

COVID-19 pandemic and resilience in the agricultural sector: A local strategy may solve the global challenges

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Agriculture remains a major engine of growth among the majority of developing and underdeveloped countries throughout the globe. But the sudden outbreak of COVID-19 has severely affected all sectors of agribusiness industries. In many parts of the world agriculture production became almost half due to the impact of this pandemic. But in two Himalayan regions of India, Darjeeling and Sikkim, mixed effects were observed during the pandemic period. Although a large number of marginal farmers were severely affected during the lockdown and even in the unlock phases, while

a significant number of farmers also gained nominal to a large amount of profit; chiefly because of reliability on complete organic farming including producing organic manure and bio-pesticides by the farmers themselves, lack of competition with imported agricultural commodities into the local market due to the inter-state travel ban, marketization of the agricultural products to the consumers through Farmers Producers Organizations (FPOs), NGOs and Sikkim State Co-operative Supply and Marketing Federation Ltd. (SIMFED) and above all creation of the Farmers' Helpline at district levels by the local government bodies to solve the problems of the farmers even in the remotest regions.

Key Words: Agriculture; COVID-19; Agricultural production; Supply chain resilience; Sustainable farming

INTRODUCTION

Agriculture is the backbone of the economy for the majority of developing and underdeveloped countries throughout the globe where the primary occupation of the rural population is predominantly agriculture [1,2]. The growth of agriculture is extremely necessary for poverty reduction and food security in these countries. World Development Report, 2008 states that agriculture must become competitive for small-scale farming to succeed in preventing poverty and food insecurity in these countries. According to FAO [3] small agricultural holdings constitute a vast majority of farms in many developing countries [4]. However, small and medium farming sectors face difficulties to produce adequate food, income, and employment throughout the year. In this situation, the only way for making agriculture more profitable and sustainable is the integration of various farming practices like field crops, dairy, piggery, poultry, fishery, etc. in an appropriate and sustainable manner and it is a reliable process for harmonious use of inputs and replenishment of nutrients through recycling of organic products or by-products.

India is an agriculture-based country and different varieties of fruits and vegetables are grown in all parts of India. Horticulture contributes 29.5% to the Gross Domestic Product originating from agriculture from 8.5% of cultivable land [5] and has proved beyond doubt its potentiality for gainful diversification. India is the second largest producer of vegetables next to China with 2.8% of total cropped area under vegetables [6]. The various constraints faced by the vegetable growers are their poor resource base and the resources at the disposal of the farmers are allocated in accordance of the importance and suitability of enterprises on the farms [7,8]. In Darjeeling district, West Bengal, India, less than 1.5% of the farmlands belong to marginal farmers [9] while the rest are occupied by different tea estates and an almost similar scenario is also in the Himalayan state of Sikkim in India. The marginal farmers in this district cultivate more intensively as compared to the other group of farmers and land use intensity was found to be the highest during the pre-kharif season followed by kharif season [10].

So, normally single farm enterprises are facing difficulties to produce adequate food, income, and employment year-round for livelihood security [4]. Now more adverse condition has appeared due to the lockdown in the wake of COVID-19 that had disrupted economic activities and the supply chains significantly [11]. The agro-industry has always been the expected root of growth for balancing import-export and managing international trade relations [12]. With the sudden outbreak of COVID-19, the sector has been

suffered severely related to the issues of trade, transport, price volatility, and rising debts. In addition, the declaration of nationwide lockdown exacerbated the situation resulting in shortage of labour supply, lack of availability of fertilizers, pesticides, imbalance in supply-demand, and problems associated with post harvesting due to social distancing [13]. The rapid spread of the virus and affected economies thus brought out inefficiencies in both the agriculture and industrial sector resulting in food insecurity [14]. Different national and international organizations like Food and Agricultural Organization (FAO), International Food Policy Research Institute (IFPRI) did their best to keep the global market open and accessible [15]. However, several nations restricted international trade and travel due to the rapid transmission of the virus resulting in poverty, hunger, and malnutrition across the globe [16]. The immediate implications of the prolonged lockdown in 2020 are for crop harvesting and marketing of agricultural commodities [17,18]. As of September 2020, India has become one of the top epicentres of COVID-19. National Institute of Epidemiology and Bloomberg reported, the country could easily surpass USA and Brazil due to the daily surge in cases [18]. In view of continuing restrictions on the movements of people and vehicular traffic, the COVID-19 pandemic has created a significant negative impact on the farm economy. The health crisis during COVID-19 pandemic has affected all sectors of livelihood. The Government of India declared a nationwide lockdown, which was subsequently extended to break the chain of the virus spreading, and it leads to a significant disruption of all economic activities and the supply chains [19,20]. With the ongoing COVID-19 pandemic, the agriculture sector was facing huge challenges regarding the increasing demand for food. Since the disease outbreak, several health-related factors like nutrition-based foods and improving safety from the viral transmission, poverty reduction, and environmental sustainability have been of vital importance [7,21]. Increasing agricultural production capacity and sustainability has become the top priority during this pandemic. The use of biofertilizers, biopesticides and other biological alternatives may enhance crop productivity and replace harmful chemicals. However, these are costly approaches and take several months for marketization. In recent years, sustainable agriculture and farming have been given top priorities in many countries to deliver better health and economic outcomes [22,23]. Functioning and efficiency of the supply chain management can be increased extensively by capitalizing on the advantage of Information and Communication Technologies (ICTs). For instance, the mobile procurement of perishable commodities can be incentivized [24].

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During this challenging time a mixed effect has been observed in the agriculture and allied sectors in the Eastern-Himalayan regions like the state of Sikkim and the Darjeeling district of West Bengal, India, where a marginal increase in profit has been observed in comparison with the pre-pandemic period in the case of few farmers, thanks to the early initiatives taken by the state governments; although many are badly affected due to continuing restrictions on movements of people and transport system during the prolonged lockdown as well as the unlock phases [25,26]. But the policies taken by local authorities in those regions may be considered as a potential strategy to reduce catastrophic effects in agricultural sectors due to any pandemic situation in the future.

MATERIALS AND METHODS

We collected information using secondary sources run through a systematic review process. We reviewed published journal articles on the effect of the COVID-19 pandemic on the agricultural sector using “Google Scholar, Research Gate, PubMed, Scopus, Web of Science, Semantic Scholar, Google Books, Ref Seek, World Wide Science, BBC news, Wolfram Alpha” etc. We searched the literature using specific search terms including ‘Agribusiness’, ‘COVID-19 pandemic’, and “Production in agricultural sectors during 2020-2021” in ‘World’, ‘Sikkim’, ‘Darjeeling’, ‘India’, ‘Nepal’ and ‘Bhutan’. Since the literature searches were done in 2022, we collected literature published till September 2022. For practicality, we included only English language literature. A total of 53 literature related to agriculture were collected and considered for the review. To assess the effect of the COVID-19 pandemic on agricultural sectors, we referred 35 literatures whose references are given against its effect in agribusiness sectors.

Impact of COVID-19 on agriculture

Agriculture production and supply chain resilience: Agriculture production has been an engine for reducing poverty and food security. It is a source of income for more than 1 billion people across the globe. Agriculture production, including different stages from planting, growing, nurturing, and harvesting to shipping of goods, needs labour requirements [27]. The dependence of market value chains, food, and agricultural sectors are considered to be less resilient due to the occurrence of the pandemic [28].

The ongoing pandemic has adversely affected the supply chain from farmers to retailers [29]. Restrictions in movements and travel bans have led to difficulties in farm inputs (seeds, fertilizers, etc.) and resulted in low agricultural production [30]. The global pandemic also caused a shortage of workers in agricultural sectors. Canada, USA, and Europe experienced a shortage of nearly 1 million migrant workers from Eastern Europe and African countries [31]. According to a recent report, the absence of laborers on the farm resulted in overall decrease in the production of agricultural commodities in Southeast Asian countries of 3.11% (17.03 million tons) in the first quarter of 2020 [32]. While the developed countries are used to utilize highly sophisticated mechanized equipment for the cultivation of crops like wheat, rice, maize, and other vegetables; many developing and underdeveloped countries deeply rely on labour-intensive farming; so, many staple crops had not been cultivated due to lockdown measures, leading to low food production and food insecurity [33]. On the contrary,

due to the excessive production of crops and the imposing of strict rules and regulations (Trade and travel), farmers were forced to dump crops in various parts of Nepal, USA, and India [34-36]. The shortage in employees and poor food supply networks forced the industries to shut down resulting in huge uncertainties in the global food sector [37]. The drop in agriculture production has also indirectly disrupted the fertilizer and pesticide industry. The sudden factory shutdown and limited and restricted transportation facilities greatly affected the flow of products toward the market and farmers [38]. This led to many crops getting rotten and several being used as manure owing to massive losses (Figure 1).

In India, the nationwide lockdown has adversely affected the harvest of crops. Lockdown has forced migrant laborers to return their homes as well as small-scale shopkeepers to forcefully shut down their businesses. A financial imbalance was also observed with the exchange of different types of equipment that the small-scale farmers rent for harvest [39]. At All-India level, agriculture production in almost half (47%) of sample districts was adversely affected by the impact of COVID-19 [40]. Magnitude wise, agriculture production (-2.7%) had not been adversely impacted significantly, mainly due to the fact that harvesting of rabi crops like wheat was almost complete by the end of April 2020. However, production in the allied sector had declined significantly, especially in the poultry sector (-19.5%), followed by the fisheries sector (-13.6%) and Sheep/ Goat/ Pig (S/G/P) sector (-8.5%), primarily due to drastic decline in demand for these products possibly due to the widespread fear circulating in the wake of COVID 19 regarding the safety of non-vegetarian food, particularly poultry meat, for health-related concerns. Similarly, production in the dairy (-6.6%) and horticulture (-5.7%) sub-sector also reduced, owing to reduced demand for these products and disruption in their supply chain [40].

A huge number of disruptions have been caused in the food security and supply chain areas. Transportation of food and crops was almost impossible due to restrictions imposed in many parts of the world. A recent report highlighted the shortage of truck drivers for transporting goods in developing countries like India [41] as workers and migrant laborers in factories or production houses were afraid of resuming work due to disease transmission. The sudden drop in the world’s economy and lack of supplies due to transportation barriers has led to a huge rise in the cost of all food commodities. To counter these, proper management of macroeconomic ramifications was urgently required [42]. In addition to these strategies, good government policies and frameworks were required to minimize the time delay through transportation restrictions. Moreover, the public should encourage the adaptation of local food supply chains to ensure adequate availability of staple foods [43].

In Darjeeling and Sikkim, India, mixed effects were observed during the pandemic period. Various agricultural enterprises of those areas are the source of livelihood for local people, viz. cultivation of rice, maize, ginger and horticultural crops as well as livestock farming like poultry, piggery, apiary, cattle and goat farming. During the lockdown period and the unlock phases a significant number of farmers experienced a nominal to huge reduction in their income, while nearly 33% farmers in the Darjeeling district and 57% farmers in Sikkim experienced marginal to high profit [25,26].

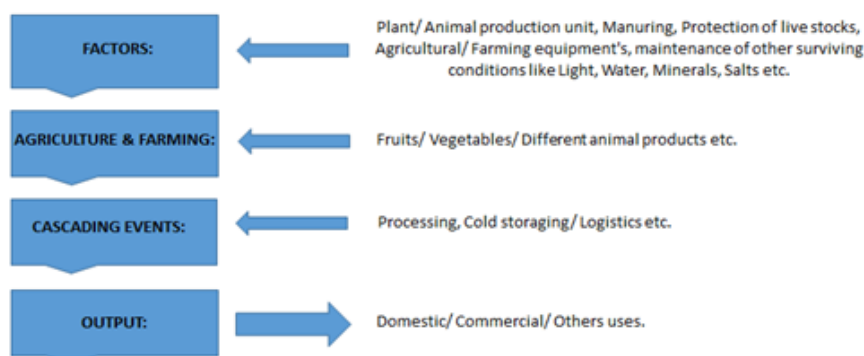


Figure 1) A schematic presentation on the overall impact of COVID-19 on agricultural sectors

The Indian state of Sikkim shares sensitive international borders with China. So, movement of vehicles and goods are always under scanner by both the state and central government security forces. And at the initial stages of the pandemic, the restricted movement and monitoring of the situation helped to control the spread of the disease. A few numbers of farmers in Sikkim had also faced an increase in profit in comparison with the pre-pandemic period, chiefly because of facilitating the supply chain and establishing special transport system to marketize the agricultural products to the consumers through Farmers Producers Organizations (FPOs), NGOs and Sikkim State Co-operative Supply and Marketing Federation Ltd. (SIMFED) without any difficulty and at the same time lack of competition with imported agricultural commodities into the local market due to inter-state travel ban [25,26]. In addition, the Farmers' Helpline had also created in each district of Sikkim and the support staff and officials were also available over the phone every day from 8 am to 6 pm to extend all possible support to the farmers for marketizing agricultural products and other farming-related issues during the lockdown period [44].

Food prices

The COVID-19 pandemic had adversely affected all agribusiness processes and storage networks which created a negative psychological impact on producers, transporter, distributor, retailer lastly the customer. Likewise, the arranging of the Kharif and Rabi crops has been placed to an end which will cause a significant halt in the up-and-coming agrarian seasons [26]. Due to disruption in supply chain owing to restrictions on movement of vehicles and closure of shops and markets, prices of agricultural inputs viz. seeds (8.8%), fertilisers (10.0%), pesticides (9.0%), fodder (11.6%), increased in the range of 9 to 12 percent. At all-India level, 54% of sample districts witnessed an increase in prices of agricultural inputs, possibly due to its non-availability [40] (Figure 2). The international price of food commodities reached the highest level of 97.19 points in September 2020, according to the FAO Food Price Index (FFPI) [45]. FAO [46] highlighted that prices have increased by 20% in Afghanistan, 35% in Yemen, and by 50% in Syria since April, 2020, and these countries faced severe food shortages [46]. The primary reasons for the price hike during COVID-19 were the demand, panic purchase, and back stocking of goods while the other factors includes the shortage of laborers, closure of food processing plants, lack of marketing platform, disruptions

in the global supply chain due to travel ban, and sorting of commodities [47]. As a long-term effect of the COVID-19 pandemic, this may also lead to inadequacy leading to unemployment, high cost, and low production. To reduce these problems, food fortification programs in rural areas to provide micronutrients to vulnerable communities is crucial [47] (Figure 3).

Food security

The main goal of introducing food security is to ensure enhancements in food access. The restrictions on international travel and transport caused a severe problem in the production, supply, and trade of agronomical products in the global market [48]. In addition to this, many countries imposed stringent social protection measures to break the chain of COVID-19 spreading [49]. In that global scenario, an estimated number of 140 million people may fall into extreme poverty with a marginal increment of 20% from the present stages [28]. The potential impact of COVID-19 on food security can be further prolonged in the form of economic disruptions, lowered investments in the agriculture sector, government expenditure, and financial assistance toward the farmers [29,49]. Recommendations to ensure food security among the vulnerable community of a society [29,39,50,51] are as follows: (1) protection of food supply chains and all allied services to ensure the movement of goods, (2) proper utilization of food reserves to meet the requirements according to demands, (3) protection of farmers and food workers by providing subsidized inputs and other services to avoid disruptions in the food supply chain; (4) keeping global trade market open to ensure availability of all commodities and avoid price hike due to panic buying or hoarding; (5) adopting sustainable farming practice to meet the daily household demands; (6) introducing social protection programs to reduce the risk of hunger and starvation among vulnerable groups through providing food materials; (7) Investments in key agricultural logistics must be enhanced; (8) Microfinance activities need to be reactivated through injection of liquidity to Non-Banking Financial Company- Micro Finance Institution (NBFCMFI) sector so that petty business activities on pavement and road side could be resurrected in semi-urban and rural areas; (9) Expanding digital infrastructure for online trading of agricultural goods (Figure 4); (10) E-commerce and delivery companies and start-ups need to be encouraged with suitable policies and incentives.

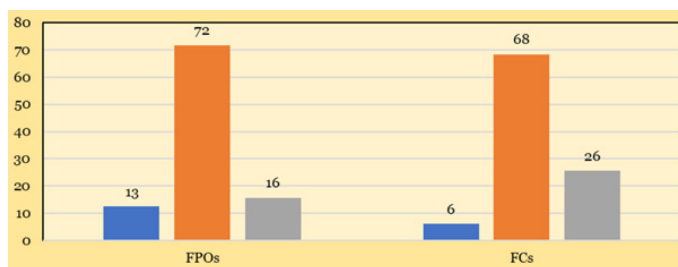


Figure 2) Impact on activities of farmers producer organisation and farmer clubs. Note: (■) Favourable; (■) Adverse; (■) No impact. (NABARD)

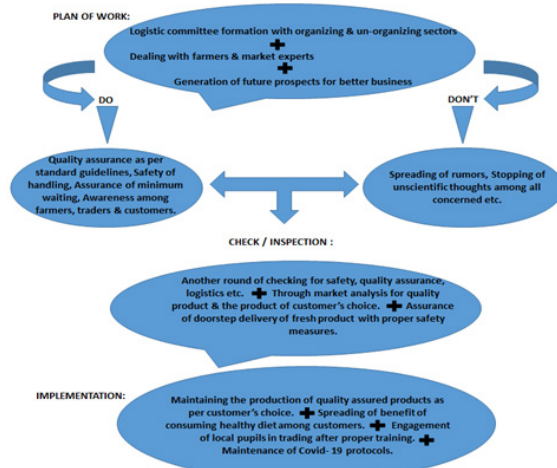
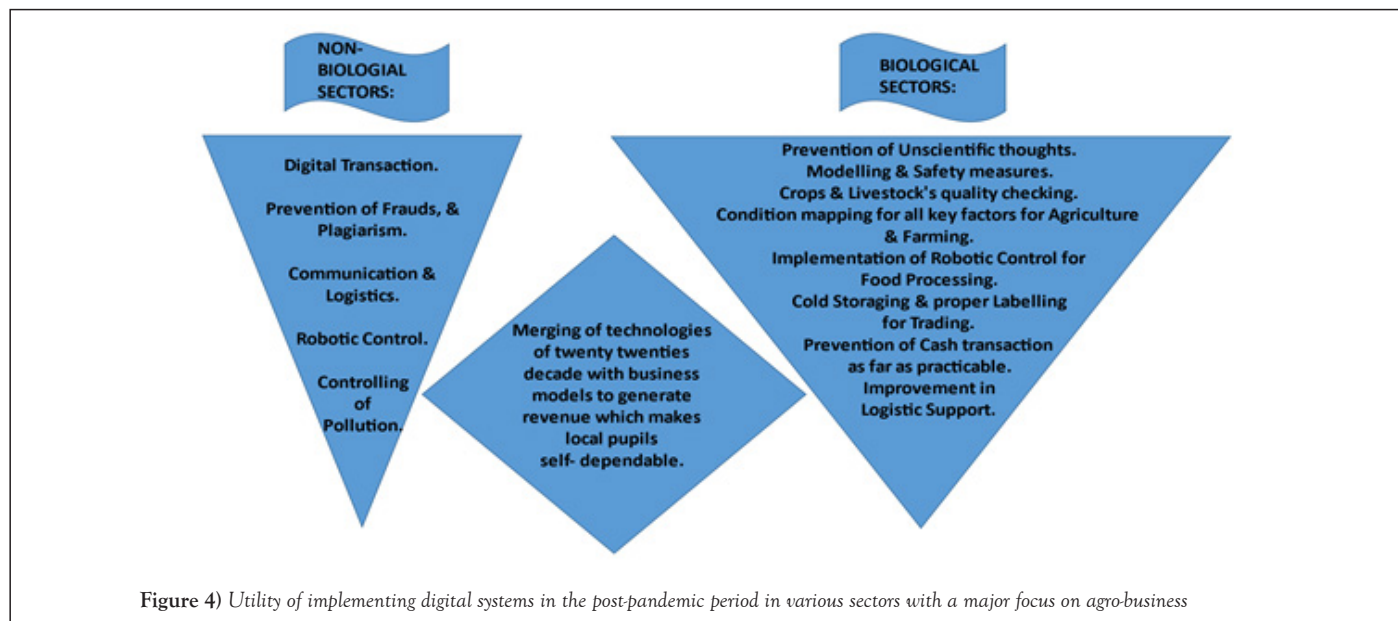


Figure 3) A PDCA model in the post-pandemic phase that can be implemented by the government



Strategies taken for sustainable farming

FAO explained sustainable agricultural development as a tool for the management and conservation of the natural resource and the orientation of technological change to ensure the satisfaction of human needs for a better tomorrow [52] The development of this particular agenda was to achieve zero hunger challenge, environmental advancement, and to attain social sustainability through the development of living standards. Five major principles that balance all the domains like socioeconomic–environmental areas of this sector are listed below [52].

- Principle 1: Improving efficiency of food production through proper utilization of resources is important in sustainable agriculture.
- Principle 2: Protection of natural resources.
- Principle 3: If agriculture fails to protect and improve rural livelihoods, equity and social well-being are unsustainable.
- Principle 4: Enhanced resilience of community, citizens, and ecosystem are responsible for sustainability.
- Principle 5: The need for effective governance and supervision. Sustainable agricultural development can be adopted using different methods either through complete organic agriculture or using different principles.

Although immediately after the nationwide lockdown was announced, the Indian Government declared an INR 1.7 trillion package, mostly to protect the vulnerable sections (including farmers) from any adverse impacts of the prolonged crisis due to Corona pandemic. The announcement includes the advance release of INR 2000 to the bank accounts of farmers to sustain their livelihood under PM-KISAN scheme [19]. The Reserve Bank of India (RBI) has reported a ban on rural term credits (counting crop advances) for a time of a quarter of a year [52]. But the small and medium size farming sectors, that are totally dependent on raw materials from the agriculture and allied sector, also need special attention so that the rural economy can stay afloat.

In Darjeeling and Sikkim, local farmers, for a long time, are used to producing bio-fertilizer, organic manure, and bio-pesticides by themselves and it is one of the key reasons of profit among a significant number of farmers during the prolonged lockdown period as well as unlocks phases during the pandemic. The unavailability of imported agricultural products into the local market due to the travel restriction was also a key factor for their profit. However, a large number of farmers also experienced reduced income chiefly because of the closing of the local market during the lockdown, the unavailability of veterinary staff for proper treatment of their livestock, and a few health issues of the farmers themselves [25,26]. The COVID-19 pandemic has also put a potential effect on the agribusiness item store network and in the long run, the loss of income and the economic slowdown may also result in a decrease

in demand in near future, particularly among the farmers and farming families without the safety nets [20].

RESULTS AND DISCUSSION

The recent pandemic has posed several unprecedented challenges in the agro-food systems worldwide affecting major areas of production, transportation, and the overall supply chain. Movement restrictions, social distancing, and strict quarantine measures imposed severe challenges in the supply chain and logistics; and have resulted in huge barriers to providing affordable and nutritious food to all. Therefore, overall food security was significantly interrupted with a higher impact on the vulnerable population. Thus, one of the key lessons learned from this pandemic would be building a resilient food system. In Darjeeling and Sikkim, India, marginal to high profits among a significant number of farmers reflects the success of sustainable organic farming, self-reliance in the production of bio-fertilizer and bio-pesticides as well as proper utilization of electronic communication systems by farmer’s co-operatives and local government. So, this is a classic example that indicates, in critical situations like the global pandemic, resilience in organic farming and the proper application of available communication technology can secure the livelihood of agriculture-based rural communities in poor or middle-income countries.

CONCLUSION

The sudden outbreak of COVID-19 has severely affected agricultural sectors which remain a major source of income and growth among the majority of developing and underdeveloped countries throughout the globe. But in two Himalayan regions of India, Darjeeling and Sikkim, marginal to high profits among a significant number of farmers have been observed. This success has relied on sustainable organic farming, self-reliance in the production of bio-fertilizer and bio-pesticides as well as proper utilization of electronic communication systems by farmer’s co-operatives and support from the local government. Although, the lack of competition with imported agricultural commodities into the local market due to the inter-state travel ban, also fuelled the increase in income among local farmers. Thus, we can conclude that even in the most adverse situation, organic farming practices and the appropriate utilization of electronic/digital technology may give safeguards to rural communities in developing or underdeveloped nations.

DECLARATION OF COMPETING INTEREST

The authors are hereby declaring that they don’t have any competing monetary interests/ personal agendas that could have been reflected to influence the review work elaborated in this paper.

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