর

৭.খাদ্যের অবস্থা:

☐ ১. পুষ্টিকর
☐ ২. আংশিক পুষ্টিকর
☐ ৩. পুষ্টি সম্পর্কে ধারণা নেই
☐ ৪. অপুষ্টিকর খাদ্য

৮.সেনিটেশন অবস্থা:

☐ ১. আধুনিক
☐ ২. স্বাস্থ্য সম্মতত
☐ ৩. খোলা জায়াগায়

৯. পানীয়জলের আবস্থা:

☐ ১.অগভীর নলকূপ
☐ ২.গভীর নলকূপ
☐ ৩.কূয়া
☐ ৪.অন্যান্য.....

১০.জমির বিবরণ

ক্রমিকনং	জমির বিবরণ	স্থানীয় এককে জমির পরিমাণ	শতাংশে জমির পরিমাণ
১.	বাড়ির জমি		
২.	আবাদি জমি		
৩.	পুকুর		
৪.	পতিত জমি		
	মোট জমি		

১১.আয়-ব্যয় বিবরণ সম্পর্কিত তথ্য:

ক. ভাসমান সবজির বাগানের জমির বিবরণ:

ক্রমিকনং	জমির বিবরণ	স্থানীয় এককে জমির পরিমাণ	শতাংশে জমির পরিমাণ
১.	নিজস্ব		
২.	ভাড়া নেয়া		
৩.	ভাড়া দেয়া		
৪.	বর্গা নেয়া		
৫.	বর্গা দেয়া		
৬.	বন্ধক নেয়া		
৭.	বন্ধক দেয়া		
	মোট জমি		

প্রতি শতাংশ জমির ভাড়ার পরিমাণ.....টাকা

ভাড়ার পরিমাণ:.....টাকা।

খ. শ্রমিক বাবদ ব্যয়:

ক্রমিক নং	বিবরণ	শ্রমিকের সংখ্যা		মজুরী (দৈনিক)	মূল্য (টাকা)
		পারিবারিক	ভাড়া		
১.	ভাসমান বাগান প্রস্তুতিতে				
২.	রোপন/বপনের				
৩.	সার ও কীটনাশক				
৪.	ফসল আহরণে				

গ. বীজ/চারা, সহায়ক দ্রব্যাদি (বাঁশ, কাঠ, দড়িইত্যাদি) গোবর/কমপোস্ট, সার ও কীটনাশক বাবদ ব্যয়:

ক্রমিক নং	বিবরণ	পারিবারিক	ক্রয়কৃত	মোট মূল্য (টাকা)

		পরিমাণ	মূল্য	পরিমাণ	মূল্য	
১.	বীজ/চারা					
২.	সার					
৩.	কীটনাশক					
৪.	গোবর/কমপোস্ট					
৫.	সহায়ক দ্রব্যাদি					
৬.	অন্যান্য					

১২.ভাসমান সবজির বাগানের ফসলের বিবরণ :

ক্রমিক নং	ফসলের নাম	উৎপাদনের পরিমাণ (কেজি)	প্রতি কেজি/প্রতিটির মূল্য	মোট মূল্য (টাকা)
১.	ডাটাশাক			
২.	কচু			
৩.	সবজির চারা			
৪.	লাউ			
৫.	অন্যান্য (.....)			

১৩.ফসল বিক্রয়ের ধরণ :

- ☐ ১. ক্ষেত থেকে
- ☐ ২. পাইকারদের কাছে
- ☐ ৩. স্থানীয় বাজারে
- ☐ ৪. বৃহৎ বাজারে

১৪.ভাসমান সবজির বাগান করতে প্রয়োজনীয় অর্থের যোগান/উৎস:

ক্রমিক নং	অর্থের উৎস	অর্থের পরিমাণ	মুনাফার হার
১.	নিজস্ব		
২.	ব্যাংক		
৩.	আত্মীয়		
৪.	মহাজন		
৫.	অন্যান্য (.....)		

১৫.ভাসমান সবজির বাগান করতে গিয়ে সম্মুখীন হওয়া বিভিন্ন সমস্যা:

ক. অর্থনৈতিক সমস্যা:

- ☐ ১. উৎপাদনে ব্যবহৃত দ্রব্যেও উচ্চমূল্য
- ☐ ২. অর্থের অপ্রত্যুলতা
- ☐ ৩. উৎপাদিত ফসলেরমূল্য কম
- ☐ ৪. অন্যান্য .....

খ. প্রযুক্তি ও কারিগরী সমস্যা:

- ☐ ১. প্রশিক্ষণ ও জ্ঞানের অভাব

☐ ২. অসামঞ্জস্যপূর্ণ পরিবেশ
☐ ৩. পোকামাকড় ও ফসলের রোগে সমস্যা
☐ ৪. অন্যান্য.....

গ. বাজারজাত করণে সমস্যাঃ

☐ ১. পরিবহণ ও যোগাযোগ সমস্যা
☐ ২. উৎপাদিত ফসলের মূল্য কম
☐ ৩. প্রকৃত বাজার মূল্যের তথ্যের অভাব
☐ ৪. অন্যান্য

১৬.ভাসমান সবজির বাগানকওে আর্থিক অবস্থার পরিবর্তনঃ

☐ ১. খুবইভাল
☐ ২. ভাল
☐ ৩. মোটামুটি
☐ ৪. কোন পরিবর্তন নেই

১৭.ভাসমান সবজির বাগান করার জন্য কোন ধরনের প্রশিক্ষণনি য়েছেন কি না?

☐ হ্যা
☐ না

যদি হ্যা হয়

প্রশিক্ষণের নাম	
প্রশিক্ষণের সময় (দিন)	
প্রশিক্ষণ প্রদানকারী প্রতিষ্ঠান	

১৮.মন্তব্যঃ .....

.....

তারিখঃ.....

সহযোগিতার জন্য ধন্যবাদ

Appendix-II

Some Pictures of Floating Bed Preparation and Crops Harvesting

Appendix-III

Some Pictures of Data Collection


ভাসমান কৃষির গবেষণা এলাকা
স্থান ঃ পূর্বপাড়া, কোটালীপাড়া, গোপালগঞ্জ।