

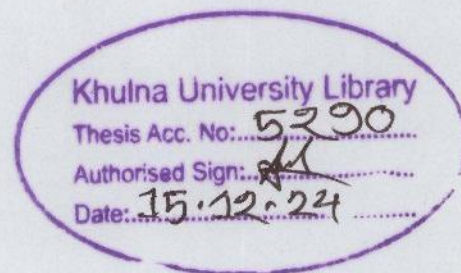
**QUANTITATIVE AND QUALITATIVE IMPACT OF CORONA PANDEMIC ON
LIVELIHOODS OF RURAL FARMERS IN BANGLADESH**

A Thesis

By

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Student Id: MS-210831



**A Thesis (Course No. AERD-6104) Submitted to Agrotechnology Discipline in Partial
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JUNE 2023

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**Dedicated
To
My Beloved Parents & Teachers**

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The Author

ABSTRACT

The rapid transmission and outspread of Corona virus quickly caused a global pandemic. The Corona pandemic and its associated circumscription measures have produced a variety of unexpected disturbances to agricultural and socioeconomic systems around the world. Therefore, the study was conducted at Dumuria and Batiaghata upazila of Khulna district to determine the quantitative and qualitative impact of Corona pandemic on livelihoods of rural farmers in Bangladesh. Data were collected from purposively selected 110 respondents using a pre-tested interview schedule. Highest portion (45.5%) of the respondents were middle aged, 49.1% had secondary level of education and 45.5% had medium sized family. Majority (61.8%) of them had high farming experience, 66.4% had small sized farm and highest portion (48.2%) had medium income. Corona pandemic highly impacted on supply of physical inputs, such as “unavailability of fertilizer in the market”, “unavailability of the required amount of fertilizer for cultivation”, “unavailability of the desired seed variety” while it impacted less on “research activity” in case of agricultural systems. Majority (51.8%) of the respondents had moderately clear perception about impacts of corona pandemic on agricultural systems while 36.4% and 11.8% respondents had partially clear and highly clear perception respectively. Corona pandemic highly impacted on “reduction in income”, “higher family expenditure”, “change in food consumption behavior” and so on while it impacted less on “death of earning member of the family” in case of livelihood activities. Highest portion (55.5%) of the respondents perceived that corona pandemic had moderate impact on their livelihood activities followed by partial impact (44.5%). In case of agricultural production, Corona pandemic lockdown highly impacted on “increased price of agricultural inputs” followed by “increased transportation cost”. But impacted less on “reduction in farmers’ access to market”. Majority (53.6%) of the respondents perceived that Corona pandemic lockdown had moderate impact on agricultural production followed by partial impact (46.4%). In case of magnitude of impact of Corona pandemic, 43.63% respondents considered economic loss as the highest magnitude of impact followed by 41.81% considered the reduction in income and increment of agricultural input cost resulting in higher cost of production. The existing quantitative as well as qualitative impacts of Corona pandemic should be minimized through taking proper initiatives by the concerned authorities to ensure better standard of life of the rural farmers.

Keywords: Impact, Corona, pandemic, livelihood, rural farmers

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CHAPTER I

INTRODUCTION



1.1 General Background

The economy of Bangladesh is primarily dependent on agriculture. Agriculture contributes about 13.35% to country's GDP where 43% of the labor forces are employed in agriculture (BBS, 2020).

On December 31, 2019, the very first occurrences of infection with a novel coronavirus (2019-nCoV) were identified in Wuhan, China which causes the disease termed as COVID-19 (Wang *et al.*, 2020). The rapid transmission and spread of coronavirus disease quickly led to a global pandemic (Middendorf *et al.*, 2021a). The global COVID-19 pandemic has produced a variety of unanticipated shocks to farming and socioeconomic systems around the world (Middendorf *et al.*, 2021b). The COVID-19 global pandemic, and its associated containment measures, have taken a massive toll on economies and societies across the world (Kesar *et al.*, 2021).

Even though the COVID-19 pandemic is a global phenomenon that has heavily affected the lives, livelihoods and wellbeing of the entire population, the degree and severity of its effects are different among groups and sectors (Asegie *et al.*, 2021). COVID-19 has had devastating impacts globally (Gatto and Islam, 2021). COVID-19 and associated lockdown had both severe direct and indirect effects on the population, penetrating several aspects of people's livelihoods. The agricultural sector has been severely affected by the impacts of COVID-19 resulting in disruptions in agricultural value chains and wide-spread food shortages. Disruptions, for example, left daily wage workers, who constitute one-third of Bangladesh's total labor force, with reduced incomes and food insecurity. Labor shortages reduced agricultural production and movement restrictions limited access to markets for both sellers and buyers (Zabir *et al.*, 2020). Prices for agricultural goods spiked at first but then quickly dropped sharply due to absence of buyers and traders in local markets, especially for perishable goods, such as vegetables and fish (Alam and Khatun, 2021 and Sunny *et al.*, 2021). In turn, in urban centers, prices for major food commodities drastically increased (Alam and Khatun, 2021). The combination of reduced agricultural production and limited market access severely undermined food security and diet diversity (Zabir *et al.*, 2020). The lockdown for the COVID-19 pandemic disrupted the whole agricultural system due to the stagnation in the transportation system. The products those produced on the farm were being wasted as it cannot be sold. Marginal farms were suffering most, because they were forced to sell

their products at nominal prices. As the price of food was rising, on the other hand, the farmers were struggling to recover the cost of production. The farmers were deprived of fair price for the agricultural marketing system centered on middlemen, brokers, or warehouses. An unexpected lockdown across borders of countries and within countries caused inputs supply, transports of agricultural products, and labor availability in the agri-food and marketing sector, which affected the food availability and prices globally (FAO, 2020a).

In Bangladesh, there are 3 main agricultural seasons, aman (May-October), boro (November-April), and aus (April-May). COVID-19 started in the end of March in 2020, and before the government-imposed lockdown and travel restrictions were in effect, much of the boro crop production in 2020 had already been harvested. For the boro crop harvest, such as boro rice or potato, the challenge was further downstream in the value chain. Traders were restricted to pick up the potatoes, farmers were limited to travel to markets to sell the produce. In turn, the Aman crop planting, mainly rice, was severely affected by the government-imposed movement restrictions (Gatto and Islam, 2021). Corona pandemic and associated lockdown had both severe direct and indirect effects on the population in several aspects of agriculture and rural farmers' livelihoods in Bangladesh.

Corona pandemic impeded all aspects of life and livelihoods. All spheres of human life were disrupted due to the pandemic which carry several impacts to diversified spheres of human life and livelihoods. To this end, this study is aimed at determining the impact of Corona pandemic on the livelihoods of rural farmers of Bangladesh.

1.2 Statement of the Problem

On March 8, 2020, Bangladesh recorded the first person infected with COVID-19. Since then, infection rates climbed quickly which was accompanied by a high fatality rate. To slow the spread of the disease, the Bangladeshi Government imposed lockdown which drastically restricted movements of people and goods (Gatto and Islam, 2021). The COVID-19 outbreak has left an indelible effect on Bangladesh's agriculture sector, like that of most developing countries. During the early phases of the pandemic, farmers engaged in agriculture production got poor prices, with the majority of them incurring losses. Labor shortages and input scarcity were the most prevailing hindrances across all the sub-sectors. The supply chain for agricultural commodities was disrupted

as a result of the lockdown and mobility restrictions, which resulted in the elimination of the majority of intermediaries (Islam *et al.*, 2023). Rural farmers' livelihood activities confined with a lot of sufferings due to the pandemic.

In view of the above background and facts, the present study was undertaken with the title "Quantitative and Qualitative Impact of Corona Pandemic on Livelihoods of Rural Farmers in Bangladesh". The study aimed at providing information regarding the following queries:

- I. What are the Socioeconomic characteristics of the respondents after Corona pandemic?
- II. What is the perception of the respondent on impacts of Corona pandemic on agricultural systems?
- III. What is the extent of the impact of Corona pandemic on the livelihood activities of rural farmers?
- IV. What is the impact of Corona pandemic lockdown on agricultural production?
- V. What is the magnitude of impact of corona pandemic?

1.3 Objectives of the Study

Considering the facts this study was conducted to identify to quantitative and qualitative impact of Corona pandemic on livelihoods of rural farmers in Bangladesh. The specific objectives of the study were:

- I. To describe the socioeconomic characteristics of the respondents
- II. To find out the extent of rural farmers' perceptions on impacts of Corona pandemic on agricultural systems
- III. To determine the impact of Corona pandemic on the livelihood activities of the rural farmers
- IV. To explore the impact of the Corona pandemic lockdown on agricultural production
- V. To explain the magnitude of the impacts of Corona pandemic

1.4 Scope of the Study

The study will show the quantitative and qualitative impact of corona pandemic on livelihoods of rural farmers in Bangladesh. The scopes of the study are as follows:

- I. The study was conducted at Dumuria and Batiaghata upazila of Khulna district. The findings may also be applicable to other areas of Bangladesh where socio-cultural, psychological and economic situation do not differ much than those of the study area.
- II. The study will help to understand impact of corona pandemic on livelihoods of rural farmers.
- III. The study will help to determine the changes in livelihoods of rural farmers due to corona pandemic.

1.5 Assumptions of the Study

An assumption is the supposition that an apparent fact or principles is true in the light of available evidence. The following assumptions were in the mind of the researchers while conducting the study:

- I. The selected respondents were capable of furnishing proper responses to the questions contain in the interview schedule and responses furnished by the respondents were valid.
- II. Information furnished by the respondents included in the sample was the representative of the whole population of the study area.
- III. The researcher who acted as interviewer was well adjusted to the social environment of the study area. Hence the data collected by him from the respondents were free from bias.
- IV. The respondents selected for the area were competent enough to the reply the questions made by the investigator.



1.6 Limitations of the Study

The limitations of the study are as follows:

- I. The study was conducted at Dumuria and Batiaghata upazila under Khulna District. Thus the finding may not represent the real scenario of whole country due to the wide spread variation in nature and one social system to other.
- II. Only few characteristics were taken into consideration for investigation in this study.
- III. The interview schedule was prepared in English but was translated into mother tongue while interviewing data.

1.7 Definition of the Terms

Certain key terms were used throughout this study which are defined here for clarity of understanding.

Age: Age of the farmers refer to the period of time in years from his birth to the time of interview.

Educational qualification: It refers to the ability of an individual to read and write or having formal education received up to certain standard of full schooling years.

Family size: It refers to actual number of permanent members in a subject's family who lived in a fixed dwelling unit and ate from the same cooking arrangement.

Farming experience: It refers to the actual number of days that individual involved with agricultural work which measured by the number of years from his/her involvement with agricultural work to the time of interview.

Farm size: Farm size refers to the respondents' area of ownership and area under cultivation in hectare.

Monthly family income: Family income refers to the total earnings of all the family members of a respondent from agriculture, job, business, service and other accessible sources.

Training received: It refers to the total number of training and total days that a respondent received in his entire life from different organizations under different training programs.

Organizational participation: Organizational participation of an individual refers to his/her participation in various organizations as ordinary member, executive committee member and executive committee officer.

Cosmopolitanism: It refers to an individual's exposure outside his own social environment, his exposure to the nearest village, own union, own upazila, other upazilas, districts or places of social and agricultural important.

Extension media contact: It refers to an individual's exposure to or contact with different communication media and sources and personalities being used for discrimination of new technologies among the farmers.

Impact: The positive and negative changes produced by an intervention, directly or indirectly, intended or unintended.

Livelihood: Livelihoods are 'means of making a living', the various activities and resources that allow people to live.

CHAPTER II

REVIEW OF LITERATURE

This chapter deals with the review of past researches related to this investigation. In spite of sincere effort adequate numbers of direct related literatures were not readily available for this study. Literatures were arranged in section wise. However, the literatures of available studies have been briefly discussed in this chapter.

2.1 Quantitative and Qualitative Impact

Quantitative impact is determined by financial losses, including lost revenue, assets or production units, and salary paid to a stalled workforce. It is a positive/negative affect on financial assets, tangible assets, intangible assets, business continuity, and health and safety. Qualitative impact is much less tangible than quantitative impact, and more difficult to evaluate.

2.2 Impacts of Corona Pandemic on Agricultural Systems

The lockdown for the COVID-19 pandemic disrupted the whole agricultural system due to the stagnation in the transportation system. The products those produced on the farm are being wasted as it cannot be sold. Marginal farms are suffering most, because they are forced to sell their products at nominal prices. As the price of food is rising, on the other hand, the farmers are struggling to recover the cost of production. The farmer is being deprived of his fair price for the agricultural marketing system centered on middlemen, brokers, or warehouses. The global impact of the COVID-19 epidemic on agriculture necessitates immediate and long-term responses. First of all, in order to develop necessary actions, it is essential to analyze and understand the direct consequences of the current pandemic on agricultural and food systems. As a result, the risks, vulnerability, resilience, and systemic shifts of agricultural systems to adapt to the present situation must be properly understood (Boughton *et al.*, 2021).

The economic impacts of COVID-19 disturbances on farms and agricultural workforce dependent households, agribusiness firms, and rural and urban buyers were severe, according to Boughton *et al.* (2021), who conducted research across Myanmar's agro-food system. Several crises have impacted the agro-food industry, including internal and overseas demand shocks, supply disruptions owing to movement limitations, and financial constraints. In India, Cariappa *et al.* (2021) found that movement restrictions, transportation issues, and reverse worker migration affected internal distribution networks, resulting in wholesale and retail price increases for several goods such as pulses, wheat, four, milk, and vegetables. Economic distortions in key rice exporters

such as Thailand and Vietnam, pushed up world prices, hurting African countries that rely heavily on imported food (Sers and Mughal, 2020).

Popescu and Popescu (2021) undertook a complete review of the COVID-19 pandemic's consequences on Romanian agricultural systems, compliance with limitations, and relationships with authorities, and made some recommendations for future management of such circumstances. They also gave a clear picture of the hardships and challenges Romanian farmers experienced throughout the pandemic. Farmers had challenges with farming technologies and agri-food product sales.

Tripathi *et al.* (2021) investigated the effects of COVID-19 on agriculture, local farming systems, and farmer adaption techniques in Tanzania and South Africa. Their study revealed that COVID-19 had a significant impact on agriculture and food security, owing to indirect channels of affect that resulted in (i) income losses and falling demands, (ii) supply chain breakdown, (iii) changed consumer reactions and dietary changes, and (iv) international and domestic trade disruptions.

Immediate impact of COVID-19 on agricultural system

Worldwide combined efforts to inhibit the virus by keeping down the human activity irresistibly caused financial shocks and costs which have the impacted on agricultural and food production system. Quarantine had severe impacts on the availability of labor for the time bounding farming such as vegetable, crops, and fruit picking. These effects become deeply in food production sector and global economics as the problem increases day by day. The consequences of the covid-19 pandemic on the agriculture sector can be divided into five categories: food security, labor availability, agricultural system resilience, farming system interconnection, and others (Haque *et al.*, 2022).

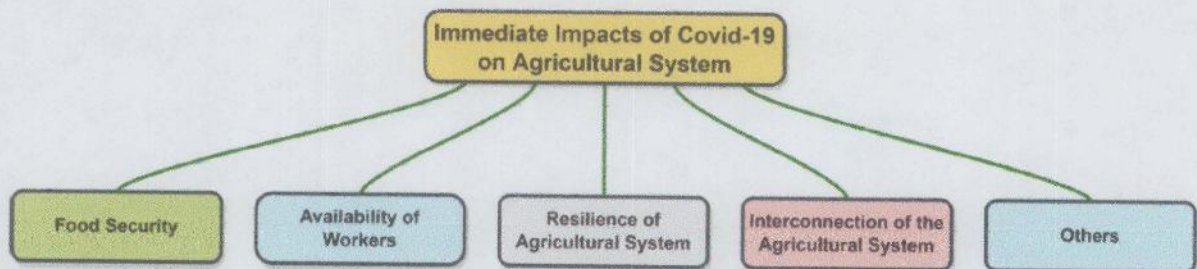


Figure 2.1 Immediate impacts of COVID-19 pandemic on agricultural system (Haque *et al.*, 2022)

Food security

Due to a loss of income temporary workers reduced the food purchase ability. Panic buying broke up the market supply system. People stored food more than their demand for fear of not getting later. Perishable products like fruits, vegetables, and milks are ruined because of transportation restriction. Food security defines having unrestricted access to food sufficient to encounter their basic needs (Rosales and Mercado, 2020).

Availability of workers

The economic and social shock caused by the COVID-19 pandemic was a global phenomenon that has impacted people from all walks of life. Transport restriction hampered the movement of workers which had severe impact on horticultural, livestock, and food processing industries. Plantation and harvesting operation were impeded due to the lack of expert workers. The pandemic had a smaller influence on the income of rural informal laborers, particularly those who work in agriculture-based employment (Swarna *et al.*, 2022). Urban informal sector laborers, on the other hand, were the hardest effected by the pandemic, as they were restricted from moving throughout communities during lockdown (Swarna *et al.*, 2022 and Siche, 2020). With their low daily wages, most urban informal workers live in deplorable conditions, and they were the hardest struck by the pandemic (Sakamoto *et al.*, 2020). The workers' well-being was influenced by their income decreases. Swarna *et al.* (2022) discovered that they had to cut more than a quarter of their food spending. Because of lockdown, quarantine, and other constraints, COVID-19 produced a vicious circle between workforce availability and income.

Resilience of agricultural system and interconnection of the agricultural system

Basic variation of economy, technology, demography, ecology and social environment creates struggling condition for many farming system (Meuwissen *et al.*, 2020). Border restrictions, travel bans, and lockdowns added threat to the agriculture sector especially for perishable products (European Commission, 2020). Agricultural system resilience to the COVID-19 pandemic was another index to measure the effects COVID-19. Small farms that primarily use family labor, were less dependent on externally hired labor, more resilient than large farms which depend on external labor (Ragasa *et al.*, 2020, Workie *et al.*, 2020, Meuwissen *et al.*, 2020). The COVID-19 virus outbreak had strong influence on international relationships that extends far beyond the workforce of the agro-food sector. Export restriction of various states created barrier for the entrance of

agricultural product into the market. Flight and port shutdown hampered the international supply chain. By the sake of 'Food sovereignty' few nations seriously impacted on global agro-marketing system.

Other consequences

The COVID-19 epidemic had a substantial impact on humanity's behaviors and activities, and agriculture was not out of it. Food security was significantly impacted due to mobility restrictions; purchasing power has decreased; conversely, food demand had increased, and an unbalanced impact on the most vulnerable population groups had also been seen. (Swarna *et al.*, 2022 and Siche, 2020). Increased focus on public health and sanitation created greater competition for vital inputs, specifically water. Impacts on achieving SDGs become more difficult. Research works were severely hampered in agro-sector. Impacts of supply chain and processing disrupt on animal welfare (Workie *et al.*, 2020, Meuwissen *et al.*, 2020).

2.3 Impacts of Corona Pandemic on Livelihood Activities

The COVID-19 pandemic compounded challenges of food security and sustainable livelihoods in developing countries (Rasul, 2021). The agricultural supply chain is disrupted by the pandemic (Pu and Zhong, 2020).

The study conducted in India depicts that the marginalization of women for accessing agricultural information is exacerbated as a result of the pandemic (Alvi *et al.*, 2021), and in turn put them at adverse long-term risk (Agarwal, 2021). The pandemic resulted in increased unemployment, decreased income for daily labor, increased food insecurity, depletion of saving and relief measures in India (Harris *et al.*, 2020). Similarly, the study conducted in Kenya and Uganda reveals that more than two-thirds of the respondents experienced income shocks due to the pandemic (Kansiime *et al.*, 2021).

As it is elaborated by Aromolaran and Muyanga (2020), the pandemic negatively affected farming households through decreased availability of labor, raised the cost of farm labor, and declined the sales of agricultural products.

The COVID-19 pandemic is likely to have confrontational effects on agrarian households in Ethiopia (Kassegn and Endris, 2021). Smallholder farmers are one of the vulnerable groups who might be hindered from working on their land, accessing markets to sell their products, or buying

seeds and other essential inputs (Food and Agriculture Organization of the United Nations (FAO), 2020a). About 30% of the rural wage labor were lost their job (Wieser *et al.*, 2020).

An overwhelming percentage of the respondents reported that due to COVID-19's lockdown, it was hard for them to find a job to maintain the daily family expenses. The effects of COVID-19 pandemic are not only limited to health but also have a major impact on the social and economic aspects (Bhuiyan *et al.*, 2020). Reports expressed that the COVID-19 would badly affect the livelihood of almost half of the global workforce both in cities and rural areas (Goshu *et al.*, 2020). It was reported that more than 10 million people will be further marginalized due to the loss of wages and jobs in Bangladesh (Ibrahim *et al.*, 2020). Bodrud-Doza *et al.* (2020) reported that many low- and middle-income people of Bangladesh will lose their jobs and income sources due to COVID-19 outbreaks.

Middendorf *et al.* (2021a) conducted a survey and found majority of respondents reported that it was more difficult to get enough food on a regular basis for their household (95.9%); that the markets where they purchase food was either closed or significantly disrupted (98%); that the price of food increased (92.3%); and the market where they sell their produce was either closed or significantly disrupted (97.4%). Farmers with 96.6% indicating disagreement that they had access to social services to help their household, and 98.5% of the respondents disagreed that they had access to farm credit. Similarly, 96.1% of respondents disagreed that they had access to subsidies or other financial supports (98.2%). When asked "what were the greatest challenges that COVID-19 posed for your household," 69.4% of the 603 respondents reported issues related to poverty, loss of income, unemployment, and deterioration in living conditions. Other major challenges reported (47.4%) included food insecurity, concerns of health, (both physical and mental), and issues related to preventative measures (e.g., market closures, mobility restrictions, curfews).

2.4 Impacts of Corona Pandemic Lockdown on Agricultural Production

Bangladesh Rural Advancement Committee (BRAC) conduct an experiment in 2020 to find out the initial loss in the agricultural sector for the lockdown started in March 2020 in Bangladesh. According to their study from the last week of March to starting of May 2020, more than about 56,536 thousand cores BDT has been loss by the farmer. Because of artificial crisis at the onset of the pandemic has led to a slight increase in market prices, however, no avail to farmer. As the production of perishable goods continues and restrict the transportation facilities, it becomes difficult to sell the produced product. 88% farmer and about 100% fishers reported their financial

loss. The significant problems mentioned by the farmers, getting no fair price (66%), keep the market open for the limited time (52%), high price of raw materials (45%), and lack of laborer (28%). Poultry prices have dropped about 44% since restaurant closed due to the holidays during lockdown. Because of decreasing demand, farmers are reduced the production which results supply shortage. As a result of shortage of supply, prices of poultry and eggs increased by 26% and 8%, respectively. COVID-19 also effects on the dairy field also. Demand of dairy products drops by 33–60% resulting in farmers reducing production by 18% of their ability (BRAC, 2020). In Bangladesh, COVID-19 and its consequences have caused havoc on an approximate 0.3 million dairy plants and 65–70 thousand poultry farms. Most of them lost their capital investment because of gradual losses. Approximately 12 to 15 million liter milk remain unfarmed that caused 6.7 million USD loss only in the milk production sector. In poultry industries from March 20 to April 4, 2020, within 2 weeks, estimated loss was 1.35 billion USD (Rahman and Das, 2021).

Gatto and Islam (2021) found a negative effect for Aman rice (and not for Boro rice) may be explained by the timing of the pandemic and associated government restrictions. The lockdown measures of April 2020 affected harvesting and post-harvest activities for Boro rice. For Aman rice, in contrast, the planting period was affected possibly resulting in reduced labor availability. In addition, (fear of) sickness affected farmers' willingness and ability to travel to their plots during planting stages.

Boughton *et al.* (2021), who conducted research across Myanmar's agro-food system found that 32% respondents had trouble finding traders to whom they could sell, 28% were constrained by market closures, 27% were hindered by movement restrictions, and 25% could not find adequate transportation to markets. Challenges in selling agricultural produce were accompanied by lower prices for commodities, as reported by 39% of the interviewed farmers. Thirty-four percent of farmers also expected further challenges in selling their harvest due to COVID-19. Rural respondents in the community survey confirmed that these issues were present nationwide: 52% mentioned more difficulties than usual for farmers to sell their produce, mainly due to low output prices, COVID-19 related mobility restrictions and not enough traders/brokers making purchases.

Middendorf *et al.* (2021a) conducted a survey and observed the impacts of COVID-19 on vegetable systems, including a reduction in access to inputs, a reduction in yields, a loss of income, reduced access to local and urban markets, reduced access to transportation, and an increase in post-harvest loss.

Mthembu *et al.* (2022) carried out a survey in the Northern Drakensberg areas of Bergville, and it assessed the impact of COVID-19 on agricultural food production in smallholder farming systems. Most farmers (77.1 to 92.4%) reported having limitations in accessing agricultural inputs of seeds, fertilizers, herbicides, fungicides, and insecticides during the COVID-19 pandemic. Results indicated a continuous decrease in yields of maize, dry beans, and soybeans across two years of cropping seasons during the COVID-19 pandemic. The study demonstrated that COVID-19 lockdowns accompanied by movement restrictions negatively impacted food production of staple crops (maize, dry beans, soybeans) despite suitable rains received during COVID-19 production periods.

Farming is an input-intensive sector also each component of production can vary considerably in the agricultural production system. The inputs and connectivity including seeds, fertilizers, chemicals, irrigation equipment's and marketing of agricultural commodities were distrusted with respect to interruptions in transportation, delays in customs clearance, limitation of credit access, increased interest rates, and capital costs, which can lead to an increase the cost of the inputs. The increases in inputs cost and the perishability of agricultural products may lead to a huge loss to the farmers. The exiting situations retarded the distribution of food and agricultural inputs which created barriers in continuous food production and supply to markets (Arumugam et al., 2021).

2.5 Impact of COVID-19 on Fisheries

The open water fish catching was greatly affected by COVID-19 pandemic globally. At the peak of the coronavirus crisis in the United States of America, as for example, catches declined by up to 40 percent over the nation (White, 2020). The demand was dropped resulted in abridged prices of fish and fish products. Constrains of input supplies (e.g., ice, gear, bait) were another limit on the scenario. The effects on catches varied around the world, with several nations experiencing substantial decreases in production in the early weeks of the Covid-19 problems. The aquaculture production has also been plagued by COVID-19 pandemic. The economic scenario for aquaculture production and markets is still quite unstable and uncertain, which has an impact on pandemic related operations (OECD, 2021). But, in many countries fish production is considered as main financial sources for fishers but this sector will feasibly struggle to withstand its activity or sustain its scheduled production cycles due to lockdown

and related economic slowdown worldwide (Zhang, 2020). Travel barriers, hard rules of seed import, and labor crisis can be some obstacles against aquaculture in the medium to long term

(Virginia Agricultural Research and Extension Centers (VT), 2020). Some nations exempted the aquaculture sector from lockdown actions (Ramsden and Harkell, 2020) or established strategies to regulate the exercise of the free movement of workers during COVID-19 outbreak (EUR-Lex 2020) but the less developed countries like Bangladesh, Pakistan, Thailand, Sri Lanka, Myanmar, Nepal will face difficulties in the coming days. Low market demand, closure of international markets (e.g., China, European Union) (Pham, 2020), travel ban, and insufficient quality seed will severely impact the production of aquaculture in the aforementioned countries.

Rahman *et al.* (2021) conducted an experiment on Baor fishery (oxbow lake) to find out the effects of COVID-19 pandemic on food security. The Baor fishery community was also severely impacted by the epidemic in case of income, food security, and health issues. Because of diminished customer and demand during the lockdown, fishermen have had to halt harvesting or limit the quantity of fish, which was the major source of income for the baor fishing community.

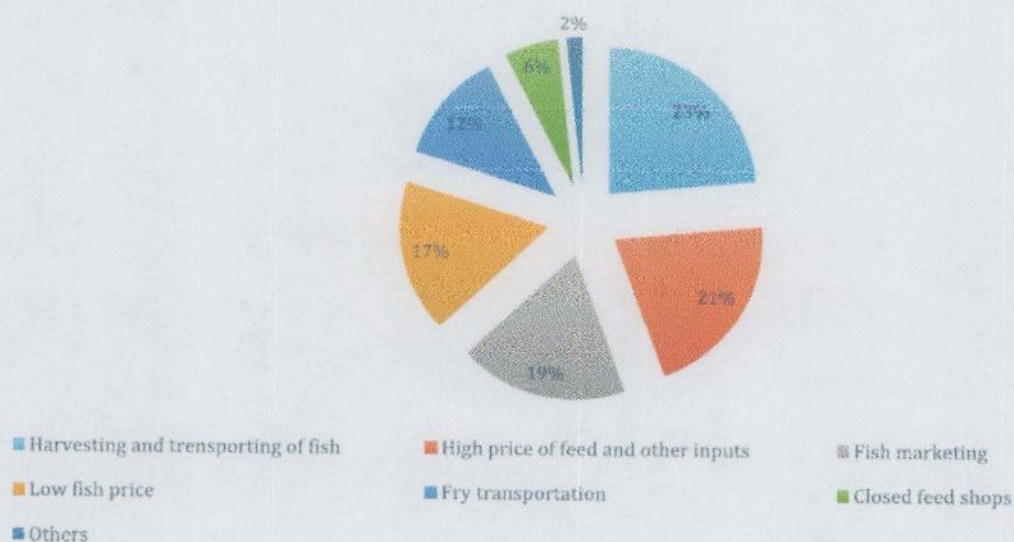


Figure 2.2 Main obstacles in oxbow lake fisheries (Haque *et al.*, 2022)

2.6 Impacts of COVID-19 on Poultry, Dairy, and Livestock Sector

According to the Bangladesh Poultry Industry Central Council, poultry meat supply dropped by 40 to 45% over previous one and half year; roughly, production was 90,000 tons per month in pre-pandemic periods (BPICC). BPICC also stated that more than 40% of farms already stopped farm because they were unable to withstand pandemic related losses (Ali and Chowdhury, 2021). The impact of COVID-19 on the livestock industry was mostly unknown and undefined. Although

formal assessments were not yet attainable, recent findings show that livestock supply chain was disrupted. From previous epidemic's study suggest that these disruptions as well as their devastating socioeconomic implications are only going to get worse. However, steps may be done to safeguard this field and the services and goods that it provides to the entire world. Daily milk demand was being decreasing gradually at the beginning of the lockdown because of COVID-19 and produced milk remains unsold. Famer faced large financial loss at the time of pandemic period (Popat *et al.*, 2020). Low milk rates also affected the sector, which fell by 4.6% on average across 70 nations, and even fell by 29 and 19% in the USA and India, respectively (IFCN (International Farm Comparison Network), 2020). Consequently, COVID-19 estimated to cost the cattle sector \$13,617,418,450 in economic losses. Many cattle growers and marketers lost access to national and international markets, and as a result decrease income. Border controls in Asia halted livestock commerce from Lao PDR, Thailand, Myanmar, and Vietnam to China (FAO, 2020b). Argentina and Uruguay were losses their earning because of export restriction.

2.7 Long-Term Effects of COVID-19 on Agriculture and Food Supply

Providing food security and nutrition to a growing global population, assuring the livelihoods of millions of people working throughout the food chain from farm to fork, and ensuring the environmental sustainability of the industry are all essential objectives (OECD, 2021). However, legislative initiatives have not progressed in this direction, and global agriculture and food commerce remain unbalanced. COVID- 19 has prompted policymakers to make quick decisions in order to keep food supply networks running. Continued investment in the long-term objective of resilient, sustainable, and productive food systems is also important.

2.8 Conceptual Framework of the Study

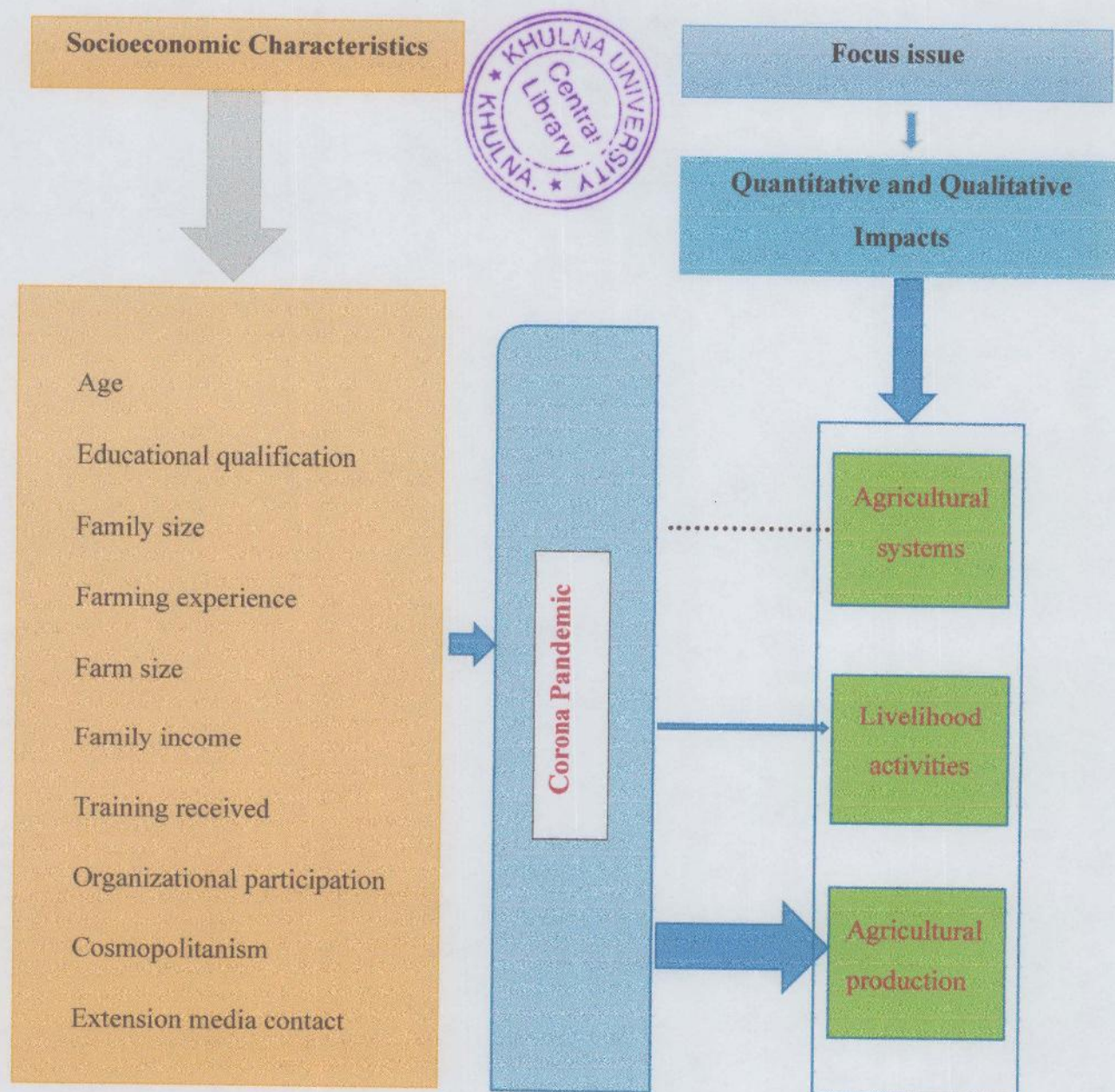


Figure 2.3 Conceptual framework of the study

Here,

..... Denotes that it might have some impacts.

→ Denotes it have some impacts.

→ Denotes it must have some impacts.

CHAPTER III

METHODOLOGY

Research methodology is a systematic way to solve a research problem. It can also be defined as the study or description of methods. It may be understood as a science of studying how research is done. It is the general research strategy that outlines the way in which research is to be undertaken and identifies the methods and procedures to be used in it. A methodology does not set out to provide solution, these methods described in the methodology; define the means or modes of data collection or something how a specific result is to be calculated. So, before conducting a research work it is very important to select proper methods and procedures that are required for collection and analysis of data.

Without an appropriate methodology the researchers are unable to collect valid and reliable data and it is important to analyze and interpret those data to reach at correct summary and conclusion. The methods and procedures followed in conducting this study have been described in this chapter.

3.1 Design of the Study

The study was conducted on the basis of collection of data through survey by interviewing rural farmers. Mixed method was used where both quantitative and qualitative data were collected. Quantitative and qualitative data were collected through interviewing respondents of the selected area using interview schedule. Qualitative data were collected through case study. It was designed to understand quantitative and qualitative impact of Corona pandemic on livelihoods of rural farmers at Dumuria and Batiaghata upazila.

3.2 Locale of the Study

The study was conducted at few villages under three unions of both Dumuria and Batiaghata upazila of Khulna district. Dumuria and Batiaghata upazila were selected for the study since it is not very far from Khulna University as well as easily accessible. Those upazilas have large population and severely affected by corona pandemic. Besides those areas people are quite conscious as they live not very far from sadar upazila. The villages were deliberately selected by the researcher. The area of Dumuria and Batiaghata upazila are 454.23 km² and 248.32 km² and they are 18 kilometers and 13 kilometers away from Khulna Sadar. In Dumuria upazila, the total land area under cultivation is 63013 acre and cropping intensity is 197% and main crops are rice, jute, vegetables. In Batiaghata upazila, the total land area under cultivation is 30296 acre and

cropping intensity is 187% and main crops are rice, oil seed, vegetables. Main source of income is from agriculture in Dumuria and Batiaghata upazila and was 65.43% and 57.45% respectively.

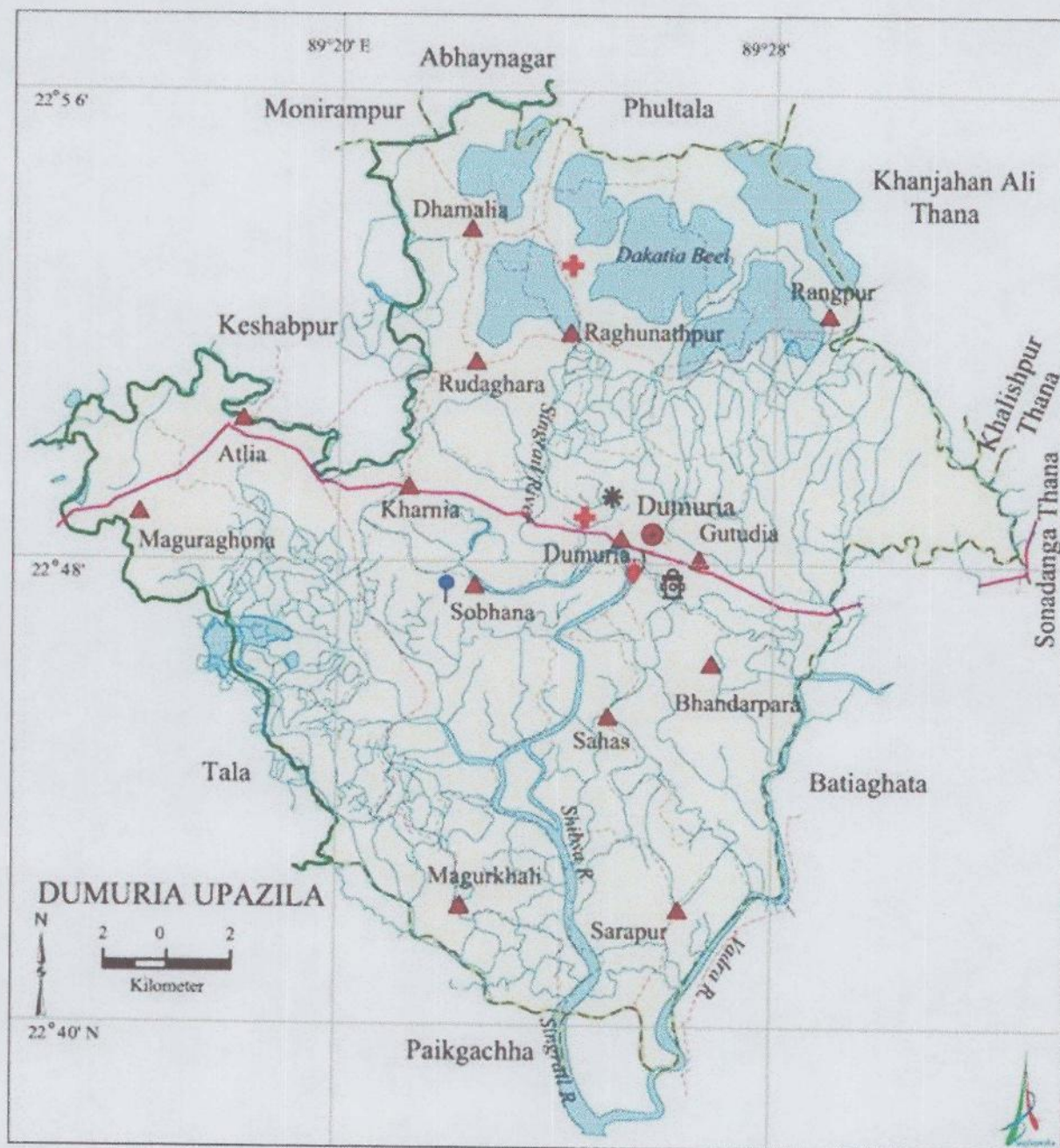


Figure 3.1 Map of Dumuria upazila, Khulna District

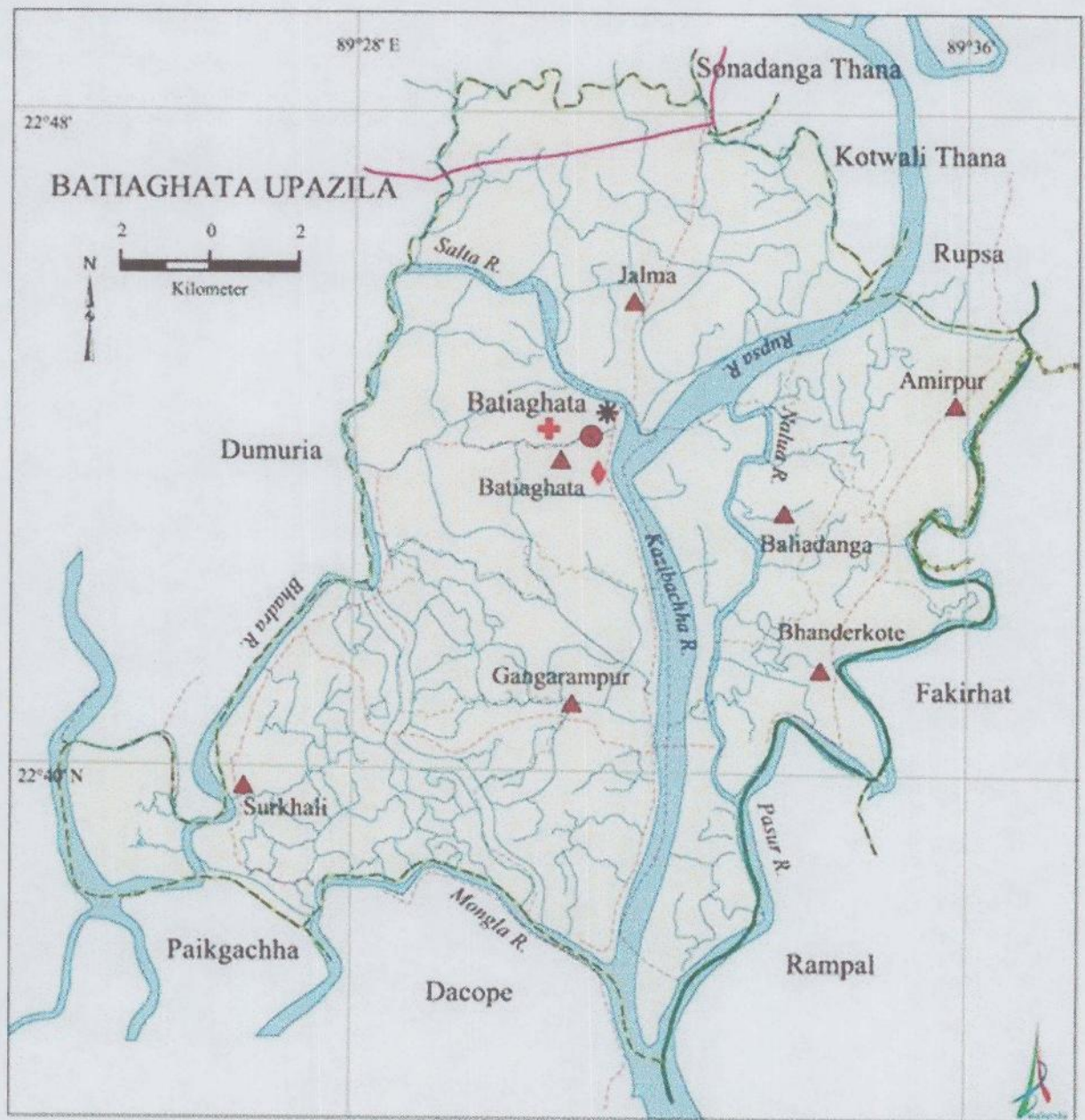


Figure 3.2 Map of Batiaghata upazila, Khulna District

3.3 Population and Sampling

All rural farmers of the upazila were considered as the population of the study. At first three unions from each of Dumuria and Batiaghata upazila were selected and data were collected from different villages of those unions. The respondents were from villages of Gutudia, Bhandarpara and Dumuria union of Dumuria upazila and villages of Gangarampur, Surkhali and Batiaghata unions of Batiaghata upazila. Multistage stratified random sampling technique was used for determining and collecting data from the respondent. The respondent number was selected purposively where unbiased randomization was done while interviewing each of the respondents.

Table 3.1 Distribution of the respondents of the study area

Name of Upazila	Name of Union	Number of Respondents
Dumuria	Gutudia	18
	Bhandarpara	21
	Dumuria	16
Batiaghata	Gangarampur	25
	Surkhali	19
	Batiaghata	11

3.4 Preparation of Interview Schedule

An interview schedule was prepared for collecting valid and reliable information from the villagers. This interview schedule was used as research instrument. It was designed according to the objectives of the study. Different simple and direct questions and scales were added to the interview schedule to collect data required for the selected variables. The English version of the interview schedule has been added in Appendix A.

3.5 Method and Time of Data Collection

The researchers collected data from the villagers through interview during their free time. The local people, the agricultural officers of the concerned block and areas helped and cooperated the researcher in data collection. During data collection, the researcher made necessary efforts to establish rapport with the villagers and farmers, so that they become free to answer the questions and statements included in the interview schedule. The researcher explained and clarified the

questions and statements as much as possible so that the farmers could easily understand and answer the questions correctly. All the data in the interview schedule was collected from the farmers checked properly. The farmers were very cooperative during interview. The researchers collected data from the respondents during March, 2023 to April, 2023. During this time the researcher made several visits for collecting valid and reliable data from the respondents.

3.6 Specification and Measurement of the Variables

3.6.1 Specification of the Variables

In survey research the specification and measurement of the variables constitute an important task. A research hypothesis contains at least two elements, an independent variable and focus variable. The researcher keeping all these in mind took adequate care in selecting the variables of the study. Before the onset of the study, the researcher visited the study area for several times. The researcher also met the farmers several times to establish an intimate relationship so the farmers can share their experiences. Based on the practical knowledge, side by side an extensive literature review and discussions with relevant experts and academicians, the researchers selected socioeconomic characteristics of these respondents as independent variables for the study. For the respondent farmer, the selected socioeconomic characteristics (independent variables) are age, educational qualification, family size, farming experience, farm size, monthly family income, training received, organizational participation, cosmopolitanism and extension media contact.

Table 3.2 Selected socioeconomic characteristics of respondents

i.	Age
ii.	Educational qualification
iii.	Family size
iv.	Farming experience
v.	Farm size
vi.	Monthly family income
vii.	Training received
viii.	Organizational participation
ix.	Cosmopolitanism
x.	Extension media contact

3.6.2 Measurements of Socioeconomic Characteristics

3.6.2.1 Age

Age of the respondents was determined by counting their age from the birth to the time of data collecting according to their statement. It was expressed in terms of complete year. It was scored one for each year of their age. It is included in the interview schedule as the item No.1 (Appendix A). According to age range the respondents of the upazila were classified into three categories as shown in Table 3.3.

Table 3.3 Categories of respondents according to their age

Categories	Age limit (Years)
Young aged	≤ 35
Middle aged	36-55
Old aged	> 55

3.6.2.2 Educational Qualification

Educational qualification of a respondent was measured in terms of year schooling. A score of score zero (0) was assigned to the respondents who cannot read and write means illiterate. If a respondent receive education outside of the school, his education equivalence score was determined corresponding to the level of his formal education. A score of "one" was assigned for every completed schooling year. The minimum can be "0" and maximum score is unknown. Educational qualification belongs to item No. 2 in the interview schedule (Appendix A). Based on educational qualification, the respondents were categorized into following categories as shown in Table 3.4

Table 3.4 Categories of respondents according to their educational qualification

Categories	Score (Years of schooling)
Illiterate	0
Can sign only	0.5
Primary	1-5
Secondary	6-10
Higher Secondary	11-12
Undergraduate	13-16
Postgraduate	>16



3.6.2.3 Family Size

Family size was determined by the total number of family members of a respondent including the respondent and the others dependents. Score of a farmer on family size was counted by the actual number of their family members. Family size belongs to item No. 3 in the interview schedule (Appendix A). On basis of family size, respondents were classified into following categories as shown in Table 3.5.

Table 3.5 Categories of respondents according to their family size

Categories	Number of family members
Small	≤ 4
Medium	5-6
Large	> 6

3.6.2.4 Farming Experience

The experience in farming of a respondent was measured by the length covered from his starting year in farming to the interview on the basis of his statement No. 4 in the interview schedule (Appendix A). The minimum and maximum score is unknown. On the basis of the farming experience, they are classified into following categories as shown in Table 3.6.

Table 3.6 Categories of respondents according to their farming experience

Categories	Score
Low	≤ 10
Medium	11-20
High	> 20

3.6.2.5 Farm Size

Farm size refers to the total area of land owned by a respondent including homestead area. It also includes the land obtained from others on share cropping/lease or taken from others on lease. The area was being estimated in terms of full of benefits to the respondents. The farm size was calculated using following formula,

$$FS = A1 + A2 + 1/2 (A3 + A4) + A5 + A6$$

Where, FS= Farm size

A1= Homestead

A2= Own land under cultivation

A3= Land given to others on barga

A4= Land taken from others on barga

A5= Land taken from others on lease

A6= Other

The farm size was recorded in local unit and then it was converted to hectare. Farm size belongs to item No.5 in the interview schedule (Appendix A). On the basis of farm size, farmers were classified into five categories which are shown in Table 3.7.

Table 3.7 Categories of respondents according to their farm size

Categories	Score (ha)
Landless	≤ 0.02
Marginal	0.02-0.2
Small	0.21-1.0
Medium	1-3
Large	>3

(Source: Agricultural Extension Manual, 2018)

3.6.2.6 Monthly Family Income

Family income (monthly) of a farmer was estimated by considering total earning in the last year from different sources viz. agriculture, business, service and others. Family income is included in the interview schedule as item No. 6 of the interview schedule (Appendix A). The minimum and maximum score is unknown.

Table 3.8 Categories of respondents according to their monthly family income

Categories	Amount (BDT)
Low	<15000
Medium	15000-25000
High	>25000

3.6.2.7 Training received

Training score of the respondent was measured depending on the number of training the respondent had received. For computing training score was given receiving on the training only. Respondents who have received one or two or three trainings, were assigned a score of 1, 2, 3 respectively. The score 0 was assigned if they do not take any train. Training received is included in the interview schedule as item No. 7 (Appendix A). The respondents were classified into following categories in the Table 3.9.

Table 3.9 Categories of respondents according to their training received

Categories	Score
No	0
Low	≤ 2
Medium	3-5
High	> 5

3.6.2.8 Organizational Participation

Organizational participation of a respondent was measured on the basis of his involvement and the nature of participation in different organizations of the study area during the time of interview. List of different organizations are shown in item No. 8 in the interview schedule (Appendix A). The score '0' was assigned for no participation, "1" for ordinary member, "2" for executive committee member and "3" for executive committee officer. The summation of score obtained by a respondent was the score of his/her organizational participation, farmers are classified into following categories as shown in Table 3.10.

Table 3.10 Categories of respondents according to their organizational participation

Categories	Score
Low	≤ 8
Medium	9-16
High	> 16

3.6.2.9 Cosmopolitanism

The cosmopolitanism score of a respondent was measured to determine the extent of his cosmopolitanism on the basis of his frequencies of visits to the places outside of his own social system. It was determined by counting the number of visits made in five different places which indicate the extent of visit as frequently, occasionally, rarely and not at all and the scores were 3, 2, 1 and 0 respectively. The score could range from 0 to 15 where '0' meaning no cosmopolitanism and "15" meaning very high cosmopolitanism. Cosmopolitanism of the respondents is shown in item No. 9 (Appendix A). Respondents are classified into different categories according to their cosmopolitanism as shown in Table 3.11.

Table 3.11 Categories of respondents according to their cosmopolitanism

Categories	Score
Low	≤ 5
Medium	6-10
High	>10

3.6.2.10 Extension Media Contact

Extension media contact of a respondent was determined as his degree of exposure with different extension media and persons that acted as information sources to motivate him and to broaden his outlook to new practices. A list of media sources was selected in consulting with local extension personnel, farmers and by reviewing related literature. It is included in item No. 10 in the interview schedule (Appendix A).

The score could range from 0 to 68 where "0" meaning no extension media exposure and "68" meaning very high extension media exposure. The respondents were classified into following categories according to extension media exposure as shown in Table 3.12.

Table 3.12 Categories of respondents according to their extension media contact

Categories	Score
No	0
Rare	1-17
Occasional	18-34
Often	35-51
Regular	>51

3.6.3 Measurement of Focus Variable

3.6.3.1 Farmers' perceptions score on impacts of Corona pandemic on agricultural systems

In this study, each respondent was asked to indicate perceptions on impacts of Corona pandemic on agricultural systems. Ultimately 24 statements were incorporated in the interview schedule (Appendix A). Each respondent was asked to indicate their perceptions against each of the statements. The perceptions rated as clear, moderately clear, partially clear, not clear and a score of 3, 2, 1, 0 were assigned against the rating scales respectively. The perceptions about impacts of Corona pandemic on agricultural systems score of a respondent was determined by summing the scores of all the statements of the item No.11 in the interview schedule (Appendix A). The perception score could range from 0 to 72. Based on farmers' perceptions about impacts of Corona pandemic on agricultural systems respondents were classified into following categories as shown in Table 3.13.

Table 3.13 Categories of respondents according to their perception about impacts of Corona pandemic on agricultural systems

Categories	Score
Partially clear	≤ 24
Moderately clear	25-48
Highly clear	>48

Farmers Perception Score (FPS) regarding the selected statements on impacts of Corona pandemic on agricultural systems has calculated by using the following formula:

$$FPS = N_1 \times 3 + N_2 \times 2 + N_3 \times 1 + N_4 \times 0$$

Where,

FPS= Farmers' Perception Score

N_1 = Number of respondents rated the statement as clear

N_2 = Number of respondents rated the statement as moderately clear

N_3 = Number of respondents rated the statement as partially clear

N_4 = Number of respondents rated the statement as not clear

Farmers' perception index is the ratio of observed perception score of impacts of Corona pandemic on agricultural systems to possible highest perception score of impacts of Corona pandemic on agricultural systems and multiple by 100. It was calculated using the following formula:

Farmers' Perception Index (FPI)

$$= \frac{\text{Observed perception score of impacts of corona pandemic on agricultural systems}}{\text{Possible highest perception score of impacts of corona pandemic on agricultural systems}} \times 100$$

3.6.3.2 Impact of Corona Pandemic on the Livelihood Activities of Rural Farmers' Score

A number of 16 statements about impact of Corona pandemic on the livelihood activities of rural farmers were incorporated in the interview schedule (Appendix A). Each respondent was asked to indicate their opinion against each of the statements. Their opinions were rated as no impact, partial impact, moderate impact, high adverse impact and a score of 0, 1, 2, 3 were assigned against the rating scales respectively. The perception score on impacts of Corona pandemic on livelihood activities of rural farmers were determined by summing the scores of all the statements of the item No.12 in the interview schedule (Appendix A). The possible range of score was 0 to 48 for the respondents. Impact of Corona pandemic on the livelihood activities of rural farmers were classified into following categories as shown in table 3.14.



Table 3.14 Categories of respondents according to their perception about impact Corona pandemic on livelihood activities

Categories	Score
Low impact	≤ 16
Moderate impact	17-32
High adverse impact	> 32

Impact Extent Score (IES) regarding the incorporated statements on impacts of Corona pandemic on the livelihood activities of rural farmers has calculated by using the following formula:

$$IES = N_1 \times 0 + N_2 \times 1 + N_3 \times 2 + N_4 \times 3$$

Where,

IES= Impact Extent Score

N_1 = Number of respondents rated the statement as no impact

N_2 = Number of respondents rated the statement as low impact

N_3 = Number of respondents rated the statement as moderate impact

N_4 = Number of respondents rated the statement as high adverse impact

Impact Extent Index is the ratio of observed score on impact of corona pandemic on livelihood activities to possible highest score on impact of corona pandemic on livelihood activities and multiple by 100. It was calculated using the following formula:

Impact Extent Index^{la} (IEI)

$$= \frac{\text{Observed score on impact of corona pandemic on livelihood activities}}{\text{Possible highest score on impact of corona pandemic on livelihood activities}} \times 100$$

la = livelihood activities

3.6.3.3 Impact of Corona Pandemic Lockdown on Agricultural Production Score

A number of 16 statements about impact of Corona pandemic on the livelihood activities of rural farmers were incorporated in the interview schedule (Appendix A). Each respondent was asked to indicate their opinion against each of the statements. Their opinions were rated as no impact, partial impact, moderate impact, high adverse impact and a score of 0, 1, 2, 3 were assigned against the rating scales respectively. The perception score on impacts of Corona pandemic lockdown on agricultural production were determined by summing the scores of all the statements of the item No.13 in the interview schedule (Appendix A). The possible range of score was 0 to 48 for the respondents. Impact of Corona pandemic lockdown on agricultural production were classified into following categories as shown in table 3.14.

Table 3.15 Categories of respondents according to their perception about impact of Corona pandemic lockdown on agricultural production

Categories	Score
Low impact	≤16
Moderate impact	17-32
High adverse impact	>32

Impact Extent Score (IES) regarding the incorporated statements on impacts of Corona pandemic Corona pandemic lockdown on agricultural production has calculated by using the following formula:

$$IES = N_1 \times 0 + N_2 \times 1 + N_3 \times 2 + N_4 \times 3$$

Where,

IES= Impact Extent Score

N_1 = Number of respondents rated the statement as no impact

N_2 = Number of respondents rated the statement as low impact

N_3 = Number of respondents rated the statement as moderate impact

N_4 = Number of respondents rated the statement as high adverse impact

Impact Extent Index^{ap} (IEI) is the ratio of observed score on impact of Corona pandemic lockdown on agricultural production to possible highest score on impact of Corona pandemic lockdown on agricultural production and multiple by 100. It was calculated using the following formula:

Impact Extent Index^{ap} (IEI)

$$= \frac{\text{Observed score on impact of Corona pandemic lockdown on agricultural production}}{\text{Possible highest score on impact of Corona pandemic lockdown on agricultural production}} \times 100$$

ap = agricultural production



3.6.3.4 Rank

The rank of a statement was determined based on the (%) of the statement. The statement which obtained highest (%) hold the first rank and then the second highest (%) hold the second rank and so on.

3.7 Data Processing and Analysis

3.7.1 Data Processing and Tabulation

During data processing, appropriate scoring technique was applied for conversion all the data. Local units of measurements were converted into standard units. In case of some variables, proper indices and scales were made through the simple accumulation of score assigned to individual or pattern of attributes.

Indices and scales were considered the efficient instruments for data reduction and analysis. All personal characteristics were categorized and arranged in simple tables for interpretation and discussion. Number, frequency, percentage, mean, range, standard deviation was used for statistical description.

3.7.2 Compilation of Data

After completion of field survey data from all the interview schedules were coded, compiled, tabulated and analyzed in accordance with the objectives of the study. In this process, all the responses in the interview schedule were given numerical coded values. Local units were converted into standard units and qualitative data were converted into quantitative ones by means of suitable scoring whenever necessary. The responses to the questions in the interview schedule were transferred to master sheet to facilitate tabulation.

3.7.3 Categorization of Data

For describing the different characteristics, the respondents were classified into several categories. These categories were developed by considering the nature of distribution of data, general understanding prevailing in the social system and possible observed scoring system. The procedure for categorization of data in respect of different variable is elaborately being discussed while discussing those variables in section.

3.7.4 Statistical Techniques

The analysis was performed using SPSS (Statistical Package for Social Science) computer package. Descriptive statistics such as range, frequency, percentage, mean, standard deviation and rank order were used whenever possible.

CHAPTER IV

RESULTS AND DISCUSSION

The main purpose of this chapter is to describe the findings of the present study. The study investigates the quantitative and qualitative impact of corona pandemic on livelihoods of rural farmers in Bangladesh. In accordance with the objectives, presentation of the findings has been made in the following sections:

- I. Description of the selected socioeconomic characteristics of the respondents
- II. Farmers' perceptions about impacts of corona pandemic on agricultural systems
- III. Impact of corona pandemic on livelihood activities perceived by the respondents
- IV. Impact of corona pandemic lockdown on agricultural production perceived by the respondents
- V. Magnitude of impact of corona pandemic according to respondent's own qualitative observation

4.1 Selected Socioeconomic Characteristics of the Respondents

The included characteristics are age, educational qualification, family size, farming experience, farm size, monthly family income, training received, organizational participation, cosmopolitanism and extension media contact of an individual. The socioeconomic characteristics of the respondents varied from different ranges. On the basis of the socioeconomic characteristics, distribution of respondents is shown below in Table 4.1.

Data presented in Table 4.1 shows that highest proportion (45.5%) of the respondents were middle aged. The minimum and maximum age was 19 and 73 years respectively with a mean of 47.08 years and standard deviation of 12.55 years. Mim and Islam (2022) found that the highest proportion (52%) of the respondents belonged to middle aged category. The participation of middle aged farmers is more due to the higher experience than young aged farmers and more energy to work than old aged farmers.

The highest portion (49.1%) of respondents had secondary level of education. The minimum and maximum schooling years were 0 and 18 classes respectively with a mean of 6.94 and standard deviation of 4.69 years. Biswas *et al.* (2022) found that highest portion (57.7%) of the respondents had secondary level of education.

The majority of families (45.5%) were medium sized. The minimum and maximum family members of the respondents were 2 and 11 respectively with a mean of 4.79 and standard deviation of 1.63. Biswas *et al.* (2022) found that majority of the families (42.3%) were medium sized.

Table 4.1 Distribution of respondents according to their socioeconomic characteristics

Respondents	Categories	Score	N=110		Mean±SD ($\bar{X} \pm \delta$)	Range (observed)	
			Number	%		Min.	Max.
Age (Years)	Young	≤35	27	24.5	47.08±12.55	19	73
	Middle	36-55	50	45.5			
	Old	>55	33	30		Range (possible): Unknown	
Educational qualification (Classes)	Illiterate	0	8	7.3	6.94±4.69	0	18
	Can sign only	0.5	18	16.4			
	Primary	1-5	15	13.6			
	Secondary	6-10	54	49.1			
	Higher Secondary	11-12	9	8.2			
	Undergraduate	13-16	2	1.8		Range (possible): 0-21	
	Postgraduate	>16	4	3.6			
Family size (Numbers)	Small	≤4	49	44.5	4.79±1.63	2	11
	Medium	5-6	50	45.5			
	Large	>6	11	10		Range (possible): Unknown	
Farming experience (Years)	Low	≤10	21	19.1	26.99±13.49	1	55
	Medium	11-20	21	19.1			
	High	>20	68	61.8		Range (possible): 0-unknown	
Farm size (Hectare)	Landless	≤0.02	1	0.9	0.877±1.24	0.02	12.14
	Marginal	0.02-0.2	8	7.3			
	Small	0.21-1.0	73	66.4			
	Medium	1.01-3	26	23.6			
	Large	>3	2	1.8		Range (possible): 0-Unknown	

Respondents	Categories	Score	N=110		Mean±SD ($\bar{X}\pm\delta$)	Range (observed)	
			Number	%		Min.	Max.
Family income (BDT month ⁻¹)	Low	<15000	41	37.3	21861.8±25384.7	8000	234000
	Medium	15000-25000	53	48.2			
	High	>25000	16	14.5		Range (possible): 0-Unknown	
Training received	Yes	26			23.6(%)		
	No	84			76.4(%)		
Training received (Number)	Low	≤2	19	73.1	1.88 ±1.33	1	7
	Medium	3-5	6	23.1			
	High	>5	1	3.8		Range (possible): 0-Unknown	
Organizational Participation (Score)	Low	≤8	110	100	0.88± 1.18	0	7
	Medium	9-16	0	0			
	High	>16	0	0		Range (possible): 0-21	
Cosmopolitani sm (Score)	Low	≤5	65	59.1	5.05±2.75	1	13
	Medium	6-10	41	37.3			
	High	>10	4	3.6		Range (possible): 0-15	
Extension media contact (Score)	No	0	0	0	19.6±7.80	8	61
	Rare	1-17	43	39.1			
	Occasional	18-34	63	57.3			
	Often	35-51	2	1.8		Range (possible): 0-68	
	Regularly	52-68	2	1.8			

SD = Standard Deviation

According to the data of Table 4.1 highest proportion (61.8%) of the respondents had high level of farming experience with a mean of 26.99 years and standard deviation of 13.49 years. The minimum and maximum experiences were 1 and 55 years respectively. Islam and Islam (2020) found majority (52.8%) had high farming experience. The respondents with vast experience of farming were involved in farming from very early life and thus had spent long time with agricultural activities, on the other hand respondents with low farming experience indicates less involvement in farming.

The farm size of the maximum respondents (66.4%) was small. The minimum and maximum land sizes of the respondents were 0.02 ha and 12.14 ha respectively with a mean of 0.877 ha and standard deviation of 1.24 ha. Biswas *et al.* (2022) found that small farmers constitute the highest proportion (69.4%) of the respondents. The average farm size of the farmers of the study area were found higher than that of national average (0.60 ha) of Bangladesh (BBS, 2020).

The data presented in the Table 4.1 shows that highest portion of the respondents (48.2%) had medium income with a mean and standard deviation of 21861.8 BDT and 25384.7 BDT respectively. The minimum and maximum income were 8000 BDT. and 234000 BDT. respectively. Biswas *et al.* (2022) also found majority (65.8%) of the respondents had medium income.

Among the respondents only 23.6% had received training on different agricultural practices and technologies. The minimum and maximum number of received training by them was 1 and 7 respectively with a mean of 1.88 and standard deviation of 1.33.

In Table 4.1 it has been shown that 100% respondent's organizational participation was low with a mean of 0.88 and standard deviation of 1.18. Mim and Islam (2022) also found 100% of the respondents had low organizational participation. The farmers had less interest in organizational participation. Usually more educated persons are involved in organizational participation. Moreover, they are busy in earning their livelihood, so most of the farmers were indifferent to organizational participation.

Among the respondents 59.1% had low cosmopolitanism. The minimum and maximum score of the respondents were 1 and 13 with a mean of 5.05 and standard deviation of 2.75. Mim and Islam (2022) found that most of the respondents (58%) had low level of cosmopolitanism whereas 40% and 2% of them had medium and high level of cosmopolitanism respectively. Rural farmer of the localities depends on agriculture and busy with work on their own land and carry on most of the agricultural activities by themselves. They hardly have much time to visit other places. So, their visit to other area is very low.

The data presented in Table 4.1 shows that highest portion (57.3%) of respondents had occasional extension media contact with a mean of 19.6 and standard deviation of 7.80. The minimum and maximum score of the respondents were 8 and 61. Extension media contact increases knowledge

and creates awareness. As a result, attitude of people changes which helps to adopt new technologies.

4.2.1 Relative Position of the Statements Related to Farmers' Perceptions

The data presented in Table 4.2 show relative position of the statements related to farmers' perceptions on impacts of Corona pandemic on agricultural systems. The score of their perception ranged from 14 to 289 where possible range was 0 to 330.

Table 4.2 Relative Position of the Statements Related to Farmers' perceptions on impacts of Corona pandemic on agricultural systems

Agricultural systems	Statement	Clear (3)	Moderately clear (2)	Partially clear (1)	Not clear (0)	Score	Index (%)	Rank
Farmers	1. Corona pandemic caused illness and consequently performance of farmer reduced	43×3	5×2	0×1	62×0	139	42.1	9 th
	2. Corona pandemic caused illness and consecutive mental depression	69×3	6×2	1×1	34×0	220	66.67	5 th
	3. Corona pandemic reduced social and cultural orientation	30×3	6×2	2×1	72×0	104	31.5	12 th
Extension services	4. Unavailability of extension services due to corona pandemic	32×3	15×2	16×1	47×0	142	43	8 th
	5. Extension services were not timely available	32×3	17×2	16×1	45×0	146	44.24	7 th
	6. Extension services were not available in appropriate method	30×3	13×2	14×1	53×0	130	39.39	11 th =

Agricultural systems	Statement	Clear (3)	Moderately clear (2)	Partially clear (1)	Not clear (0)	Score	Index (%)	Rank
Research in Agriculture	7. Unavailability of time demanding research	3×3	4×2	3×1	100×0	20	6.06	19 th =
	8. Research generated knowledge dissemination to the farmer was unavailable	3×3	4×2	3×1	100×0	20	6.06	19 th =
	9. Research activity postponed due to the pandemic	4×3	1×2	0×1	104×0	14	4.24	20 th
Supply of physical inputs	10. Unavailability of fertilizer in the market	86×3	12×2	7×1	5×0	289	87.57	1 st =
	11. Unavailability of required amount of fertilizer for cultivation	86×3	12×2	7×1	5×0	289	87.57	1 st =
	12. Unavailability of the desired seed variety hampered cultivation	86×3	12×2	7×1	5×0	289	87.57	1 st =
	13. Timely unavailability of seeds led to late sowing	85×3	13×2	7×1	5×0	288	87.27	2 nd
	14. Unavailability of required pesticide has disrupted intercultural operation	84×3	13×2	7×1	6×0	285	86.36	3 rd

Agricultural systems	Statement	Clear (3)	Moderately clear (2)	Partially clear (1)	Not clear (0)	Score	Index (%)	Rank
External issues	22. Medical facilities were scanty	9×3	4×2	8×1	89×0	43	13.03	16 th
	23. Movement restriction	6×3	2×2	6×1	96×0	28	8.48	18 th
	24. Closure of educational institute	7×3	3×2	8×1	92×0	35	10.60	17 th

The data presented in Table 4.2 shows that farmers' perceptions about the impacts of Corona pandemic on agricultural systems were collected through their considerations about some incorporated statements such as "unavailability of fertilizer in the market", "unavailability of the required amount of fertilizer for cultivation", "unavailability of the desired seed variety hampered cultivation" which were ranked 1st. "Timely unavailability of seeds led to late sowing" ranked 2nd according to the respondent's perception where the "unavailability of required pesticides has disrupted intercultural operations" ranked 3rd. Statements such as "movement restriction", "unavailability of time demanding research", "research generated knowledge dissemination to the farmer was unavailable", and "research activity postponed due to the pandemic" ranked 18th, 19th, 19th and 20th respectively.

During the pandemic, the supply of physical inputs was not available in time as well as in the required amount which still exists in some cases. The unavailability of fertilizer, seed, and pesticides has disrupted agricultural operations as well as the timely unavailability of seed has led to late sowing, unavailability of required pesticides in the market has disrupted intercultural operations. The timely unavailability of pesticides in the market has led to rapid disease transmission. Corona pandemic caused illness and consecutive mental depression in farmers as well as consecutive performance reduction and less cultural orientation in some cases. Migration of labor to other places or occupations during the pandemic has resulted in labor shortage and disrupted harvest operations. Agricultural extension services were not available in time in appropriate methods which still exist according to some respondent's perceptions. Production

activity was impeded during the pandemic which has led to yield loss and the expected yield was not obtained. Market closure caused difficulties in the collection of inputs leading to delays in agricultural operations and marketing of produced products disrupted due to the lack of enough transportation facilities as well as there was lack of buyers during the pandemic. Medical facilities were scanty during the pandemic time which still exists. There was unavailability of time-demanding research, research activity was postponed due to the pandemic and research-generated knowledge dissemination to farmers was unavailable which has impeded agricultural research and dissemination of research-generated knowledge.

In some cases, farmers' perceptions about the impacts of corona pandemic on agricultural systems were clear but those were not impactful to them according to their opinion. Besides those were considered as impactful to other farmers by them.

Crop production affected due to the challenges of accessing inputs, delay in planting seasons, and inability to hire labor (Middendorf *et al.*, 2021a). Popescu and Popescu (2022) recorded that there was delay of agricultural work, cancelation of investments, delays in receiving agricultural inputs and lack of, or insufficient labor in farms. Tripathi *et al.* (2021) investigated the effects of COVID-19 on agriculture and found supply chain breakdown.

4.2.2 Respondent's Categorization According to their Perception on Impacts of Corona Pandemic on Agricultural Systems

Results presented in Table 4.3 indicate that majority of the respondents (51.8%) had moderately clear perception about impacts of corona pandemic on agricultural systems where 36.4% and 11.8% respondents had partially clear and highly clear perception respectively. The minimum and maximum score was 3 and 72 with the mean of 31.47 and standard deviation of 14.19.

Table 4.3 Distribution of respondents according to their perception on impacts of Corona pandemic on agricultural systems

Categories	Score	N=110		Mean $\pm$ Standard Deviation ($\bar{X}\pm\delta$)	Range (observed)	
		Number	%		Min.	Max.
Partially clear	≤ 24	40	36.4	31.47 $\pm$ 14.19	3	72
Moderately clear	25-48	57	51.8			
Highly clear	> 48	13	11.8		Range (possible): 0-72	

Among the respondents, the highest portion had moderately clear perception about the impacts of corona pandemic on agricultural systems because respondents' concept about the impact of corona pandemic on agricultural systems was different. Individual respondent was different in thought as well as thinkability and they had different perceptions as well as different considerations.

4.3.1 Relative Position of Statements on Impact of Corona Pandemic on Livelihood Activities

The data presented in Table 4.4 show relative position of statements on impact of corona pandemic on livelihood activities of rural farmers. The score of impact of corona pandemic on the livelihood activities of rural farmers ranged from 2 to 260 where possible range was 0 to 330.

Table 4.4 Relative Position of statements on impact of corona pandemic on the livelihood activities of rural farmers

Sl. No.	Statement	No Impact (0)	Partial Impact (1)	Moderate impact (2)	High Adverse impact (3)	Score	Index (%)	Rank
1.	Death of earning member left family helpless which has changed economic condition of the family	109×0	0×1	1×2	0×3	2	0.60	15 th
2.	Reduction of working ability of the earning member has made income less	100×0	4×1	5×2	1×3	17	5.15	12 th =
3.	Reduction in income has made maintenance of family difficult	2×0	8×1	48×2	52×3	260	78.8	1 st
4.	Higher family expenditure leads to poor standard of life	4×0	12×1	49×2	45×3	245	74.2	2 nd
5.	Change in food consumption behavior due to the pandemic	5×0	12×1	62×2	31×3	229	69.4	3 rd
6.	To bear family expenses selling of land	106×0	0×1	2×2	2×3	10	3.03	14 th
7.	Fluctuation of stable income from	6×0	25×1	70×2	9×3	192	58.2	5 th

Sl. No.	Statement	No Impact (0)	Partial Impact (1)	Moderate impact (2)	High Adverse impact (3)	Score	Index (%)	Rank
	cultivation due to the pandemic							
8.	Changes has occurred in purchasing capacity of necessary commodities	3×0	20×1	68×2	19×3	213	64.5	4 th
9.	Loss of job has compelled to migrate to other occupation	100×0	4×1	5×2	1×3	17	5.15	12 th =
10.	Pandemic has led to child dropout from schooling	104×0	1×1	3×2	2×3	13	3.93	13 th
11.	Pandemic has led to reduction in access to medical services	66×0	30×1	13×2	1×3	59	17.8	11 th
12.	Reduction of diversified earning sources has made to depend on specific earning source	65×0	19×1	21×2	5×3	76	23.03	9 th
13.	Non-farming earning activities impeded which has led to reduction in income	65×0	26×1	16×2	3×3	67	20.3	10 th
14.	Lack of access to credit during pandemic disrupted income generating activity	47×0	28×1	35×2	0×3	98	29.7	8 th
15.	Corona pandemic has led to food insecurity	13×0	16×1	73×2	8×3	186	56.4	6 th
16.	Indebtedness of farmer to bear family expenses due to corona pandemic	26×0	24×1	54×2	6×3	150	45.4	7 th

4.3.2 Respondent's Categorization According to their Perception about Impact of Corona Pandemic on Livelihood Activities

Results presented in Table 4.4 indicate majority of the respondents (55.5%) had moderate impact on their livelihood activities where 44.5% respondents had partial impact. The minimum and maximum score was 2 and 31 with the mean of 16.80 and standard deviation of 5.64.

Table 4.5 Distribution of respondents according to their perception about impact of Corona pandemic on livelihood activities

Categories	Score	N=110		Mean $\pm$ Standard Deviation ($\bar{X} \pm \delta$)	Range (observed)	
		Number	%		Min.	Max.
Partial impact	≤ 16	49	44.5	16.80 $\pm$ 5.64	2	31
Moderate impact	17-32	61	55.5			
High adverse impact	> 32	0	0		Range (possible): 0 - 48	

Respondent's livelihood activities had moderate impact due to corona pandemic according to the majority of the respondents because they faced several difficulties during the pandemic which carried several impacts to them. Reduction in income, higher family expenditure and change in food consumption behavior can be considered as the most impactful aspects of the respondent's livelihood.

4.4.1 Relative Position of statements on impact of Corona pandemic lockdown on agricultural production

The data presented in Table 4.5 show relative position of statements on impact of corona pandemic lockdown on agricultural production. The score of impact of corona pandemic lockdown on agricultural production ranged from 17 to 307 where possible range was 0 to 330.

Table 4.6 Relative Position of the statements on impact of corona pandemic lockdown on agricultural production

Sl. No.	Statement	No Impact (0)	Partial Impact (1)	Moderate impact (2)	High Adverse impact (3)	Score	Index (%)	Rank
1.	Corona pandemic caused disruption in supply chain and consecutive reduction in production	68×0	14×1	20×2	8×3	78	23.63	10 th
2.	Timely unavailability of agricultural inputs has resulted in reduction in agricultural production	57×0	12×1	24×2	17×3	111	33.63	8 th
3.	Increased price of agricultural inputs hampered agricultural production	2×0	1×1	15×2	92×3	307	93.03	1 st
4.	Restriction on human movement led to labor shortage and affected agricultural operations	67×0	13×1	12×2	18×3	91	27.6	9 th
5.	Timely unavailability of livestock and fisheries food impeded the production of livestock and fisheries	50×0	20×1	12×2	28×3	128	38.8	5 th
6.	Famers faced difficulty due to the increased price of livestock and fisheries food	29×0	5×1	18×2	58×3	215	65.15	3 rd
7.	Unavailability of veterinary services for livestock in required time disrupted livestock raising as well as production	55×0	38×1	13×2	4×3	76	23.03	11 th
8.	Unavailable transportation facilities due to lockdown hampered	63×0	6×1	13×2	28×3	116	35.15	7 th

Sl. No.	Statement	No Impact (0)	Partial Impact (1)	Moderate impact (2)	High Adverse impact (3)	Score	Index (%)	Rank
	transportation of product to the market							
9.	Increased transportation cost resulted in higher cost of production	5×0	1×1	16×2	88×3	297	90	2 nd
10.	Reduction in farmers access to market due to lockdown	95×0	13×1	2×2	0×3	17	5.15	15 th
11.	Increment of post-harvest losses due lack of proper transportation facilities	73×0	28×1	9×2	0×3	46	13.9	14 th
12.	Disposal of perishable products due to lack storage facilities	66×0	31×1	11×2	2×3	59	17.8	12 th
13.	Low market price of the produced product due to lockdown	40×0	23×1	41×2	6×3	123	37.3	6 th
14.	Reduction in demand of the produced product due to lockdown	69×0	31×1	7×2	3×3	54	16.4	13 th =
15.	Reduced demand led to reduction in price of the product	68×0	32×1	8×2	2×3	54	16.4	13 th =
16.	Fluctuation of market price of the product due to lockdown	8×0	32×1	46×2	24×3	196	59.4	4 th

The “increased price of agricultural inputs hampered agricultural production” was ranked 1st where “increased transportation cost resulted in higher cost of production” ranked 2nd according to respondent’s consideration. “Farmers faced difficulty due to the increased price of livestock and fisheries food”, “fluctuation of the market price of the product due to lockdown”, “timely unavailability of livestock and fisheries food impeded the production of livestock and fisheries” such statements were ranked 3rd, 4th and 5th respectively. Statements such as “reduction in demand for the produced product due to lockdown”, “reduced demand led to a reduction in the price of the

product”, “increment of post-harvest losses due to lack of proper transportation facilities”, and “reduction in farmer's access to market due to lockdown” were ranked 13th, 14th, 15th respectively.

During corona pandemic lockdown, there were obstacles to many aspects of agricultural production which still exist. Respondents are facing difficulties due to the increased price of agricultural inputs and it has impeded agricultural production. During the pandemic, transportation costs increased which has resulted in higher cost of production and the increased transportation cost still remains. Livestock feed and fisheries food prices have been increased and farmers are facing difficulties in livestock rearing as well as fisheries cultivation. Besides timely unavailability of livestock and fisheries food impeded production of livestock and fisheries. During the pandemic lockdown, there was a fluctuation in the market price of products which remains in some cases and farmers do not get proper prices for their products resulting in a low market price of the product. The timely unavailability of agricultural inputs has resulted in a reduction in agricultural production. There was a restriction on human movement during the lockdown which has led to the migration of labor in some cases resulting in labor shortages and affecting agricultural operations. Corona pandemic disrupted the supply chain which has resulted in a consecutive reduction in production. The reduction in demand for the produced product due to the lockdown resulted in a reduction in the price of the product. Besides there was increment of post-harvest losses due to lack of proper transportation facilities.

The agricultural supply chain was disrupted by the pandemic (Pu and Zhong, 2020). Middendorf *et al.* (2021a) observed a reduction in access to inputs, a reduction in yields, a loss of income, reduced access to local and urban markets, reduced access to transportation, and an increase in post-harvest loss.

4.4.2 Respondent's Categorization According to Impact of Corona Pandemic Lockdown on Agricultural Production

Results presented in Table 4.6 indicate that majority of the respondents (53.6%) had moderate impact of Corona pandemic lockdown on agricultural production where 46.4% respondents had partial impact. The minimum and maximum score was 7 and 36 with the mean of 17.89 and standard deviation of 7.85.

Table 4.7 Distribution of respondents according to their perception about impact of Corona pandemic lockdown on agricultural production

Categories	Score	N=110		Mean $\pm$ Standard Deviation ($\bar{X}\pm\delta$)	Range (observed)	
		Number	%		Min.	Max.
Partial impact	≤ 16	51	46.4	17.89 $\pm$ 7.85	7	36
Moderate impact	17-32	59	53.6			
High adverse impact	>32	0	0		Range (possible): 0-48	

There was moderate impact of corona pandemic lockdown on agricultural production according to the respondent's observation. The increased price of agricultural inputs due to the pandemic has hampered agricultural production. Besides increased transportation cost has resulted in higher cost of production as well as respondents has faced difficulties due to the increased price of livestock and fisheries food.

4.5.1 Rank Order of Qualitative Impacts

The data presented in Table 4.7 show that majority (43.63%) of the respondents indicated economic loss as the highest magnitude of impact where 41.81% respondents considered reduction in income and increment of agricultural input cost resulting in higher cost of production as the 2nd highest magnitude of impact. Higher family expenditure (27.27%) was ranked 3rd while selling of land to bear expenses (0.91%), difficulty in bearing children's educational cost (0.91%), and death of a family member (0.91%) was ranked 10th.

Table 4.8 Rank order of qualitative impacts of corona pandemic according to respondent's own qualitative observation

SL.	Observation	Citation	%	Rank
1.	Economic loss	48	43.63	1 st
2.	Reduction in income	46	41.81	2 nd =
3.	Increment of agricultural input cost resulting in higher cost of production	46	41.81	2 nd =
4.	Higher family expenditure	30	27.27	3 rd

SL.	Observation	Citation	%	Rank
5.	Price increment of daily necessary commodities	15	13.63	4 th
6.	Price of the produced product is low	14	12.72	5 th
7.	Change in food consumption behavior	10	9.09	6 th
8.	Increment of disease	6	5.45	7 th
9.	High price of fisheries food and medicine	4	3.63	8 th
10.	Loss of job	2	1.82	9 th =
11.	Reduction of earning sources	2	1.82	9 th =
12.	Economic problem of wage earners has increased	1	0.91	10 th =
13.	Selling of land to bear expenses	1	0.91	10 th =
14.	Difficulty in bearing children educational cost	1	0.91	10 th =
15.	Death of family member	1	0.91	10 th =

The economic loss was the highest magnitude of the impact of corona pandemic according to a majority of the respondents because the pandemic has incurred economic losses to them. Besides reduction in income and increment of agricultural input cost resulting in higher cost of production has taken place due to the pandemic. The price of agricultural inputs increased during the pandemic time and the price has not decreased after the pandemic. Higher prices after the pandemic have led to higher family expenditure resulting in changes in purchasing capacity and consumer behavior. Loss of jobs and reduction of earning sources has happened due to the pandemic. Before the pandemic, some respondents depended on various earning sources but during the pandemic time some earning sources closed and it is on continuation now. Selling of land to bear expenses, difficulty in bearing children's educational costs and death of a family member was highly impactful on individual respondents because it has made a difficult situation for them and it has happened due to the pandemic according to their opinion.

Middendorf et al. (2021a) When asked “what were the greatest challenges that COVID-19 posed for your household,” found that 69.4% of the 603 respondents reported issues related to poverty, loss of income, unemployment, and deterioration in living conditions.

4.5.2 Case Studies of Qualitative Impacts

Case Study: 1

A respondent from Bhandarpara union of Dumuria upazila named Bidhan Kabiraj said *"...Financial condition is poor since Corona, unable to sell at right price. Fish feed is more expensive, fertilizers and medicine price are almost double. Price of fuel is high and also price of daily necessary commodities is high but selling price of product is low. Family expenses have increased..."*

According to the respondent's observation, his financial condition was poor since the rapid transmission of corona virus. Fish feed, fertilizer, medicine, fuel prices was very high but selling price of products were low as well as not as expected. Price increment of daily necessary commodities has resulted in higher family expenses.

Case Study: 2

A respondent from Dumuria union of Dumuria upazila named Tijankar Mandal said *"...After corona pandemic, the prices of agricultural inputs have increased a lot but the crops are not sold at higher prices accordingly. The wages of agricultural laborers have increased a lot after the pandemic. Price of electricity and diesel has increased due to which the cost of irrigation has also increased more than before..."*

Price of agricultural inputs have increased resulting in higher production cost but the produced crops are not sold at higher prices commensurately. Increment of wages of laborers working in agricultural fields after the pandemic. Moreover, price increment of electricity and diesel has resulted in increment of irrigation cost which is more than before.

Case Study: 3

A respondent from Gangarampur union of Batiaghata upazila named Sujit Sarker said *"...Ours is an agriculture dependent area where the impact of corona pandemic is severe. Due to corona many new farmers are coming to agricultural activities but due to inexperience they are not able to be benefitted in a positive way. Marginal farmers have suffered as many job holders have come to agricultural activities to have more income..."*

Impact of corona pandemic on the respondent's area was severe and the area was dependent on agriculture. Many new farmers were involving with agricultural activities but they were not getting

benefitted due to inexperience. Besides marginal farmers were suffering because many job holders joined in agricultural activities to have more income.

Case Study: 4

A 50 years old respondent from Surkhali union of Batiaghata upazila named Yusuf Sheikh said *"...Dairy farm has closed down due to corona pandemic, prices of necessary commodities have soared since corona pandemic, extra income has been reduced due to corona and business risks have increased. Fertilizers, seeds, medicine prices are increasing from the time of corona pandemic but not decreasing. Cost of production has increased but income has not increased. Death of elder sister during corona pandemic has made me mentally depressed..."*

The respondent's dairy farm has shut down due to corona pandemic which resulted in reduction of extra income. Price of daily necessary commodities, fertilizers, seeds, medicine are increasing from the time of corona pandemic but not decreasing. Price increment of agricultural inputs has increased cost of production but selling price is not as expected that's why income has not increased. Besides he had mental depression due to the death of his elder sister during the pandemic.



CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

The Study was conducted at Dumuria and Batiaghata upazila to determine quantitative and qualitative impact of corona pandemic on livelihoods of rural farmers in Bangladesh. In the study area, 110 respondents were selected purposively. Data were collected through interview with the respondents using an interview schedule. The selected socioeconomic characteristics of the farmers were age, educational qualification, family size, farming experience, farm size, family income, training received, organizational participation, cosmopolitanism and extension media contact. Appropriate scales were used to measure variables of the study.

5.1 Summary of Findings

5.1.1 Selected Socioeconomic Characteristics of the Respondents

Age: Highest proportion (45.5%) of the respondents were middle aged. The minimum and maximum age was 19 and 73 years respectively with a mean of 47.08 years and standard deviation 12.55.

Educational Qualification: Majority (49.1%) of the respondents had secondary level of education. The minimum and maximum schooling years were 0 and 18 classes respectively with a mean of 6.94 and standard deviation of 4.69.

Family Size: Majority of the families (45.5%) were medium sized. The minimum and maximum family members of the respondents were 2 and 11 respectively with a mean of 4.79 and standard deviation of 1.63.

Farming Experience: Highest proportion (61.8%) of the respondents had high level of farming experience with a mean of 26.99 years and standard deviation 13.49 years. The maximum and minimum experiences were 1 and 55 years respectively.

Farm Size: The farm size of the maximum respondents (66.4%) was small. The minimum and maximum farm sizes of the respondents were 0.02 ha and 12.14 ha respectively with a mean of 0.877 ha and standard deviation of 1.24 ha.

Family Income: Highest portion of the respondents (48.2%) had medium income with a mean and standard deviation of 21861.8 BDT and 25384.7 BDT respectively. The minimum and maximum income were 8000 BDT. and 234000 BDT. respectively.

Training Received: Among the respondents only 23.6% had received training on different agricultural practices and technologies. The minimum and maximum number of received training by them was 1 and 7 respectively with a mean of 1.88 and standard deviation of 1.33.

Organizational Participation: 100% of the respondent's organizational participation was low with a mean of 0.88 and standard deviation of 1.18.

Cosmopolitanism: Among the respondents 59.1% had low cosmopolitanism. The minimum and maximum score of the respondents were 1 and 13 with a mean of 5.05 and standard deviation 2.75.

Extension Media Contact: Highest portion (57.3%) of respondents had occasional extension media contact with a mean of 19.6 and standard deviation of 7.80. The minimum and maximum score of the respondents were 8 and 61.

5.1.2 Farmers' Perceptions about Impacts of Corona Pandemic on Agricultural Systems

Farmers' perception about the impacts of Corona pandemic on agricultural systems were collected through their considerations about some incorporated statements such as "unavailability of fertilizer in the market", "unavailability of required amount of fertilizer for cultivation", "unavailability of the desired seed variety hampered cultivation" which were ranked 1st. Timely unavailability of seeds led to late sowing ranked 2nd according the respondent's perception where "unavailability of required pesticide has disrupted intercultural operation" statements obtained 3rd rank.

Majority of the respondents (51.8%) had moderately clear perception about impacts of corona pandemic on agricultural systems while 36.4% and 11.8% respondents had partially clear and highly clear perception respectively. The minimum and maximum score was 3 and 72 with the mean of 31.47 and standard deviation of 14.19.

5.1.3 Impact of Corona Pandemic on Livelihood Activities Perceived by the Respondents

Respondent's opinion about the impact of Corona pandemic on their livelihood activities were collected through some incorporated statements such as "reduction in income has made maintenance of family difficult" was ranked 1st according to the respondent's consideration where

“higher family expenditure leads to poor standard of life” was ranked 2nd and “Change in food consumption behavior due to the pandemic” ranked 3rd.

Highest portion of the respondents (55.5%) had moderate impact on their livelihood activities where 44.5% respondents had partial impact. The minimum and maximum score was 2 and 31 with the mean of 16.80 and standard deviation of 5.64.

5.1.4 Impact of Corona Pandemic Lockdown on Agricultural Production Perceived by the Respondents

“Increased price of agricultural inputs hampered agricultural production” ranked 1st where “increased transportation cost resulted in higher cost of production” ranked 2nd according to respondents’ consideration. “Farmers faced difficulty due to the increased price of livestock and fisheries food” ranked 3rd.

Majority of the respondents (53.6%) had moderate impact of Corona pandemic lockdown on agricultural production where 46.4% respondents had partial impact. The minimum and maximum score was 7 and 36 with the mean of 17.89 and standard deviation of 7.85.

5.1.5 Magnitude of Impact of Corona Pandemic According to Respondent’s Own Qualitative Observation

Among the respondents, 43.63% of the respondents considered economic loss as highest magnitude of impact which was ranked 1st where 41.81% respondents considered reduction in income and increment of agricultural input cost resulting in higher cost of production as highest magnitude of impact which was ranked 2nd. Higher family expenditure (27.27%) was considered as highest magnitude of impact by the respondents and ranked 3rd.

5.1.6 Case Studies of Qualitative Impacts

A respondent from Bhandarpara union of Dumuria upazila named Bidhan Kabiraj said “.....Financial condition is poor since Corona, unable to sell at right price. Fish feed is more expensive, fertilizers and medicine price are almost double. price of fuel is high and also price of daily necessary commodities is high but selling price of product is low, family expenses have increased...”

A 50 years old respondent from Gangarampur union of Batiaghata upazila named Yusuf Sheikh said “...Dairy farm has closed down due to corona pandemic, prices of necessary commodities

have soared since corona pandemic, extra income has been reduced due to Corona and business risks have increased. Fertilizers, seeds, medicine prices are increasing from the time of corona pandemic but not decreasing. Cost of production has increased but income has not increased. Death of elder sister during corona pandemic has made me mentally depressed...”

5.2 Conclusion

Highest proportion (45.5%) of the respondents were middle aged. Majority (49.1%) of respondents had secondary level of education. Majority of families (45.5%) were medium sized. Highest proportion (61.8%) of the respondents had high level of farming experience. The farm size of the maximum respondents (66.4%) was small. Highest portion of the respondents (48.2%) had medium income. Only 23.6% had received training on different agricultural practices and technologies among the respondents. 100% respondent's organizational participation was low. Among the respondents 59.1% had low cosmopolitanism. The middle aged majority respondents with high farming experience are not able to migrate to other occupation because of low level of education should be brought under long term planning to minimize the impact of corona pandemic.

Majority of the respondents (51.8%) had moderately clear perception about impacts of corona pandemic on agricultural systems where 36.4% and 11.8% respondents had partially clear and highly clear perception respectively. Highest portion of the respondents (55.5%) had moderate impact on their livelihood activities where 44.5% respondents had partial impact. Majority of the respondents (53.6%) had moderate impact of Corona pandemic lockdown on agricultural production where 46.4% respondents had partial impact. The moderate impact of corona pandemic should be transformed to minimum impact through proper policy implication by the concerned authorities.

Among the respondents, 43.63% of the respondents considered economic loss as highest magnitude of impact which was ranked 1st where 41.81% respondents considered reduction in income and increment of agricultural input cost resulting in higher cost of production as highest magnitude of impact which was ranked 2nd. Higher family expenditure (27.27%) was considered as highest magnitude of impact by the respondents and ranked 3rd. The magnitude of impact of corona pandemic can be minimized through controlling inflation as well as increment of income of individuals.

5.3 Recommendations

The present study was conducted at Dumuria and Batiaghata upazila of Khulna district. It is recommended that similar study should be conducted at different areas of the country to understand and generalize the findings. The study was exclusively confined to determine the impact of corona pandemic on livelihoods of rural farmers in Bangladesh. Further studies should be conducted to determine various aspects of impacts of corona pandemic by government and non-government organizations.

CHAPTER VI

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Appendix A

Agrotechnology Discipline

Life Science School

Khulna University, Khulna-9208

Title: Quantitative and Qualitative Impact of Corona Pandemic on Livelihoods of Rural Farmers in Bangladesh

(Confidentiality will be maintained and all information will be used only for study purpose)

Serial No:

Date:

Respondent's Name:

Union:

Village:

Thana:

Contact No.:

District:

1. Age of the Respondent (years):

2. Educational qualification (Schooling year):

a) Illiterate b) Can sign only c) Passed class.....

3. Family Size:

4. Farming Experience (years):

5. Farm size (ha):

Please provide information about your lands according to use

SL No.	Use of land	Area of land	
		Local unit	Hectare or acre
A1	Homestead		
A2	Own land under cultivation		
A3	Land given to others on barga		
A4	Land taken from others on barga		
A5	Land taken from others on lease		
A6	Others		

6. Family income (BDT):

Please mention information's about your family income (annual) from different sources:

Serial	Sources of income	Income/Month (Taka)	Income/Year (Taka)
1.	Crop		
2.	Livestock		
3.	Fish		
4.	Business		
5.	Service		
6.	Other		
Total			

7. Training Received: Do you receive any agricultural training?

A. Yes ()

B. No ()

Name of the Training	Duration (No of Days)	Organized By

8. Organizational participation:

Please mention the nature and number of your participation in the following organizations:

SL. No	Name of the organization (Non-political)	Extent of involvement (with Duration)				
		No Involvement (0)	General Member (1)	Executive Member (2)	Executive Officer (3)	Duration (years)
1.	Farmer's cooperative committee					
2.	School committee					
3.	Committee (Mosque/ Temple/ Church / Mondir)					
4.	NGO committee					
5.	Union council					
6.	Youth club					
7.	Others					

9. Cosmopolitanism:

Please indicate the number of times you have visited the following places within the specified period:

SL No.	Place of visit	Nature of visit			
		Frequently (3)	Occasionally (2)	Rarely (1)	Not at all (0)
1.	Relative or other Known persons located outside of your own village	5-6 times/month	3-4 times/month	1-2 times/month	0 times/month
2.	Union parishad office	8-10 times/month	5-6 times/month	2-3 times/month	0 times/month
3.	Own upazila/ distric sadar	5-6 times/month	3-4 times/month	1-2 times/month	0 times/month
4.	Other district upazila/ sadar	4 times/year	3 times/year	1-2 times/year	0 times/year
5.	Capital and other cities	3 times/year	2 times/year	1 times/year	0 times/year

10. Extension media contact:

Categories		Regularly (4)	Often (3)	Occasionally (2)	Rarely (1)	Not at all (0)
A. Mass media	1. Radio					
	2. Television					
	3. Newspaper					
	4. Poster					
B. Group Contact	1. FFS					
	2. Upazilla Fairs					
	3. Demonstration					
	4. Field Days					
C. Personal Cosmopolite	1. Office call (SAAO)					
	2. Office call (AEO/UAO)					
	3. Farm & home visit (SAAO)					
	4. Email					
	5. Mobile					
D. Personal Localite	1. Friends					
	2. Neighbor					
	3. Dealer (pesticide)					
	4. Model farmer					

11. Farmers' perceptions on impacts of Corona pandemic on agricultural systems

Agricultural systems	Statement	Clear (3)	Moderately clear (2)	Partially clear (1)	Not clear (0)
Farmers	1. Corona pandemic caused illness and consequently performance of farmer reduced 2. Corona pandemic caused illness and consecutive mental depression 3. Corona pandemic reduced social and cultural orientation				
Extension services	4. Unavailability of extension services due to corona pandemic 5. Extension services were not timely available 6. Extension services were not available in appropriate method				
Research in Agriculture	7. Unavailability of time demanding research 8. Research generated knowledge dissemination to the farmer was unavailable 9. Research activity postponed due to the pandemic				
Supply of physical inputs	10. Unavailability of fertilizer in the market 11. Unavailability of required amount of fertilizer for cultivation 12. Unavailability of the desired seed variety hampered cultivation 13. Timely unavailability of seeds led to late sowing				

Agricultural systems	Statement	Clear (3)	Moderately clear (2)	Partially clear (1)	Not clear (0)
	14. Unavailability of required pesticide has disrupted intercultural operation 15. Timely unavailability of pesticide in the market led to rapid disease transmission				
Production activity	16. Corona pandemic impeded intensive caretaking of crops which has led to yield loss 17. Expected yield was not obtained due to the pandemic 18. Labour shortage during the pandemic disrupted harvest operation				
Marketing	19. Market closure caused difficulties in collection of inputs lead to delay in agricultural operation 20. Marketing of produced product disrupted due to lack of enough transportation facilities 21. Could not sell product due to lack of buyers				
External issues	22. Medical facilities were scanty 23. Movement restriction 24. Closure of educational institute				

12. Impact of Corona pandemic on the livelihood activities of rural farmers

SL.	Statement	No Impact (0)	Partial Impact (1)	Moderate Impact (2)	High Adverse Impact (3)
1.	Death of earning member left family helpless which has changed economic condition of the family				
2.	Reduction of working ability of the earning member has made income less				
3.	Reduction in income has made maintenance of family difficult				
4.	Higher family expenditure leads to poor standard of life				
5.	Change in food consumption behavior due to the pandemic				
6.	To bear family expenses selling of land				
7.	Fluctuation of stable income from cultivation due to the pandemic				
8.	Changes has occurred in purchasing capacity of necessary commodities				
9.	Loss of job has compelled to migrate to other occupation				
10.	Pandemic has led to child dropout from schooling				
11.	Pandemic has led to reduction in access to medical services				
12.	Reduction of diversified earning sources has made to depend on specific earning source				
13.	Non-farming earning activities impeded which has led to reduction in income				
14.	Lack of access to credit during pandemic disrupted income generating activity				
15.	Corona pandemic has led to food insecurity				
16.	Indebtedness of farmer to bear family expenses due to corona pandemic				

13. Impact of Corona pandemic lockdown on agricultural production

SL.	Statement	No Impact (0)	Partial Impact (1)	Moderate Impact (2)	High Adverse Impact (3)
1.	Corona pandemic caused disruption in supply chain and consecutive reduction in production				
2.	Timely unavailability of agricultural inputs has resulted in reduction in agricultural production				
3.	Increased price of agricultural inputs hampered agricultural production				
4.	Restriction on human movement led to labor shortage and affected agricultural operations				
5.	Timely unavailability of livestock and fisheries food impeded the production of livestock and fisheries				
6.	Farmers faced difficulty due to the increased price of livestock and fisheries food				
7.	Unavailability of veterinary services for livestock in required time disrupted livestock raising as well as production				
8.	Unavailable transportation facilities due to lockdown hampered transportation of product to the market				
9.	Increased transportation cost resulted in higher cost of production				
10.	Reduction in farmers' access to market due to lockdown				
11.	Increment of post-harvest losses due lack of proper transportation facilities				
12.	Disposal of perishable products due to lack storage facilities				
13.	Low market price of the produced product due to lockdown				
14.	Reduction in demand of the produced product due to lockdown				