



## Impact of the Corona pandemic on the livelihoods of rural farmers in some selected areas of Khulna district in Bangladesh

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### ABSTRACT

The rapid transmission and outspread of the Coronavirus quickly caused a global 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 to determine the impact of the Corona pandemic on the livelihoods of rural farmers, to determine rural farmers' perceived impacts of the Corona pandemic on agricultural systems, to explain the magnitude of the impacts of the Corona pandemic in some selected areas of Khulna district in Bangladesh. Data were collected from purposively selected 110 respondents using a pre-tested interview schedule through personal interviews conducted from March, 2023 to April, 2023. Descriptive statistics such as range, frequency, percentage, mean, standard deviation and rank order were used whenever possible. Majority (45.5%) of the respondents had medium sized families where the majority (61.8%) of them had high farming experience, 66.4% had small-sized farms and the highest portion (48.2%) had medium income. The majority (58.2%) of the respondents had a moderately clear perception of the impacts of the pandemic on agricultural systems while 18.2% and 23.6% of respondents had partially clear and highly clear perceptions, respectively. The highest portion (55.5%) of the respondents perceived that they had a moderate impact on their livelihood activities followed by a partial impact (44.5%). The majority (53.6%) of the respondents perceived that the lockdown had a moderate impact on agricultural production followed by a partial impact (46.4%). About 43.63% of respondents considered economic loss as the highest magnitude of impact while 41.81% considered a reduction in income and an increase of agricultural input cost resulting in a higher cost of production. The existing impacts of the Corona pandemic should be minimized by taking proper initiatives by the concerned authorities to ensure a better standard of life for rural farmers.

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### 1. Introduction

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 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 well-being 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 the 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 widespread 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 the 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,

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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. An unexpected lockdown across borders of countries and within countries caused input supply, transport of agricultural products, and labor availability in the agri-food and marketing sector, which affected food availability and prices globally (FAO, 2020). Corona pandemic impeded all aspects of life and livelihoods. All spheres of human life were disrupted due to the pandemic which has had several impacts on 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.

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

In view of the above background and facts, the study was conducted to determine the impact of the Corona pandemic on the livelihoods of rural farmers in some selected areas of Khulna district in Bangladesh.

The study was aimed at providing information regarding the following queries:

- (i) What are the socioeconomic characteristics of the respondents after the Corona pandemic?
- (ii) What are the perceived impacts of Corona pandemic on agricultural systems?
- (iii) What are the impacts of the Corona pandemic on the livelihood activities of rural farmers?
- (iv) What are the impacts of Corona pandemic lockdown on agricultural production?
- (v) What is the magnitude of the impacts of the Corona pandemic?

### **Objectives of the study**

The specific objectives of the study were:

- (i) To determine the socioeconomic characteristics of the respondents
- (ii) To determine rural farmers' perceived impacts of the Corona pandemic on agricultural systems
- (iii) To determine the impact of the Corona pandemic on the livelihood activities of rural farmers

- (iv) To assess the impact of the Corona pandemic lockdown on agricultural production
- (v) To explain the magnitude of the impacts of the Corona pandemic

## **2. Materials and Methods**

### **2.1. Design of the study**

The study was conducted based on the collection of data through a survey by interviewing rural farmers. Mixed method was used where both quantitative and qualitative data were collected. Qualitative data were collected through the case study. It was designed to determine the impact of the Corona pandemic on the livelihoods of rural farmers at Dumuria and Batiaghata upazila of Khulna district.

### **2.2. Locale of the study**

The study was conducted at a few villages under three unions of both Dumuria and Batiaghata upazila of Khulna district. Those upazilas were selected for the study since it is not very far from Khulna University and is easily accessible. Those upazilas have large populations and are severely affected by corona pandemic. Besides people in those areas are quite conscious as they live not very far from Sadar upazila.

### **2.3. Population and sampling**

All rural farmers of the upazilas 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. A 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.

### **2.4. Specification of the variables**

The selected socioeconomic characteristics of the respondents were treated as independent variables while the impact of the Corona pandemic on the livelihoods of rural farmers was considered as the focus (dependent) variable. The selected socioeconomic characteristics of the respondents were age (years), educational qualification (classes), family size (numbers), farming experience (years), farm size (hectare), monthly family income (BDT month<sup>-1</sup>), training received (number), organizational participation (score), cosmopolitanism (score) and extension media contact (score).

### **2.5. Measurement of focus variable**

#### **2.5.1. Farmers' perceptions score on the impacts of Corona pandemic on agricultural systems**

Each respondent was asked to indicate their perceptions about impacts of Corona pandemic on agricultural systems to 18 incorporated statements in the interview schedule. They were asked to indicate their perceptions against each of the statements. Their perceptions rated as

clear, moderately clear, partially clear, and not clear and a score of 3, 2, 1, 0 were assigned against the rating scales, respectively. The perception score of a respondent was determined by summing the scores of all the statements. The score could range from 0 to 54. Farmers Perception Score (FPS) regarding the selected statements about impacts of Corona pandemic on agricultural systems was 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<sub>1</sub>= Number of respondents rated the statement as clear

N<sub>2</sub> = Number of respondents rated the statement as moderately clear

N<sub>3</sub>= Number of respondents rated the statement as partially clear

N<sub>4</sub>= Number of respondents rated the statement as not clear

Farmers' perception index (FPI) 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:

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

### 2.5.2. 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. 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 scale, 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 in the interview schedule. The possible range of score was 0 to 48 for the respondents. Impact Extent Score (IES) for each of the incorporated statements on impacts of Corona pandemic on the livelihood activities of rural farmers was 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<sub>1</sub>= Number of respondents rated the statement as no impact

N<sub>2</sub>= Number of respondents rated the statement as low impact

N<sub>3</sub>= Number of respondents rated the statement as moderate impact

N<sub>4</sub>= Number of respondents rated the statement as high adverse impact

Impact Extent Index (IEI) 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:

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

la = livelihood activities

## 2.6. Data processing and analysis

During data processing, appropriate scoring technique was applied for conversion all the data. Local units of measurements were converted into standard units. Analysis of data were 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.

## 3. Results and Discussion

### 3.1. Selected socioeconomic characteristics of the respondents

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 1. Data presented in Table 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) conducted a study at Dumuria upazila of Khulna district and 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) also found that highest portion (57.7%) of the respondents had secondary level of education at Assasuni upazila of Satkhira district. 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 at Assasuni upazila of Satkhira district.

**Table 1.** Distribution of respondents according to their socioeconomic characteristics

Characteristics	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			
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			
	Postgraduate	>16	4	3.6			
Family size (No.)	Small	≤4	49	44.5	4.79±1.63	2	11
	Medium	5-6	50	45.5			
	Large	>6	11	10			
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			
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			
Family income (BDT month <sup>-1</sup> )	Low	<15000	41	37.3	21861.8±25384.7	8000	234000
	Medium	15000-25000	53	48.2			
	High	>25000	16	14.5			
Training received	Yes	26		23.6(%)			
	No	84		76.4(%)			
Training received (No.)	Low	≤2	19	73.1	1.88 ±1.33	1	7
	Medium	3-5	6	23.1			
	High	>5	1	3.8			
Organizational Participation (Score)	Low	≤8	110	100	0.88± 1.18	0	7
	Medium	9-16	0	0			
	High	>16	0	0			
Cosmopolitanism (Score)	Low	≤5	65	59.1	5.05±2.75	1	13
	Medium	6-10	41	37.3			
	High	>10	4	3.6			

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			
	Regularly	52-68	2	1.8			
						Range (possible): 0-68	

SD = Standard Deviation

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) conducted a study at three villages named Ghola, Zoykhali and Shailmary of Jalma union of Batiaghata upazila under Khulna district and 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. 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). 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, 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. All of the respondent's organizational participation was low with a mean of 0.88 and standard deviation of 1.18. Mim and Islam (2022) conducted a study at Dumuria upazila of Khulna district and also found 100% of the respondents had low organizational participation. The farmers had less interest in organizational participation. Organizational participation of educated persons is notable. Moreover, they remain 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 at Dumuria upazila of Khulna district. 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. 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.

### 3.2. Relative position of the statements related to farmers' perceptions

The data presented in Table 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 99 to 289 where possible range was 0 to 330.

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 1<sup>st</sup>. "Timely unavailability of seeds led to late sowing" ranked 2<sup>nd</sup> according to the respondent's perception where the "unavailability of required pesticides has disrupted intercultural operations" ranked 3<sup>rd</sup>. 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.

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 according to them.

According to Middendorf *et al.* (2021a), Crop production affected due to the challenges of accessing inputs, delay

in planting seasons, and inability to hire labor in Burkina Faso. Popescu and Popescu (2022) recorded in Romania 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 that the supply chain was broken down in Tanzania and South Africa.

**Table 2.** Relative position of the statements related to farmers' perceptions on impacts of Corona pandemic on agricultural systems

Agricultural systems	Statements	Clear (3)	Moderately clear (2)	Partially clear (1)	Not clear (0)	Score	Index (%)	Rank
Farmers	Corona pandemic caused illness and consequently performance of farmer reduced	43x3	5x2	0x1	62x0	139	42.1	10 <sup>th</sup>
	Corona pandemic caused illness and consecutive mental depression	69x3	6x2	1x1	34x0	220	66.67	5 <sup>th</sup>
	Corona pandemic reduced social and cultural orientation	30x3	6x2	2x1	72x0	104	31.5	12 <sup>th</sup>
Extension services	Unavailability of extension services due to corona pandemic	32x3	15x2	16x1	47x0	142	43	8 <sup>th</sup>
	Extension services were not timely available	32x3	17x2	16x1	45x0	146	44.24	7 <sup>th</sup>
	Extension services were not available in appropriate method	30x3	13x2	14x1	53x0	130	39.39	11 <sup>th</sup> =
Supply of physical inputs	Unavailability of fertilizer in the market	86x3	12x2	7x1	5x0	289	87.57	1 <sup>st</sup> =
	Unavailability of required amount of fertilizer for cultivation	86x3	12x2	7x1	5x0	289	87.57	1 <sup>st</sup> =
	Unavailability of the desired seed variety hampered cultivation	86x3	12x2	7x1	5x0	289	87.57	1 <sup>st</sup> =
	Timely unavailability of seeds led to late sowing	85x3	13x2	7x1	5x0	288	87.27	2 <sup>nd</sup>
	Unavailability of required pesticide has disrupted intercultural operation	84x3	13x2	7x1	6x0	285	86.36	3 <sup>rd</sup>
Production activity	Timely unavailability of pesticide in the market led to rapid disease transmission	82x3	10x2	10x1	8x0	276	83.63	4 <sup>th</sup>
	Corona pandemic impeded intensive caretaking of crops which has led to yield loss	25x3	13x2	29x1	43x0	130	39.39	11 <sup>th</sup> =
	Expected yield was not obtained due to the pandemic	27x3	14x2	27x1	42x0	136	41.21	9 <sup>th</sup>
Marketing	Labor shortage during the pandemic disrupted harvest operation	32x3	14x2	31x1	33x0	155	46.96	6 <sup>th</sup>
	Market closure caused difficulties in collection of inputs lead to delay in agricultural operation	21x3	9x2	21x1	59x0	102	30.90	13 <sup>th</sup>
	Marketing of produced product disrupted due to lack of enough transportation facilities	20x3	9x2	21x1	60x0	99	30	15 <sup>th</sup>
	Could not sell product due to lack of buyers	21x3	9x2	20x1	60x0	101	30.6	14 <sup>th</sup>

("=" It indicates equal rank)

### 3.3. Respondent's categorization according to their perception on impacts of corona pandemic on agricultural systems

Results presented in Table 3 indicate that the majority of the respondents (58.2%) had moderately clear perception about the impacts of the corona pandemic on agricultural

systems whereas 18.2% and 23.6% of respondents had partially clear and highly clear perception, respectively. The minimum and maximum score was 3 and 54 with the mean of 31.18 and standard deviation of 12.11.

The highest portion of the respondents had moderately clear perception about the impacts of the corona

pandemic on agricultural systems because respondents' concepts about the impact of the corona pandemic on agricultural systems were different. Individual respondent was different in thought as well as thinkability, and they had different perceptions as well as different considerations.

### 3.4. Relative position of statements on impact of corona pandemic on livelihood activities

The data presented in Table 4 show the 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 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	$\leq 18$	20	18.2	31.18 $\pm$ 12.11	3	54
Moderately clear	19-36	64	58.2			
Highly clear	$> 36$	26	23.6		Range (possible): 0-54	

Respondents' opinions about the impact of Corona pandemic on their livelihood activities were collected through some incorporated statements in the interview schedule. The statement such as "reduction in income has made the maintenance of the family difficult" was ranked 1<sup>st</sup> where "higher family expenditure leads to a poor standard of life" was ranked 2<sup>nd</sup>. "Change in food consumption behavior due to the pandemic" has taken place and ranked 3<sup>rd</sup>. Statements such as the "pandemic has led to child dropout out from schooling", "to bear family expenses selling of land", and "death of earning members left families helpless which has changed economic condition of the family" were ranked 13<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> respectively.

Due to corona pandemic income reduction has taken place which has made family maintenance difficult. The increasing price of commodities during corona pandemic has not been stopped and now higher expenditure for families leads to a poor standard of life. Besides change in behavior of food consumption has happened due to the pandemic. The purchasing capacity of the respondents has changed due to a reduction in income as well as the higher price of daily necessary commodities. There is the fluctuation of stable income from cultivation as well as the pandemic has led to food insecurity in some cases. The indebtedness of the respondents to bear family expenses has resulted due to the pandemic. Besides, there was a lack of access to credit facilities during the pandemic, which has disrupted income generating activity and non-farming activities impeded, which has led to a reduction in income. Diversified earning sources has been reduced due to a lack of capital and the pandemic has led to a reduction in access to medical services due to income reduction. Some respondents lost their job during the pandemic and they have been compelled to migrate to other occupations. Besides the reduction of the working ability of the earning member of the family has made

income less. The pandemic has led to child dropouts from schooling and they are doing agricultural work as well as other jobs. The selling of land has taken place to bear family expenses and to pay the debt and get medical treatment. The death of earning member of the family has left the family helpless resulting in changing the economic condition of the family.

The COVID-19 pandemic compounded food security challenges and sustainable livelihoods in developing countries (Rasul, 2021). Asegie *et al.* (2021) found at South Wollo and Oromia Zones, Ethiopia that the livelihoods of 88.89% of the households were affected by the pandemic. The pandemic significantly affected and forced households to cease their livelihood activities such as daily labor (34.82%), small business trade (26.3%), livestock trading (23.7%), income from remittance (21.49%) and labor migration (11.48%).

### 3.5. Respondent's categorization according to their perception about impact of corona pandemic on livelihood activities

The results presented in Table 5 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.

### 3.6. Relative position of statements on impact of corona pandemic lockdown on agricultural production

The data presented in Table 6 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.** Relative Position of statements on impact of corona pandemic on the livelihood activities of rural farmers

Sl. No.	Statements	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	109x0	0x1	1x2	0x3	2	0.60	15 <sup>th</sup>
2.	Reduction of working ability of the earning member has made income less	100x0	4x1	5x2	1x3	17	5.15	12 <sup>th</sup> =
3.	Reduction in income has made maintenance of family difficult	2x0	8x1	48x2	52x3	260	78.8	1 <sup>st</sup>
4.	Higher family expenditure leads to poor standard of life	4x0	12x1	49x2	45x3	245	74.2	2 <sup>nd</sup>
5.	Change in food consumption behavior due to the pandemic	5x0	12x1	62x2	31x3	229	69.4	3 <sup>rd</sup>
6.	To bear family expenses selling of land	106x0	0x1	2x2	2x3	10	3.03	14 <sup>th</sup>
7.	Fluctuation of stable income from cultivation due to the pandemic	6x0	25x1	70x2	9x3	192	58.2	5 <sup>th</sup>
8.	Changes has occurred in purchasing capacity of necessary commodities	3x0	20x1	68x2	19x3	213	64.5	4 <sup>th</sup>
9.	Loss of job has compelled to migrate to other occupation	100x0	4x1	5x2	1x3	17	5.15	12 <sup>th</sup> =
10.	Pandemic has led to child dropout from schooling	104x0	1x1	3x2	2x3	13	3.93	13 <sup>th</sup>
11.	Pandemic has led to reduction in access to medical services	66x0	30x1	13x2	1x3	59	17.8	11 <sup>th</sup>
12.	Reduction of diversified earning sources has made to depend on specific earning source	65x0	19x1	21x2	5x3	76	23.03	9 <sup>th</sup>
13.	Non-farming earning activities impeded which has led to reduction in income	65x0	26x1	16x2	3x3	67	20.3	10 <sup>th</sup>
14.	Lack of access to credit during pandemic disrupted income generating activity	47x0	28x1	35x2	0x3	98	29.7	8 <sup>th</sup>
15.	Corona pandemic has led to food insecurity	13x0	16x1	73x2	8x3	186	56.4	6 <sup>th</sup>
16.	Indebtedness of farmer to bear family expenses due to corona pandemic	26x0	24x1	54x2	6x3	150	45.4	7 <sup>th</sup>

("=" It indicates equal rank)

**Table 5.** Distribution of respondents according to their perception about impact of Corona pandemic on livelihood activities

Categories	Score	n=110		Mean $\pm$ Standard Deviation ( $\bar{X} \pm \sigma$ )	Range (observed)	
		Number	%		Min.	Max.
Partial impact	$\leq 16$	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	



**Table 6.** Relative position of the statements on impact of Corona pandemic lockdown on agricultural production

Sl. No.	Statements	No (0)	Impact	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	68x0		14x1	20x2	8x3	78	23.63	10 <sup>th</sup>
2.	Timely unavailability of agricultural inputs has resulted in reduction in agricultural production	57x0		12x1	24x2	17x3	111	33.63	8 <sup>th</sup>
3.	Increased price of agricultural inputs hampered agricultural production	2x0		1x1	15x2	92x3	307	93.03	1 <sup>st</sup>
4.	Restriction on human movement led to labor shortage and affected agricultural operations	67x0		13x1	12x2	18x3	91	27.6	9 <sup>th</sup>
5.	Timely unavailability of livestock and fisheries feed impeded the production of livestock and fisheries	50x0		20x1	12x2	28x3	128	38.8	5 <sup>th</sup>
6.	Famers faced difficulty due to the increased price of livestock and fisheries feed	29x0		5x1	18x2	58x3	215	65.15	3 <sup>rd</sup>
7.	Unavailability of veterinary services for livestock in required time disrupted livestock raising as well as production	55x0		38x1	13x2	4x3	76	23.03	11 <sup>th</sup>
8.	Unavailable transportation facilities due to lockdown hampered transportation of product to the market	63x0		6x1	13x2	28x3	116	35.15	7 <sup>th</sup>
9.	Increased transportation cost resulted in higher cost of production	5x0		1x1	16x2	88x3	297	90	2 <sup>nd</sup>
10.	Reduction in farmers access to market due to lockdown	95x0		13x1	2x2	0x3	17	5.15	15 <sup>th</sup>
11.	Increment of post-harvest losses due lack of proper transportation facilities	73x0		28x1	9x2	0x3	46	13.9	14 <sup>th</sup>
12.	Disposal of perishable products due to lack storage facilities	66x0		31x1	11x2	2x3	59	17.8	12 <sup>th</sup>
13.	Low market price of the produced product due to lockdown	40x0		23x1	41x2	6x3	123	37.3	6 <sup>th</sup>
14.	Reduction in demand of the produced product due to lockdown	69x0		31x1	7x2	3x3	54	16.4	13 <sup>th</sup> =
15.	Reduced demand led to reduction in price of the product	68x0		32x1	8x2	2x3	54	16.4	13 <sup>th</sup> =
16.	Fluctuation of market price of the product due to lockdown	8x0		32x1	46x2	24x3	196	59.4	4 <sup>th</sup>

("=" It indicates equal rank)

The “increased price of agricultural inputs hampered agricultural production” was ranked 1<sup>st</sup> while “increased transportation cost resulted in higher cost of production” ranked 2<sup>nd</sup>. “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 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup>, 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 13<sup>th</sup>, 14<sup>th</sup>, 15<sup>th</sup> respectively.

During the corona pandemic lockdown, there were obstacles to many aspects of agricultural production which still exist in some cases. The 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.

Pu and Zhong (2020) found in China that the agricultural supply chain was disrupted by the pandemic. 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 in Burkina Faso.

### 3.7 Respondent's categorization according to impact of corona pandemic lockdown on agricultural production

Results presented in Table 7 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.

There was moderate impact of the corona pandemic lockdown on agricultural production. 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.

### 3.8 Rank order of the magnitude of the impacts

The data presented in Table 8 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 2<sup>nd</sup> highest magnitude of impact. Higher family expenditure (27.27%) was ranked 3<sup>rd</sup> 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 10<sup>th</sup>.

The economic loss was the highest magnitude of the impact of the 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.

### 3.9 Case studies of the 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.

**Table 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	$\leq 16$	51	46.4			
Moderate impact	17-32	59	53.6	17.89 $\pm$ 7.85	7	36
High adverse impact	$>32$	0	0		Range (possible): 0-48	

**Table 8.** Rank order of the magnitude of impacts of corona pandemic according to respondent's own observation

Sl. No.	Observation	Citation	%	Rank
1.	Economic loss	48	43.63	1 <sup>st</sup>
2.	Reduction in income	46	41.81	2 <sup>nd</sup> =
3.	Increment of agricultural input cost resulting in higher cost of production	46	41.81	2 <sup>nd</sup> =
4.	Higher family expenditure	30	27.27	3 <sup>rd</sup>
5.	Price increment of daily necessary commodities	15	13.63	4 <sup>th</sup>
6.	Price of the produced product is low	14	12.72	5 <sup>th</sup>
7.	Change in food consumption behavior	10	9.09	6 <sup>th</sup>
8.	Increment of disease	6	5.45	7 <sup>th</sup>
9.	High price of fisheries food and medicine	4	3.63	8 <sup>th</sup>
10.	Loss of job	2	1.82	9 <sup>th</sup> =
11.	Reduction of earning sources	2	1.82	9 <sup>th</sup> =
12.	Economic problem of wage earners has increased	1	0.91	10 <sup>th</sup> =
13.	Selling of land to bear expenses	1	0.91	10 <sup>th</sup> =
14.	Difficulty in bearing children educational cost	1	0.91	10 <sup>th</sup> =
15.	Death of family member	1	0.91	10 <sup>th</sup> =

("=" It indicates equal rank)

### 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. The price of electricity and diesel has increased, so 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.

#### 4. Conclusion

The highest proportion (45.5%) of the respondents were middle-aged with a medium sized family (45.5%) while 61.8% of the respondents had a high level of farming experience and a small sized farm (66.4%). The highest portion of the respondents (48.2%) had medium income. The majority of the respondents (58.2%) had moderately clear perception about the impacts of corona pandemic on agricultural systems while 18.2% and 23.6% respondents had partially clear and highly clear perception respectively. The highest portion of the respondents (55.5%) had moderate impact on their livelihood activities while 44.5% respondents had partial impact. The majority of the respondents (53.6%) had moderate impact of the Corona pandemic lockdown on agricultural production while 46.4% respondents had partial impact. Among the respondents, 43.63% of the respondents considered economic loss as the 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 production cost, ranked 2<sup>nd</sup>. Higher family expenditure (27.27%) was considered as highest magnitude of impact by the respondents and ranked 3<sup>rd</sup>.

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 the corona pandemic. The moderate impact of corona pandemic should be transformed to minimum impact through proper policy implication by the concerned authorities. The magnitude of the impact of corona pandemic can be minimized by controlling inflation and increasing the income of individuals. Further research should also be done in other parts of Bangladesh to determine the impact of the Corona pandemic on the livelihoods of rural farmers.

#### 5. Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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