



Agrifood Systems Policy Research

How to build a pandemic
resilient agrifood system?
A review of policy lessons
from COVID-19 in
Bangladesh

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ABSTRACT

The COVID-19 pandemic impacted most of the Bangladesh population and almost all sectors of its economy, including the agriculture and food systems. The Government of Bangladesh (GoB) and development partners took measures to prevent the spread of the virus and keep the agriculture and food systems running, and farmers and communities adopted local techniques as resilience measures to adapt to and lessen the effect of the virus. This review attempts to synthesize the knowledge on impacts of COVID-19 on Bangladesh agriculture and food systems, and document government's and development partners' policy responses and measures to COVID-19 to mitigate the impacts and farmers' coping strategies as effective resilience measures. The aim here is to provide a comprehensive picture of impacts and policy lessons to the Bangladesh government and development partners to effectively manage any future pandemics such as COVID-19 in the country and in developing countries of Asia. The core lesson is that agriculture needs a transformation to technology intensive (both digital and non-digital), efficient supply chains (i.e., shorter value chains), mechanization, farmer organizations led, and consumer connected (e.g., online platforms and direct marketing channels) with various kinds of resilience measures, including information sharing systems, financial mechanisms and social safety nets. A diversified approach is required for perishable and non-perishable commodities. There is also a need of international effort to minimize trade and supply disruption and prevention of export ban and similar policies to reduce the impact on food system and associated livelihoods.



Rice field in Dinajpur, Photo Credit: Abdul Momin

1. Introduction

The first case of COVID-19 in Bangladesh was reported on 8 March 2020 (WHO, 2020a). The government took several measures to prevent the spread of the virus, including the implementation of a nationwide lockdown (“General Holiday”) between 26 March and 30 May 2020 accompanied by several protective measures such as restricted movement, closures, mandatory wearing of masks, etc. During this period, the government ordered closure of all businesses and institutions other than hospitals, kitchen markets (kachar bazar), pharmacies, and other emergency and health-related services (WHO, 2020b). Such restrictions and closures resulted in restricted access to agricultural products, inputs, markets and Extension and Advisory Services (EAS). In August 2020, Bangladesh witnessed its first wave of the pandemic. The second wave came in the first week of April 2021. A country-wide lockdown remained in place since April 14, 2021. This lockdown was less strict than the first one allowing for public and private offices, and some industries to remain operational although transportation was limited along with border control measures in place. The third wave of the pandemic occurred in early July 2021. The government then announced a seven-day strict lockdown from July 1 to 7 during which all government, semi-government, autonomous, and private offices, and all transportations, excepting those providing emergency services were closed or suspended. However, industries remained operational by maintaining health protocols (IMF, 2021).

To combat the COVID-19, the government has been taking various

steps such as diagnosis of the suspected cases, quarantine or isolation of infected patients, grant general leave for working staff from all offices for staying at home, increase public awareness and enforce social distancing and so on. In addition, to address the adverse socio-economic situations, the government announced several financial stimulus packages. IMF (2021a) has summarized the policy/fiscal responses by the Government of Bangladesh (GoB) as of 1 July 2021. As of end of April 2021, Bangladesh Taka (BDT) 390.7 billion (about US\$ 4.6 billion) of fiscal stimulus had been announced, of which BDT186 billion (about US\$ 2.2 billion) had been disbursed. The Fiscal Year 21/22 budget included higher allocations for health, agriculture, and social safety net programs. However, very limited diagnostic facilities and health workers compared to the country's population, limited health resources such as hospital beds, personal protective equipment, intensive care unit, and ventilators in the hospitals, along with limited public unawareness about the pandemic have remained the major challenges for Bangladesh to tackle the situation effectively.

This study is based on review of COVID-19 related literature related to agriculture - journal papers and reports from all possible sources and website links- from past three years focusing on Bangladesh. The objectives are to:

- i. Synthesize the knowledge on overall impacts of COVID-19 on Bangladesh agriculture and food systems.
- ii. Document government's and development partners' policy responses and measures and farmers' coping strategies to mitigate the impacts.
- iii. Provide a comprehensive picture of impacts and policy lessons to the

Bangladesh government and development partners to effectively manage any future pandemics such as COVID-19 in the country and in developing countries of Asia.

2. Method

Amjath-Babu et al. (2020) developed a conceptual diagram depicting the

potential impact pathways of COVID-19 that may affect agriculture and food production systems in South Asia (Figure 1). The figure reveals that the interactive effects could cascade throughout the agriculture and food system. The current review looks at the policy measures that attempted to reduce each potential impacts along this pathway for Bangladesh.

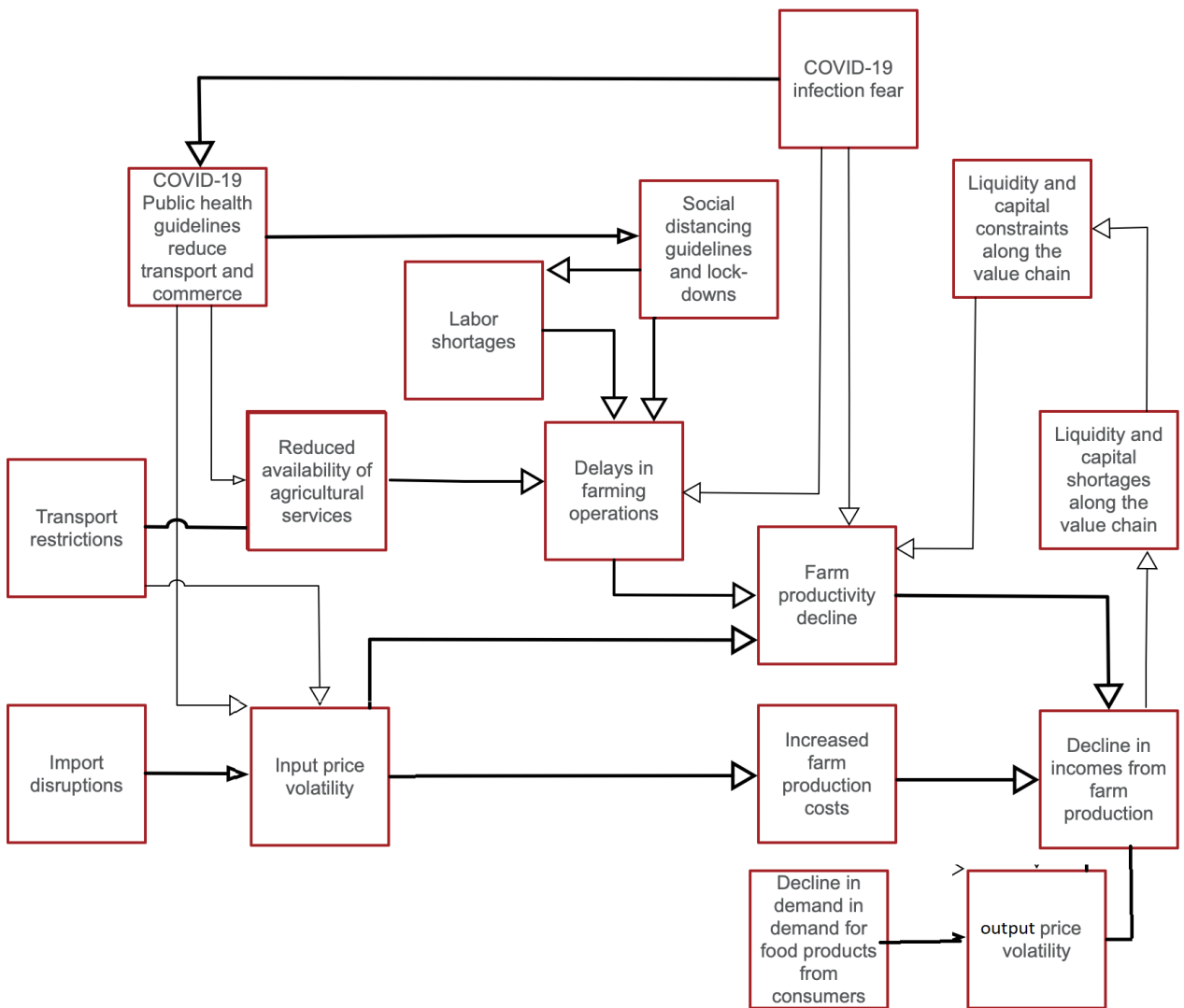


Figure 1: COVID-19 related immediate food system disruption and impacts (Source: Amjath-Babu et al., 2020b)

3. Food system disruptions caused by COVID-19 pandemic

As in most other countries (e.g., Stephens et al., 2022), the COVID-19 pandemic has disproportionately affected various sectors of the Bangladesh economy. Among the three broad sectors, manufacturing sector was hard hit followed by service sector while agriculture sector remained relatively insulated (SAARC Finance Cell, 2021). In agriculture, the most affected sectors included crop, livestock and poultry, aquaculture and fisheries, ornamental flowers, and vegetables and fruits. Major agricultural products that experienced adverse disruption in supply chains included onion, garlic, ginger, lentil, sugarcane, palm oil, spices such as pepper and turmeric, and fruits and vegetables.

Another study based on survey of extension and advisory service providers by the Society for Bangladesh Agricultural Extension Network identified 22 major problems of which those related to “wastage and low price of farmers’ products (vegetables, fruits,

egg, milk, meat, flower, shrimp, crab, etc.) at farm gate or local market due to disconnect with the customer, absence of traders (e.g., middlemen as collectors, transporters wholesalers, etc.) and vehicles for transport” as the top-ranked problems (Ali, 2020). A study across 56 districts by Malek et al. (2021) found that the rural economy of Bangladesh experienced several adverse impacts from the containment measures, such as delayed harvest, difficulty in selling farm produce, labor and material input disruptions and cost increases, and reductions in remittance receipts and non-farm business sales. Vulnerability was especially apparent in households with a head who was female, less educated, young, or casual labor. Livelihoods varied significantly among geographical areas according to the concentration of the infection and less significantly according to the stringency of the lockdown measures (Table 1). Ali et al. (2020) identified 28 problems faced by the Bangladeshi farmers arising from the COVID-19 pandemic, with 22 as severe. Problems relating to product wastage, low product-level pricing, absence of traders, and transportation issues were identified as top ranking.



Vegetable market in Dinajpur, Photo Credit: Zakir Hossain

Table 1. Households' Preferences for Government Responses to COVID-19 (adapted from Malek et al., 2021).

| Policies | Somewhat and Strongly Want (%) | Average score |
|---|--------------------------------|---------------|
| Removal of movement restrictions to access markets | 57.4 | 3.28 |
| Removal of movement restrictions for traders to visits farmers/retailers | 69.8 | 3.71 |
| Loan repayment moratorium | 86.3 | 4.43 |
| Cash assistance for farm inputs/business raw materials | 86.4 | 4.46 |
| Soft loans for farm inputs/business working capital/starting a new business | 86.6 | 4.45 |
| Cash/products for rural work program | 90.8 | 4.58 |
| Skill adjustment training for returning employees from abroad | 73.3 | 4.08 |
| Soft loans for returning employees from abroad to start a new business | 72.8 | 4.09 |
| Job creation | 87.0 | 4.55 |

3.1 Decline in demand for food products

The economic shutdown with travel restriction greatly hampered the farmer-consumer alliance resulting in an imbalance between demand and supply of food. The three successive cycles of lockdown in 2020 broke the cohesion and coherence in supply and demand balance, supply chain break up, customers' consumption habit, and relationship between the producers and workers. (Kumar et al., 2020). The disruption revealed the underlying weaknesses in supply chains of the rapidly perishable products such as vegetables, flowers, poultry and dairy products, boro rice and maize.

WorldFish and FAO (2020) reported that the fish seed systems have been adversely affected on both supply and demand side. On the supply side, movement restrictions increased the cost of transportation of the inputs required for seed production. Consequently, the cost of feed and other aquaculture inputs increased substantially. The transportation problem further reduced the ability of seed suppliers to deliver the input to grow-out farmers in a timely manner. Most hatcheries specializing in the dissemination of breeder seed stopped production due to reduced demand. Belton et al. (2021) also reported that the aquatic food value chains were severely

disrupted with rising prices of production input. Impacts on demand for aquatic foods, production inputs, and labor were longer lasting than impacts on their supply. On the demand side, closure of restaurants and the enforcement of lockdowns reduced the market for aquaculture fishes. The demand decline was due to less ability of consumers to buy fish because of fewer income-earning activities.

Ayeshik and Nazrul (2021) reported that the immediate impact of the COVID-19 pandemic on dairy sector was seen in April-May 2020 itself as 4 million liters of milk worth 18.9 crore BDT (USD 22.5 million) were being wasted due to insufficient demand. The slowdown of milk demand caused economic hardship for the dairy farmers since it was their main source of daily income. Many of those farmers were forced to quit dairy farming and were seeking for an alternative livelihood. Due to such impact of the pandemic on the dairy sector, the projected growth of the dairy industry dropped from 5.5% to 2.1% in 2020 itself. Rahman and Das (2021) reported that COVID-19 severely affected an estimated 0.3 million dairy farms and 65–70 thousand commercial poultry farms in Bangladesh, by many of them closing or halting productions due to the continuous losses.

In Bangladesh, about 50-60% of maize, almost 40% of soybean, and most of the API (Pharmaceutical active ingredients) used for animal medicine are imported. Sultana (2020) reported the major implications of initial outbreak of COVID-19 on the livestock industry as: (i) Import disruption of maize and soybean as raw materials for animal feed and shortage of supply of medicines for the livestock due to shortage of API, (ii) Misconceptions and misinformation about the virus originating or

transmitting through livestock (poultry, cattle) causing a decline in consumption of animal-based protein, (iii) Demand decline and supply chain disruption causing the prices of eggs, poultry, meat, and dairy products to decline. (iv) Insufficient workforce, reduced meat processing, disruptions logistic, and transportation facilities affecting the livestock value chain.

3.2 Disruption in farm services and input provision

Bhandari et al. (2021) prepared a conceptual framework for the transmission of disruptions in the rice value chain (RVC). They reported that the lockdowns, shutdowns, and other protection measures induced by the COVID-19-pandemic disrupted the upstream (input supply and production), midstream (processing, marketing, and logistics), and downstream (retail and consumption) segments of the RVC. The major drivers disrupting the RVC were restrictions on mobility, transport and trade, labor shortage, reduced access to agricultural services, limited access to input and output markets, constrained financial flow, and declining income and food demand. COVID-19 pandemic caused the rural-urban disconnect, making farmers unable to sell produce, leading to increased price differences between producers and consumers (i.e., low prices to farmers and high prices to consumers), decreasing income and cash flows, and hampered businesses in the RVC.

IRRI/FAO (2020) also summarized the most significant impacts of COVID-19 on Bangladesh's RVC, described how actors have been impacted, and set out recommendations for addressing the challenges and normalizing the supply chain.

The impacts were:

1. Lockdown and labour shortages increased costs and delayed the rice harvesting and planting.
2. Limited access to extension services led to decreased rice yield and quality.
3. Limited procurement and distribution of good quality rice seed due to lockdown would impact rice yield.
4. Rice mills were struggling to cope with financial losses.
5. Disruptions in the supply chains of inputs and outputs.
6. Reduced cash flow to run businesses.
7. Smallholder rice farmers faced difficulties selling rice to government warehouses.

Nazrul and Sultana (2020) reported that the pandemic had the most significant impact on the transport sector of the fish supply chain. During the lockdown there were limited number of commercial vehicles on the streets and those that were in operation had faced increased checking and scrutiny by law enforcement agencies. This resulted in rise in transportation cost, which in turn led to marginal increase in fish feed price at the retail level but no formal price increase for the feed manufacturers. Nazrul and Sultana (2020) further observed that the shrimp farmers experienced a severe crisis in accessing shrimp seed stock from the market. The supply crunch had led to 200-300% increase in prices for seed stock. With increased logistical cost and decreased customer buying power, the income of fish market intermediaries witnessed a reduction on an average by 53%.

COVID-19 also jeopardized the lives of coastal shrimp producers. Rahman et al. (2021) reported that the pandemic had

detrimental effect on the livelihoods of shrimp farmers as the total livelihood diversification score was higher before (0.53) than during the pandemic (0.43). The cost of shrimp production increased, and profitability reduced considerably during the pandemic when compared with before the pandemic. Ensuring adequate capital supply, access to health facilities, and appropriate coverage of social safety-net programs were suggested as mitigating measures of the negative livelihoods. Rahman et al. (2021) reported that the COVID-19 negatively affected the health and livelihoods and food security of the fisheries communities in the Baor (Oxbowlake) basin in southwestern Bangladesh. Fishers had to either stop harvesting or lower the quantity of fishes for harvesting due to reduced consumer demands during the lockdown period. The fish supply chains and fish culture inputs were also disrupted due to no or reduced transportation. All these factors negatively impacted the health and incomes of the people dependent on fishing activity.

Hasan et al. (2021) reported that COVID-19 pandemic resulted in a squeeze on profit for the finfish farmer and resulted in disparities within the supply chain. Benefit-cost ratio analysis of farming revealed that although carp and other catfish farming remained close to the break-even level, pangasius and tilapia farming were forcing the farmers to a debt cycle. Whilst the consumers were paying higher prices for pangasius and carp and slightly reduced prices for tilapia and other catfish, the finfish farmers were receiving less profits. To compensate for rising operational costs and reduced income, fish farmers reduced workers and their wages.

Ahmed et al. (2021) also reported that in Khulna, the fish production activities were seriously hampered due to unavailability of inputs (aqua-medicine, disinfectants, and fish seed and feed, etc.), reduced labor availability, increased prices of production materials, and interrupted communication, etc.

Sattar et al. (2021) reported that disrupted production and transportation, declining consumer demand, and volatile markets brought huge financial difficulties to poultry sector, leading to the permanent closure of many poultry farms. The extent of the damage experienced during the first months of COVID-19 was a consequence of how interconnected the stakeholders and businesses are across the poultry sector. For example, a shift in consumer demand in live bird markets had ripple effects that impacted the price of goods and put pressure on traders, middlemen, farmers, and input suppliers. They demonstrated that the interconnectedness across all levels of the poultry industry makes it fragile by the pandemic. This suggests the need of long-term planning efforts to save the industry against similar pandemics in future.

3.3 Decline in farm income and adverse consequence on food security

COVID-19 resulted in negative impacts on the livelihoods of the marginal population in Bangladesh. Hossain (2021) reported that many people working in the informal sector lost their job and income due to pandemic. Motaleb et al. (2020) examined the food security and welfare impacts of the COVID-19 induced lockdown on daily wage workers both in the farm and nonfarm sectors. Considering daily wage

earning and wage loss, they estimated that the one-day complete lockdown would generate a US\$64.2 million equivalent economic loss. Kang et al. (2021a,b) reported that the pandemic increased the unemployment and poverty among the people in both urban and rural areas throughout the Asian Pacific region, including Bangladesh, although urban areas were more impacted than the rural areas. Islam et al. (2021) found that COVID-19 created an unprecedented impact on household food insecurity resulting in 33% of households extremely food insecure and 19% highly insecure. COVID-19 crisis forced households into long-term loan burden, causing delayed households' economic recovery. They concluded that the long-term GOs and NGOs sustainable economic recovery intervention could help marginalized people to build back better from COVID-19.

Ahmed et al. (2020) studied the determinants and dynamics of food insecurity at two stages after lockdowns. Their results revealed three important implications: (i) 90% of the households experienced income loss due to COVID-19, (ii) more than 50% of the household heads were either in farming or as day laborers, and (iii) savings, borrowings, and food stocks appeared to be the main coping strategies to address food shortages during the pandemic. In terms of occupation, food insecurity was relatively higher in households that are primarily farmers and wage laborers than in households with more stable occupations, such as with public sector jobs or owning businesses. Alam and Khatun (2021) reported that the lockdown impeded vegetable farmers' access to markets and limiting their productivity and sales capacities. The vegetables (brinjal, cucumber, pointed gourd, yard long beans and bottle

and garments employing women were hardest hit by the pandemic and female workers rapidly lost their means to earn income and were confined at homes. Beyond lost jobs and reduced working hours, the pandemic also increased the women's time under poverty. She reported that countrywide lockdown and social distancing increased women's burden of unpaid care and domestic work as manifested by about 55% of surveyed women facing additional domestic work stress and 58% with increased unpaid care work. Extra care of children due to schools' closure and of family members returning home from urban areas or overseas further exacerbated women's and girls' unpaid workloads during home quarantine and post-pandemic period compared to pre-pandemic. The reduction in wage employment opportunities in farm and agro-processing industries lead women to a greater risk of income insecurity. Maximum numbers of agro-processing industries were closed, and women workers were fired since maintaining social distancing was not possible. Some agro-processing industries changed operating policy to cope with the pandemic, allowing work by male workers only. Such results suggest the need of the gender-inclusive policy to minimize the effects of the pandemic, placing women at the center of policy debate. A rapid assessment conducted by Solidaridad in July 2020 highlighted that (i) women were more vulnerable during pandemic than pre-pandemic time compared to men due to their inaccessibility to technology, financial credits, input supplies, and markets, and (ii) women who had planted crops prior to the pandemic found themselves stranded without labor to harvest their crops (Neha and Kumar, 2021). Dixon et al. (2021) reported that in Bangladesh the movement of female labour was

more restricted compared to their male counterparts due to social restrictions. The participation of female and older farmworkers decreased compared to the pre-COVID-19 situation. The impact of the loss of off-farm urban work among women was more pronounced compared to rural off-farm work. Usually, only men went out to the field and women were more focused on household work and their children's education. As a result, women became more dependent on men due to decreased external opportunity. However, through community seed banks, women contributed to household food security during the pandemic.

Rahman et al. (2021) showed that the worsening of the food security status was increasing the stress level of the women. Additionally, a significant negative association was observed between the Perceived Stress Scale (PSS) score for women during the lockdown and change in food security status between the two waves, indicating that deterioration in food security over the pandemic period increased the stress level in women in both urban and rural areas.

4. Farmers' coping mechanisms

4.1. Aquaculture and fisheries

WorldFish (2021) reported that the aquaculture farmers adapted to the challenges of COVID-19 by reducing production costs, sourcing alternative inputs, diversifying business activities, leveraging social capital, borrowing, seeking alternative employment, and reducing food consumption. Many of these coping strategies are likely to

undermine well-being and longer-term resilience, but there was also some evidence of proactive strategies with potential to strengthen business performance. WorldFish highlighted the importance of homestead food/fish production and food preservation practices as coping mechanisms for securing access to nutritious foods, particularly during economic shocks or food shortages. Mamun et al. (2021) reported the following coping strategies in aquaculture and fisheries sector during COVID-19: (i) Larger-scale actors in this sector utilized a mixture of strategies to adapt to COVID-19 impacts, while some small-scale actors coped by seeking supplementary sources of income, (ii) Most forms of support and assistance they received were informal with few receiving government support, (iii) Lower-income respondents described leveraging social capital with friends, relatives, and better-off individuals to obtain loans or food to support their households, and (iv) Some wealthier respondents reported providing food and financial assistance to their workers or neighbors.

Mandala et al. (2021) described that the fish farmers followed several types of coping strategies, including decreasing grocery shopping by shifting to online shopping, reducing consumption of high price commodities and junk food, cleaning fish and meat with hot water and vinegar, and increasing the consumption of protein and vitamin C rich food items. Prior to COVID-19, about 80% of the surveyed households used to buy fish from wet markets, which dropped to 45% during pandemic since many of them substituted fish and meat with poultry, eggs, and dried fish. About half of the households stockpiled rice, lentils, and potatoes during the peak of the pandemic for future use.

4.2 Food security

Malek et al. (2021) observed that rural households preferred cash or product support, rural work or employment support, and cash assistance or soft loans for farm inputs. Das et al. (2020) found that the rural households with mild/moderate food insecurity adopted either financial (27%) or both financial and food compromised (32%) coping strategies, but 61% of urban mild/moderate food insecure households and nearly 90% of severely food insecure households applied both forms of coping strategies. Different coping strategies by different groups could result in differences in long-term economic and nutritional consequences. Kim and Kang (2021) suggested that 74.4% of respondents in their study found food assistance would be effective in coping with a negative impact of COVID-19. Montu (2021) reported that reducing food intake and medical expenses, borrowing and begging, selling assets, displacement, child labour, and relief assistance were some of the coping strategies for food security during different stages of pandemic in coastal Bangladesh.

4.3 Producer organizations and virtual call centers

Producer Organizations (POs) have been created in Bangladesh as part of the Global Agriculture and Food Security Program's Missing Middle Initiative, supervised by FAO. A World Bank (2020) study revealed that as soon as after the first lockdown started, the POs started running 57 'Virtual Call Centers' (VCCs) in eight high-poverty districts to directly benefit farmer members. The POs established an ecosystem linking farmers with input suppliers and off takers by complying with GoB's

physical distancing protocol. The VCCs, each operated by a volunteer, facilitated the purchase of agricultural inputs and services and sale of produce. The POs worked closely with local authorities to ensure uninterrupted transport of produce during the shutdown period by following transparent governance and simple accounting methods. In addition to using mobile transfers like bKash, Rocket and Nagad to avoid paper currency transactions, the POs used Facebook and Messenger to share information and transaction records daily and zoom method to organize regular virtual meetings. Open Foris Collect Mobile was used to gather transaction data, which was regularly posted on the MMI Bangladesh A2F+ project's website (MMI Bangladesh A2F+ Project, 2021). Thus, the Pos and VCCs were considered to be resilient models during and after pandemic.

5. Government measures and responses

At the onset of the COVID-19 outbreak, there was a significant adverse impact on the food supply chain. Hence, the GoB decided to ensure an uninterrupted supply chain for agricultural inputs, allowing all agricultural input shops to remain open at specific times to support farmers. As the pandemic unfolded, the GoB as well as the donors and development partners and the NGOs responded to the pandemic quickly. The Bangladesh's Ministry of Agriculture, Fisheries and Livestock took steps to retain and intensify production and coordinate efforts to ensure timely availability of inputs, extension support, transportation, and value addition as the cropping season commenced. The GoB encouraged the farming community to cultivate more areas without keeping the land fallow or leaving other

resources unused and safeguard other value-chain actors, making sure that farm produce continues to reach markets while following social distance guidelines. Alam and Khatun (2021) reported that government measure of providing cash support was more important than food support for vegetables growers to ensure a ready supply of necessary low-cost resources and help fight against the food shortage.

The government showed strong commitment to ensuring food security by supporting farmers in the early harvesting of boro rice in April-May 2020, which was threatened by forecasted flash floods and lack of workers due to lockdowns. The government provided facilitation services and supplied mechanical harvesters on credit. Together with this, a combination of innovative local interventions in labour mobilisation, technology and strong monitoring resulted in a successful boro harvest. The government ensured that farmers received good boro prices to help ease their pandemic-related financial troubles. As a result, the government procurement target of boro rice was doubled. Farmers received higher prices for their rice than they did in 2019 (BRAC, 2020).

The Department of Livestock Services (DLS) and the Ministry of Livestock and Fisheries (MoLF) provided support to poultry farmers for the distribution and marketing of eggs and poultry, along with MoLF support for the early release of imported poultry feed materials and pharmaceutical products from the docks (Mahmud, 2020). World Bank (2020) reported that the MoLF and the World Bank provided the \$96 million emergency response through LDDP

(Livestock and Dairy Development Project) to protect livelihoods of the most vulnerable families that operate in the livestock sector. The response measures included: (1) Mass media communication to highlight the importance of milk, eggs, and meat for building immunity and consumer confidence that livestock products do not transmit the virus; (2) Cash transfer schemes to support business continuation for vulnerable poultry and dairy producers. receive financial support, with at least 25% to women; (3) Distributing milk cream separators for longer shelf life and helping farmers to stay in business; (4) Providing cooling devices for medicinal storage along with Mobile Veterinary Clinics (MVCs); (5) Van rentals to market milk and eggs for communities, and (6) Providing Personal Protective Equipment (PPE). It was envisioned that in the short run, such a response would help smallholder farmers safeguard their assets and activities and stay in business, while in the mid- to long run, LDDP would further embrace WHO's One Health principles to reduce the emergence and spread of zoonotic diseases. It would prioritize activities such as the modernization of wet markets to improve food safety, eradication of major animal diseases, building of modern slaughterhouses, and expansion of cold chain facilities for processing and storing milk, eggs, and meat. This would allow healthy income growth for producers and better nutrition for consumers.

FAO (2020) recommended the following measures to save poultry industry and provide relief to farmers: (1) Effective public communication to reassure consumers that coronavirus does not spread through chicken and eggs; (2) Restoration of the supply chain of

poultry meat and eggs; (3) Innovation of alternative channels of marketing eggs and broilers (e.g., temporary selling points, street vendors, home delivery); (4) Immediate cash incentives and access to interest-free credit facility to smallholder farmers to continue or restart their business; (5) Access to soft loans for large farmers; (6) Ensuring veterinary services and supply of necessary vaccines and medicines; and (7) Identification of locally available alternatives to imported feed ingredients and medicines. BNNC (Bangladesh National Nutrition Council), along with a high-level Expert Committee on Food Security and Nutrition, assessed the anticipated malnutrition case burden post-COVID-19 to develop workable solutions and suggested for the adoption of a three-pronged recommendation strategy focusing on development of a comprehensive multisectoral food and nutrition security response plan (BNNC, 2020). The plan encompasses protection and strengthening of the existing health and nutrition programs and services, and prevention of hunger and malnutrition with special emphasis laid on provision of right relief commodities to the poor, new poor, gender, and other vulnerable groups, in partnerships between GOs, NGOs, civil societies, local clusters and private sector. Supporting farmers, small and medium enterprises (SMEs), food systems and food supplies through strengthening the market regulation system and offering financial stimulus packages were proposed. They also proposed for the need of a multisectoral and well-coordinated approach to onboard all possible sectors in designing, implementing, supporting, and monitoring progress of the proposed plan. The regular monitoring of the impact of COVID-19 to ensure timely and appropriate actions called

for ready availability of information on nutrition and food insecurity status of households through an established nutrition surveillance system.

In agriculture sector, until June 2021, the GoB provided a stimulus package of BDT 50 billion (at 4% interest, or easy term credit) in soft loans to farmers alongside other support measures (e.g., facilitating machinery for crop harvesting at a subsidized rates and farmer labour mobilization, exempting farm product transportation from lockdown, distribution of free seeds, etc.) to boost up agricultural production. In this package, there was a provision of one-off transfer to vulnerable households and for expanding social security programs including old-age allowance, support for the widowed, deserted, and destitute women, and open market sale of rice and wheat at subsidized prices. This incentive has created an immediate impact on the performance of agricultural credit disbursement (SAARC Finance Cell, 2021). However, there were also some instances of lack of grass root level co-ordination, monitoring and proper distribution of cash support for the poor farmers for effective implementation.

IMF (2020b) approved US\$732 million emergency assistance consisting of Tk 8.6 billion (USD 100 million) additional procurement for farmers and Tk 2 billion (USD 23.5 million) for agricultural machinery to address the urgent balance-of-payments and fiscal needs. Increased allocation was made to the Open Market Sale (OMS) program to facilitate the purchase of rice at one-third of the market price. The Ministry of Disaster Management and Relief distributed more than 325,000 tons of food at the district level during 2019-20

fiscal year (FY20) and had a plan to provide food support to 5 million more families through ration cards under the Food-Friendly Program during 2020-21 (FY21).

6. Insights for future pandemic events

The COVID-19 pandemic has revealed some important policy lessons from both the farmers and the government of Bangladesh that the country and other South Asian countries can learn to prepare for similar pandemics in future. Suri (2020) suggested that a “food system” approach to malnutrition requires inclusive policies that should address both supply and demand. It is necessary to reinforce strategic action to build an inclusive, sustainable and resilient food system. Protecting the agriculture sector from various vulnerabilities is crucial to cope with the immediate as well as long-term shocks of COVID-19. Shoaib and Arafat (2020) proposed three key issues to be addressed to protect the country’s agriculture sector from COVID-19 or other similar shocks in future: i) ensuring proper transportation of, and fair prices for, farmers’ produce; ii) providing arrangements for farmers to avail mechanized resources for timely crop production operations, and iii) securing safe access for farmers to finance required for harvesting and procuring materials for all crops. We suggest that the GoB address short-term problems as well as those necessary for building longer-term resilience.

6.1 Policies adopted by government and development partners and their effectiveness

6.1.1 Promoting mechanization

Proper storage management and farm mechanization can reduce the loss of production. Shoaib and Arafat (2020) reported that mechanization, especially use of harvesters, proved effective in Haor area. Decentralization efforts of government through local leaders may place the agricultural products to the market with minimum health hazards (Ahmed, 2021). IRRI/FAO (2020 August) recommended the need for mechanization to address the challenges and normalizing the rice supply chain. They suggested: (i) mechanization for rice planting, harvesting, threshing and postharvest operations in rice farming, (ii) promoting custom-hiring services of farm machinery by engaging youth, and (iii) using public-private partnerships to scale-up farm mechanization.

6.1.2 Digital transformation

The COVID-19 pandemic has driven a shift towards digitalization of agriculture in a way people buy and sell the agricultural products and livestock online. In response to the pandemic, ICT (2021) Division of GoB prepared a “Post COVID-19 ICT Roadmap for Bangladesh: Agenda for Agriculture and Food Security”. The roadmap was prepared to fight the pandemic and ensuing crisis and to find innovative ways to flourish in the ‘new normal’. Agriculture and food security is one of the 18 priority sectors selected based on the impact of COVID-19 on the sector and its potential for transformation of the economy and society. The GoB and private sector jointly collaborated to accelerate the

adoption of emerging technologies such as artificial intelligence, big data, cloud computing, and blockchain to face the pandemic for monitoring, resource allocation and decision making. ICT Division, together with several other government organizations, technology and telecom companies, followed the suit (ICT, 2021). It was expected that such ICT-based emerging technologies would lead businesses, and the pandemic will be more of a growth opportunity than a setback. Bangladesh also launched its first and open digital marketplace ‘Food for Nation’ in May 2020 to help connect farmers and consumers and to ensure emergency food delivery across the country amid the coronavirus outbreak. The mobile phone-friendly interface aims to collect agriculture products directly from the farmers to ensure a fair price and a demand-driven distribution of those products (Bdnews24.com, 2020). IRRI/FAO (2020) suggested for promoting the use of digital tools and services to provide extension and agro-advisory services and improving the market systems for rice inputs and outputs through E-marketing. Chand (2020) reported that the International Potato Center project (CIP) in Bangladesh also made creative use of technology in potato distribution to ensure that nutritious orange fleshed sweet potato reaches to needy families during the pandemic. Likewise, Cotton Development Board (CDB, 2020) of Bangladesh adopted the digital communication system to connect between the CDB’s extension offices and research centers to ensure that cotton research and development activities run smoothly in the face of any crises including COVID-19.

The COVID-19 pandemic has also driven a shift towards digitalization of cattle

marketing. The cattle market of Bangladesh gets the spotlight every year during the Islamic festival of Eid ul-Adha when cattle and other domestic animals are slaughtered on the occasion. On-line digital platforms (or E-commerce stores) are being used in Bangladesh to sell cattle and goats online over the past few years. The digital cattle market consists of both formal (e.g., Bengal Meat, Daraz, Bikroy.com, DNCC Digital Haat, Sheba.xyz) and informal players (e.g., F-commerce stores, small-scale on-line agriculture produce businesses operating solely on Facebook such as Shuddho Krishi) (Uddin, 2020). Many residential areas in Dhaka city voluntarily banned the usual open slaughter of cows during the pandemic in 2020 Eid to maintain social distancing.

As a result, online businesses emerged that offered customers to outsource all rituals and practices such as buying and maintaining cattle for sacrifice, arranging the slaughter, cutting, and processing the meat, and delivering it to customers' homes. During the pandemic, digital platforms were increasing their capabilities to cater to a market demand with significant rise of such platforms operating online (Uddin (2020). Thus, various restrictions and social distancing measures brought upon by the pandemic has provided Bangladesh's digital cattle market with a major opportunity to scale up.

The GoB's Department of Agricultural Extension (DAE) also provided adequate support to farmers via digital means and community radio programs on planting and harvesting field crops. During lockdowns and after, regular messages on COVID-19 were being broadcast to

farmers on "Bangladesh Betar" (Radio Bangladesh) nationally. The programme "Desh Amar-Mati Amar" and "Krishi Samachar" have been providing information on improved technologies, success stories from the field, and essential measures that farmers should follow in farming. Such digital technologies have been proved to be highly useful and successful during the pandemic. Likewise, Krishak Bondhu Postal Service (KBPS) was launched to transport agricultural products free of cost by postal department vehicles prior to relaxing of agricultural transport restrictions during lockdowns.

The World Bank also took initiatives on digital technology and virtual call centers (VCCs). Some lessons learnt from such initiatives were (WB, 2020):

- Availability of technology: Connectivity and affordability of mobile phones and internet services are crucial. The government's past initiatives to develop the ICT service sector and move the country toward 'Digital Bangladesh' has helped facilitate the rapid implementation.
- Ownership: The VCC approach was designed and implemented by farmer members of the producer organizations, which fostered ownership of the initiative.
- Rapid response: The POs acted rapidly to establish the virtual eco-system by maintaining transparency, accountability, and good governance. This helped build confidence among farmers, suppliers and buyers including private companies and facilitated implementation within a short period.
- Rural logistics: In addition to digital technology, reliable rural logistics, like the rickshaw van for transporting agriculture produce, was instrumental.

- Coordination: Timely coordination between POs, suppliers, off takers, local authorities including law enforcement agencies enabled green channels to be established for safe and uninterrupted transport of produce.
- Disintermediation: This approach significantly reduced intermediaries in the rural food supply chain and directly connected farmers to consumers.

Finally, maintenance of a proper database is important to identify, monitor, and evaluate properly for food distribution channels to needy people. Local monitoring through NGOs or local government bodies can be a way to address this. 'Big Data Concept' could be used to ensure proper evaluation and distribution of the stimulus package by ensuring a complete database of farms, farmers, products, markets, and prices. Such database could also be useful for digitalization of agriculture.

6.1.3 Agriculture credit and marketing support

IRRI/FAO (2020) recommended the following during COVID-19 crisis or similar other pandemics in future: (i) Pay special attention for ensuring the availability of labour and transport to safeguard the farmer–miller– consumer supply chain, (ii) Provide rice mills with access to low-interest credit to overcome their financial losses and resume operations, (iii) Empower large producer organizations for collection and marketing of agricultural products from small-scale farmers and millers, (iv) Provide financial support to RVC actors, including tax relief, loan moratoriums, and low-interest credit for at least one year, (v) Provide policy support for access to loans for RVC actors, (vi) Declare a fair minimum support price for rice to ensure farmer profit, (vii)

Simplify the paddy procurement process so that farmers can easily sell their paddy, and (viii) Buy paddy directly from farmers instead of purchasing rice from millers. Shoaib and Arafat (2020) recommended that microcredit institutions and NGOs suspend loan collection from farmers during COVID-19 crisis or similar other pandemics.

WorldFish Centre recommended the following to improve the resilience of the aquatic food system and supply chain actors during COVID-19 pandemic or similar shocks in future: (i) Help alleviate heightened financial burdens, particularly among small-scale actors by increasing the accessibility of government or commercial bank loans, waiving existing loan fees, or extending repayment deadlines, (ii) Help reduce logistical bottlenecks by improving communication, clarification, flexibility, and awareness of changing government policies that affect aquatic food value chain actors (e.g., transportation permits, import documents, and letter of credit applications), (iii) Protect aquatic food value chain actors from sudden shocks by providing index-based insurance, where payouts are based on an index that is related to agricultural losses, and (iv) Provide universal social safety net coverage to buffer food- and economic-related shocks in the short term and to help build resilience in the long term.

Financial capital is generally linked with all resilience properties. Reduced capital availability can affect the resilience of fishing communities and hence requires special attention to ensure fishers' well-being. Bhowmik et al. (2021) showed that dependency on a single income source, inadequate access to aid and financial and natural resources, lack of skills and knowledge on alternative

livelihood options, absence of strong social protection and social networks, social inequalities, institutional incompetence, and lack of community leadership and cooperation can severely affect fishers' resilience. They recommended for drastic investments in small-scale marine fisheries, skills and knowledge development for alternative income generation activities, and an exclusive social safety net program for the fisherfolks. The approaches and findings of this study can guide other emerging economies who enjoy significant contributions from the marine fisheries sector to understand the resilience of their fishers and address the prevailing challenges owing to the pandemic and other natural calamities.

BRAC (2020; May 2020) reported that the government incentives/measures for the farmers in forms of easy term credit, harvesting machinery, and additional labor force needs to adopt more accessible and transparent delivery mechanisms to reach farmers. Incentive packages and their delivery mechanisms need to be made more accessible to the most marginalized or landless farmers who are at the bottom of the pyramid. Public private partnerships can also be considered to ensure a transparent delivery mechanism.

6.1.4 Postharvest storage and processing facilities

It was found during the beginning of lockdown that farmers hoard extra stock for future due to uncertainties and unpredictable nature of the pandemic. The middlemen and the illegally operating hoarders also take advantage of the pandemic and hoard the stock. Such stocks contribute to destabilizing markets. To tackle such problem, rice

banks, which are village-level silos to store food grains for challenging times, were being piloted by some NGOs. As a shared pool, the total food grains stored in such silos typically are much smaller in amount than the total amount of rice otherwise stocked up in individual households. Other measures taken were: (i) Injecting cash to millers who buy paddy for cash but sell finished rice for credit, playing the vital role of investors in the supply chain, and (ii) 'Warehouse financing' using millers' rice stocks as collateral to access immediate and low-interest credit. These could be supported by government monitoring to discourage hoarding by the millers. BRAC (2020; May 2020) suggested that the GoB for establishing collection centers for agro-produces, similar to paddy procurement, closer to smallholder producers during and after pandemic. Kabir et al. (2020) suggested that the procurement of *boro* rice at the declared minimum price of Tk 26 per kg at harvest needs to be implemented at full scale so that farmers' incentives to produce rice is sustained.

6.1.5 Social safety net programs

The Food Friendly Program (FFP), a well-performing program providing rice to the poor, experienced disruptions and poor delivery of the public food transfers during the COVID-19 pandemic. Chowdhury et al. (2021) reported that the program didn't deliver the full allotments of rice to recipients, complicating efforts to alleviate severe economic impacts. The authors discussed the challenges associated with the FFP and suggested how this and other similar programs could be monitored to improve their adaptability and resilience of the safety-net programs such as FFP during an unanticipated crisis or emergency.

They showed that the future crisis responses could be improved by institutionalizing routine monitoring of program operational efficiency such as creating a monitoring and reporting unit within the food ministry and using a small-sample phone survey complemented by periodic larger evaluations to provide real-time analysis to policymakers.

After estimating the daily per capita food expenditure separately for farm and nonfarm households, Motaleb et al. (2020) estimated that a minimum compensation package of around US\$ 1 per day per household would be required for the daily wage-based farm and nonfarm households to ensure minimum food security. Chakrobarty et al. (2020) reported that the COVID-19 depression creates health and psychological risks, earning failure, and maintaining normal life difficult. Food supply chain must be continued moving and the accessibility of nutritious food to the poor and vulnerable portion should be ensured through Social Safety Net, Food for Work, VGF, Money move, and other social well-being and safety net plans.

Rahman et al. (2020), however, reported that the poverty impact of the government stimulus package is low due to the relatively small size of direct transfers. If cash transfers amount is increased, they can substantially contribute to poverty reduction as they can generate enough economic activities to bring the poverty incidence level down to the pre-COVID situation. They estimated that Bangladesh could restore the pre-COVID baseline poverty rate of 20.5% by spending only 1% of GDP as direct cash transfer to low-income households, in addition to the current social security spending. This can also indirectly stimulate the supply-

side response, contributing to income enhancement, as well as jobs and livelihood opportunities for low- and middle-income households who were hit hard by the pandemic.

Rashid et al. (2020) suggested that continuation of the lockdown needs to be accompanied by strong political resolve and better social safety nets for those in need to ensure that people do not go without basic meals and have basic health information and support. The experiences of people living and working in slums in Bangladesh needs to be captured and translated to context specific strategies for lockdown as current measures risk starvation for many. LightCastle Analytical Wing (2020) suggested that to tackle the pandemic and revive the rural livelihoods, it's imperative to prioritize farmers and rural workers in the food and cash-based support initiatives and decentralize them.

6.1.6 Improving international trade policies

COVID-19 is affecting food availability through disruptions in international trade. Such restrictions can limit the availability of food in food-import-dependent countries, increasing food prices and reducing access to food. Between March and July 2020, 21 countries imposed trade restrictions, representing about 4% of global food trade. Since then, more countries announced trade restrictions. China and India banned export of rice, wheat, and other food commodities, which largely affected the food security of poor countries (Verhagen et al., 2021; Table 2, Table 3). Trade restrictions and food stockpiling resulted in most low-income countries experiencing moderate-to severe increases in food prices in the

second quarter of 2020 (World Food Programme 2020). Hence there is a need of an international dialogue against such restrictions and allow for

free flow of commodities between countries by maintaining food safety protocols so that there will be no food deficit during or after pandemics.

Table 2. Emerging evidence from the literature on the short-term effects of COVID-19 on food security (Adapted from Verhagen et al., 2021).

| Mechanism | |
|--------------------------------|--|
| Food Production, supply chains | Availability: Reduced labor, physical lockdowns, disrupted supply chains, and COVID-19 outbreaks in food processing facilities risked bringing down agricultural production. But government prioritization of food production has minimized this effect. |
| Trade | Availability: International trade restrictions on food were put in place but have been mostly lifted. While trade has taken a hit, agricultural trade has been mostly unaffected. |
| Disrupted supply chains | Availability/Access: Physical lockdowns and international travel restrictions risked disrupting supply chains, but effective government measures on prioritization of food have limited these effects. |
| Food prices | Access: Food prices for many staple foods have increased because of COVID-19, trade restrictions, rising conflict, and the locust outbreak. |
| Household income | Access: The economic contraction, reduced remittances, and physical lockdown have reduced household income. The consumption of food has been less affected because of reduced savings, but only for those who had the ability to save prior to the pandemic. |
| Inequalities | Access/Inequality: The short-term distributional effects of COVID-19 are largely unknown, with conflicting evidence on groups most strongly affected by household income and rural and urban differences in impact. |
| School closures | Access: School closures affect education, as well as access to food from school meals. Utilization: Limited access to school meals has the potential to limit dietary diversity and safe food processing for children in the poorer households. |
| Dietary shifts | Utilization: Changing household income and food prices are projected to result in a shift away from meat, dairy, and vegetables toward staple crops. This is a coping mechanism for households. |
| WATSAN | Utilization: Mixed evidence. Lockdowns reduced physical access to WATSAN, but the COVID-19 pandemic has also resulted in increased spending on WATSAN infrastructure. |

Table 3. Emerging evidence from the literature on the long-term effects of COVID-19 on food security (Adapted from Verhagen et al., 2021).

| Mechanism | |
|-----------------|---|
| Economic growth | Availability: Reduced economic growth could reduce agricultural investment, especially for productivity-enhancing investments. Access: Reduced economic growth is coupled with reduced household income, driving up poverty and reducing access to food. Utilization: Reduced investment in education, WATSAN, and health systems. |
| Inequality | Access/Utilization: Long-term unemployment and reduced education are expected to increase inequality because of COVID-19. |
| Education | Utilization: Temporary school closures tend to result in long-term learning losses, higher school dropouts, and long-term losses to human capital. Furthermore, reduced household income may lower education intake. Access: Lower education has long-term feedbacks to human capital, economic growth, and inequality. |
| Government debt | Government debt is rising, with anticipated disproportionate impacts on government finances in countries at high risk of debt sustainability. Availability: Reduced investments in agriculture. Access/Inequality: Reduced spending on social welfare and education, with feedbacks to inequality. Utilization: Reduced government spending on education, health, and WATSAN, with potential feedbacks to education, economic growth, and inequality. |

The World Bank suggested the GoB to take special attention and follow the following trade responses to avoid food security crisis during and after such pandemics. Such responses would ensure: (i) functioning food markets and value chains domestically and internationally; (ii) maintaining purchasing power of the rural and urban poor, including the large informal sector by providing social protection measures; and (iii) safeguarding production of the next agricultural season by assuring input and labor supply. Also, appropriate measures need to be taken to facilitate trade, remove import tariffs, and refrain trade restrictions as important trade

responses (Ahmad, 2020). The GoB could import rice on a government-to-government basis. This would enable them to expand open market sales, which would dampen the price at the retailer level and force wholesalers to reduce their prices.

6.1.7 Improving gender policy

To curb the hunger pandemic and address its disproportionate effects on women and girls globally, Sarah et al. (2020) from CARE International made the following recommendations:

- Governments scale up gender-responsive social safety nets and

minimize disruptions to agriculture and markets with a specific focus and measurable targets on women food producers and female-headed households.

- All donors, UN agencies, and governments publicly commit that all funding supports gender equality and women's and girls' empowerment, and at least half of food and nutrition security funding supports women and girls directly.
- Governments include at least one gender expert on pandemic response teams – at national and local levels – and ensure that all decisions and data in these committees are based on robust gender analysis and meaningful engagement with women and girls.
- All pandemic coordination, planning, and priority-setting platforms should be gender-balanced, with representation from local women-led and women's rights organizations.
- Supports from donors, UN agencies, and governments are needed for food system transformations. Also, women and girls need to be recognized as leaders in food systems and to ensure that they have equal rights and equal access to crucial resources as producers and consumers.

6.1.8 Promotion of urban agriculture

IIED (2020) reported that the lockdown triggered urban agriculture – both in practice and in recognizing its value - as a reliable and sustainable source of nutritious food during hard times. During and after the lockdowns, hundreds of small households and community fruit and vegetable gardens sprang up on little pieces of land and vacant lots, which could provide families with cheaper and nutritious food and create an alternative income source. Kang et al. (2021a,b) recommended

promoting urban agriculture with efficient food distribution and cash support and supporting small-holder farmers for procurement and adequate functioning of the supply chain system in the Asian Pacific region to mitigate the impacts of COVID-19. Bhuiyan and Ferdous (2021) also reported that growing vegetables on roof of the house has potential to meet household vegetables and nutrition security with more than 60% of the respondents getting direct support from their roof top gardening during the pandemic. Almost 41% of the respondents claimed that this food supply was enough to sufficiently meet their need for vegetables. More than 90% thought that if provided with proper training and necessary support, roof top gardening could ensure food security during and after pandemics in countries with low per capita agricultural land such as Bangladesh and many other Asian countries.

During COVID-19, social insecurity as well as economic hardship have put members of the Korail community, a large informal, low-income settlement in Dhaka, in a more miserable condition than before. ICCCAD (2021) reported that the lakeside residents of the Korail community had been organizing themselves during the pandemic to cooperate and collectively manage their urban gardening practices. They work in groups in a cooperative manner, each comprising 5 to 10 farmers who share, manage, and secure their plot and distribute the products. They design and allocate their plots for growing a variety of leafy and root vegetables, and spices and fruits on creepers, vines, and trees. The practice features a diverse cropping strategy, which optimizes both the nutritional value and productivity of the plots.

7. Conclusions

This review has systematically captured immediate and medium-term impacts on agriculture and food systems of Bangladesh from the early onset of COVID-19 in March 2020 until end-2021. COVID-19 pandemic impacted the entire value chains of all sub-sectors of agriculture, including crops, fruits and vegetables, ornamental flowers, livestock, poultry, and fisheries. Of all, poultry and fisheries sub-sectors were most affected followed by perishable products such as vegetables, fruits, milk, and ornamental flowers. Urban households were more affected than the rural ones. Women's unpaid workloads at home were increased and outside movement restrictions affected their earnings. Most small business enterprises and handicrafts industries were most affected resulting in workers losing their jobs. Due to trade restrictions by neighboring countries, import and export of commodities were hampered negatively affecting the country's economy and increasing food insecurity.

This study has summarized several policy lessons for Bangladesh and other countries. The essence of the lessons is that there is a need to build food

systems and adopt farming systems that will be resilient against disruptions caused by COVID-19 or similar other pandemics in future. For this, agriculture needs a transformation to efficient technology (both digital and non-digital), efficient supply chains (i.e., shorter value chains), mechanization, farmer organizations led, and consumer connected (e.g., online platforms and direct marketing channels) with various kinds of resilience measures, including information sharing systems, financial mechanisms and social safety nets. In macro-scale, there is also a need to develop country's economy that is resilient against shocks or perturbations or pandemics. Documenting impacts of such pandemics on local farming and food systems and Bangladesh's economy and actions for resilience can lead to improved pandemic mitigation strategies that are able to both manage public health risks as well as the costs of human movement and other restrictions on agriculture. The current review has provided a comprehensive picture of impacts and policy lessons to the Bangladesh government and development partners to effectively manage any future pandemics such as COVID-19 in the country and in developing countries of Asia.



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