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The Covid-19 Lockdown and Its Impact on the Agri-Food Supply Chain in India: Insights from Government Policy Perspective

El bloqueo de Covid-19 y su impacto en la cadena de suministro agroalimentario en la India: perspectivas desde la perspectiva de las políticas gubernamentales

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ABSTRACT

The outbreak of the Covid-19 pandemic is an unprecedented shock to the Indian economy. Agriculture being the backbone of the Indian economy has been severely affected by the shock waves of the Covid-19 pandemic and subsequent lockdown. In this paper, we have documented the evidences of the Covid-19 impact on Indian agri-food supply chain viz., production, post-harvest handling & storage, processing & packaging, distribution and consumption. In addition, we have analyzed the policies announced by the government in mitigating the impact of the shock and revitalizing the Indian agriculture. Finally, we have put forward some policy recommendations for future consideration.

Key words: Agri-food supply chain, Agricultural marketing, Covid-19 pandemic, Lockdown, India.

RESUMEN

El estallido de la pandemia Covid-19 es un shock sin precedentes para la economía india. La agricultura, que es la columna vertebral de la economía india, se ha visto gravemente afectada por las ondas de choque de la pandemia Covid-19 y el posterior cierre. En este documento, hemos documentado las evidencias del impacto de Covid-19 en la cadena de suministro agroalimentaria de la India, es decir, producción, manipulación y almacenamiento poscosecha, procesamiento y envasado, distribución y consumo. Además,

hemos analizado las políticas anunciadas por el gobierno para mitigar el impacto del shock y revitalizar la agricultura india. Por último, hemos presentado algunas recomendaciones de política para su consideración futura.

Palabras clave: cadena de suministro agroalimentario, comercialización agrícola, pandemia de Covid-19, cierre, India.

INTRODUCTION

The recent outbreak of Covid-19 pandemic has created an unprecedented global crisis, sending shock waves through health systems, economies and societies around the world. This outbreak (caused by the SARS-CoV-2 virus) was triggered in December, 2019 in Wuhan city of Hubei province in China (The Economist, 2020). From its epicentre in China, Covid-19 continues to spread rapidly across all over the world devastating lives and livelihoods. Today, the world faces a severe and acute public health emergency due to this global pandemic. Many have described the Covid-19 pandemic as the defining global health crisis in modern time and the greatest challenge faced by the world since the Second World War. In order to prevent or limit the spread and severity of this highly contagious disease, countries around the world has resorted to temporal policies such as, social distancing, self-isolation at home, shut down of institutions and public facilities, restrictions on movement of people, closure of non-essential business, and even lock-down of the entire country. These policies appear to work in curbing the spread of the pandemic but they severely curtail economic output and restrict demand. Experts feared that these policies can potentially lead to dire consequences for economies around the world and eventually resulting in an unprecedented deep and prolonged global recession (Goodman, 2020).

India reported the first case of the pandemic in January, 30, 2020. Since then the number of cases has significantly raised. In order to restrict, the spread of the pandemic, the government of India declared a three week long nationwide lockdown starting from March 25, 2020,which was further extended (in a phased manner) for considerable period of time. The unprecedented lockdown (also unparalleled in the world) is expected to have significant adverse effect on the economy. The magnitude of such impact will depend on the factors, such as duration and severity of the health crisis, duration of lockdown and the manner in which post lockdown situation unfolds (Dev and Sengupta, 2020). Moreover, the crisis comes at a time when Indian economy was already in a parlous state, as reflected by

the slowing down of Gross Domestic Product (GDP)[1] growth and rise in unemployment. Therefore, the outbreak of the pandemic is expected to worsen the economic shock. As both demand and supply gets disrupted, the economic shock is likely to impact every sector of the economy.

Agriculture is one of the most important sectors in Indian economy in generating employment opportunity. In fact, it is the largest source of livelihoods in the country. Moreover, the economic transformation of a developing country like India crucially depends on the performance of its agriculture and allied activities. The agriculture sector plays a pivotal role in rural livelihood[2], employment and national food security. Nearly half of the country's population at present still depends on agriculture and allied services for their livelihoods. Agriculture contributes 13.9% in the gross value added in the first half of 2019-20 (GoIa, 2020), which essentially imply that per capita income is lower in agriculture. The outbreak of the Covid-19 is likely to exert a significant shock on Indian agriculture. In this paper, the potential impacts of the shock have been assessed by considering their implications along the supply chain functions and stages.

Apart from the introductory section, the paper has been organized as follows: first a brief description on 'agri-food supply chain' has been provided which followed by the assessment of the potential impact of the Covid-19 pandemic on agri-food supply chain in India. Thereafter, the paper critically evaluates the govt. policies in mitigating the impact of the shock and resuming agricultural activities and finally it rests on concluding remarks.

POTENTIAL IMPACT OF THE COVID-19 PANDEMIC ON THE AGRI-FOOD SUPPLY CHAIN IN INDIA

The term 'supply chain' refers to a set of interconnected and coordinated links that take place as a product moves from the primary production unit to the final consumer. Alternatively, it can be described as the full range of activities that are required to bring a product from conception, through the intermediary stages of transformation, delivery to final consumers, and final disposal after use (Kaplinsky and Morris, 2001). Hence, the agri-food supply chain covers the entire chain of activities from production to the processing, distribution, and retailing to the ultimate consumers. There are mainly two types of agri-food supply chain, namely, agri-food chain for fresh agricultural products and agri-food chain for processed food products. The agri-food supply chains and networks plays an

[1]GDP measures the total market value of the goods and services produced within a country during a specified period of time. It serves as a gauge of an economy's overall size and health.

[2] According to FAO reports, 70 percent of the rural households in India at present primarily depend on agriculture for their livelihood (FAO, 2018).

important role in providing producers access to markets and also affect the economic, social and environmental sustainability of rural communities (Naik and Suresh, 2018).

One of the key characteristics of supply chain is that it does not evolve in a deterministic process; rather it adapts and responds to local conditions, the policy and institutional environment, market power, and consumer preferences, among other things (Kirimi et al, 2011). Hence, the current crisis caused by the outbreak of the Covid-19 pandemic is expected to disrupt local supply chain, which actually links producers to consumers. Imposition of trade protectionist policies (or border closure) once again is raising concern on the disruption of global supply chain. Evidences around the globe, confirms that the pandemic is exerting both demand and supply shock on the agri-food supply chain (Schmidhuber et al, 2020).

However, this paper made on attempt to document the evidences of impact of the Covid-19 pandemic on agri-food supply chain in India. For this purpose, we have synthesized the evidences disruption caused by the pandemic and subsequent lockdown along each and every stages of supply chain (following Forsido et al, 2020), namely, production, post-harvest handling & storage, processing & packaging, distribution and consumption (figure 1). In order to collect these evidences several newspaper reports, articles, reports published by the government of India were accessed. As most of the information sources used in the paper are of non-academic origin, necessary steps were taken to ensure their credibility. For instance, in most cases news stories published by reputable news organizations has been cited as information sources[3]. Besides, wherever possible the accuracy of such news reporting has been checked by cross-verifying with similar stories from other sources. The findings are presented as follows:

[3] According to Kousha and Thelwall (2017), if information of non-academic origin needs to be cited by an article, then stories published by reputable news organizations may be a reasonable choice provided they have accuracy and impartiality policies.

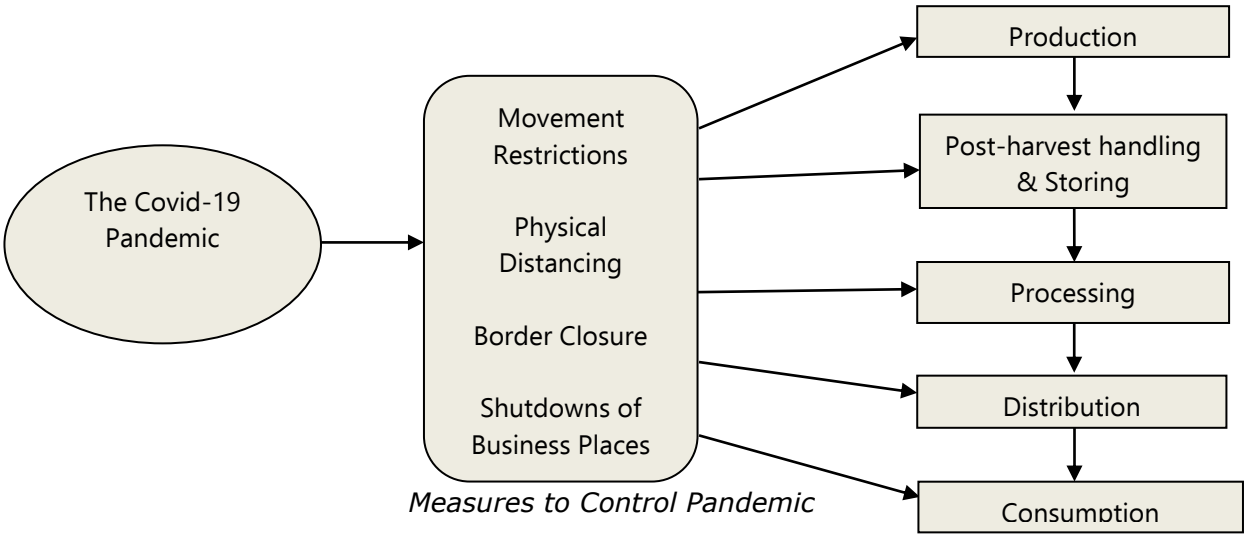

Figure 1: The Covid-19 Pandemic and its controlling measures affecting each and every stages of agri-food supply chain in India (Source: Author's own composition)

Production: The impact of the Covid-19 pandemic on agricultural production is assessed in terms of availability and access to agricultural inputs. Restriction on movements of people and vehicular traffic due the Covid-19 caused a temporary disruption in the timely distributions of agricultural inputs thereby, resulted in a reduction in their availability. The necessary inputs such as fertilizers, pesticides, improved seeds, feeds had not only become scarce but also their prices increased due to shortage (FAO, 2020). Moreover, as countries around the world started closing their national borders, the import of agricultural inputs was largely affected (Forsido et al, 2020). In Indian context, an analysis prepared by Agricultural Ministry of India indicated that the outbreak of Covid-19 could heavily impact the Indian pesticide industry which mostly relies on Chinese imports for their raw materials (Barghava, 2020). The lack of availability and access to agricultural inputs can have a major impact on agricultural production in India. Media reports highlighted cases in which the lack of availability of agricultural inputs such as fertilizers and pesticides hampered crop yields of Indian farmers (Times of India, 2020). The pandemic may also have serious impact on labour intensive crop production in India. According to media reports many farmers across the country faced an acute shortage of labour as many migrant workers left for their home (Jebaraj, 2020). Moreover, as the pandemic coincides with the 'Rabi' harvesting season, the migration of workers from several parts of India to their native places triggered a sense of panic among the farmers. In addition, there was also shortage of necessary agricultural

machinery like combine harvesters and their operators across the country. Several media reports indicate that due to non-availability of the necessary agricultural labour and machineries, farmers across many states in India were unable to harvest their ready crops (Agrwal, 2020; Chattopadhyay, 2020; Singh 2020). Experts feared that it could potentially not only increase the risk of food shortage but also enhance the prices of foods at rate beyond affordable for common masses (Singh, 2020).

Post-harvest handling & storage: Movement restriction due to Covid-19 caused significant disruptions in post-harvest handling and storage activities. Media reports indicate disruption of post-harvest handling operations across the country due to the dearth of labour (Ramakumar, 2020; The New Indian Express, 2020). In addition to the shortage of labour, there were also problems of lack of storage and transport facility. The Covid-19 pandemic has put a spotlight on the lack of adequate cold storage infrastructure in the country. Many instances of farmers facing difficulty due to the absence of adequate cold storage facilities were highlighted in the media (Ramakumar, 2020; Das, 2020). In addition, the procurement of agricultural produce by both govt. agencies and other traders was severely disrupted. Several Agricultural Produce Market Committees (APMC)[4] mandis (or collection centres) remained closed across the country in the initial days of lockdown[5]. Farmers being unable to reach the APMC mandis due to lack of adequate labour and logistic services were forced to make distress sell for their produce (Jha, 2020a). This is evident from the significant drop in arrivals in the APMC mandis. A close look at crop-wise arrival during the period 15 March-14 April revealed that only 40% of the mandis reported arrivals of wheat, 43% of chickpea, and just 33% of mustard compared with the average number of mandis reporting arrivals in the previous three years. Moreover, compared to the quantity sold in the same 21-day period in 2019, the arrivals in 2020 is only 6 per cent for wheat and chickpea and 4 per cent for mustard (Rawal and Verma, 2020). The lack of transportation also affected the timely sales of agricultural produce. This had led to a considerable waste of several perishable foods like vegetable, fruit and milk. Several cases of farmer's dumping their agricultural produce for not been able to either sell or store their produce were reported across the country (The Hindu, 2020a). However, the situation improved considerably, especially during the second phase of the lockdown as more mandis

[4]APMCs are the marketing boards established by state governments in India to ensure farmers' protection from the exploitations by intermediaries as well as ensuring that the farm to retail price spread does not reach excessively high levels.

[5] While examining the arrival and price trends in 1331APMC mandis across 20 states for seven key food commodities, Rawal and Verma (2020) found that during 15 March-14 April,2020 as many as 38 percent of the mandis were non-functional compared to that of a meager 5% in 2019.

had become operational[6].

Processing and Packaging: The Covid-19 pandemic and subsequent lockdown also affected the food processing and packaging in India. Reports suggest that despite relaxation of lockdown norms, many food processing units across the country remained closed (Krar, 2020; Rao, 2020). Besides, a large number of food processing units across several states were forced to reduce their operating capacity due to several problems such as unavailability of raw materials and labour, logistic issues etc. (Jha, 2020b). Many food processing industries were unable to procure raw materials due to closure of several mandis (Rao, 2020; Jha, 2020b). Moreover, the food processing industries were also facing acute labour shortage as many migrant workers had returned to their home (Business Standard, 2020; The Hindu, 2020b). Similar challenges were also faced by the industries engaged in food packaging (The Economic Times, 2020a). In addition to the key challenges such as shortage of raw materials, transportation and manpower, the packaging industries in many states were not been able to get timely approval for operations from the local authorities (Ambwani, 2020). These bottlenecks put the supply chain of packaging industries under severe strain which also affected the food processing industries as they are inter-dependent.

Distribution: Restriction on movements of people and vehicular traffic due to the Covid-19 pandemic caused severe disruption in the distribution of foods in India. Key bottlenecks such as shortage manpower, lack of logistic services had affected the supply chains of farmers-wholesalers and wholesalers-retailers creating an artificial scarcity across the country leading to panic buying. Besides, closure of APMC mandis and other wholesale points, retail agricultural markets in several states had caused severe disruption in supply of foods from the production to the consumption centres (figure 2). Media reports highlights that due to the closure of several restaurants across the country, e-commerce start-ups had faced severe disruption in their online delivery of foods (The Economic Times, 2020b). Reports also indicate severe disruption in supply of meat and fish across the country due to the shutting down of state borders. In addition, blockades to state borders led to new supplies being cut off and huge delay in deliveries. This had proved to be particularly obstructive for fresh food supply chains and resulted in increased levels of food loss and waste.

[6] According to a report published by government of India, eighty percent of the main APMC markets (2069 out of 2587) had become operational by 21 April, almost double the percentage (42%) at the beginning (26 March) of the lockdown (GoIb, 2020).

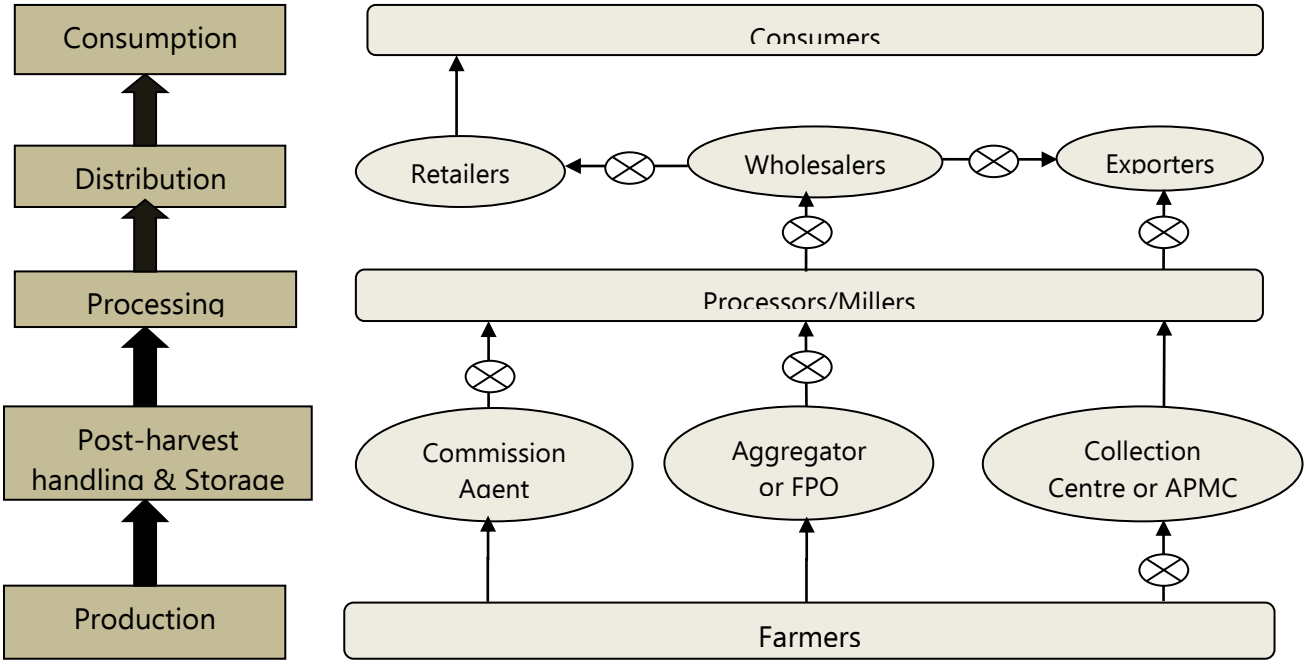

Figure 2: Typical Agro-Food Supply Chain in India, with potential bottlenecks
(Source: Author's own composition from news reports)

However, the situation has recovered considerably since the govt. announcement to include the supply of food under essential services. Although, several media reports claim that despite govt. order to exempt supply of foods under the purview of lockdown, local authorities in many states were interpreting these guidelines differently. As a result, many packaged food companies had to scramble in order to get clearances from local authorities for transportation of essential products (Ambwani, 2020). Moreover, uncertainty about the rules on the inter-state travel had made it extremely difficult to transport produce across state lines. In addition to the supply disruptions, the lockdown had a major adverse impact on demand. Media reports highlights a decline in demand for fresh foods like vegetable, milk, fish and meat due to shut downs of hotels and restaurants. Besides, the Covid-19 pandemic and subsequent also had a significant adverse impact on foreign trade in India. The foreign trade of agricultural produce has been facing a lot of hurdles because of the restrictions imposed both internally and externally (i.e. restrictions imposed by other countries on exports as well as imports). The exports of major food products such as, rice& other cereals, fruits & vegetables, meat, dairy &poultry products had come to a standstill because of the lockdown. Interestingly, a close look at the APEDA export trend of the year 2019 revealed a decline in export of major agri-food products continued till the month of October as compared to the previous year (i.e. 2018) (figure 3). However, after that, there

are clear signs of improvement in export performance. But, since the outbreak of the pandemic there has been a tremendous decline in export. As the trend shows, decline in APEDA export in February, 2020 was only -5.9% whereas in March, 2020 it was -27.7%. It clearly shows the impact of the Covid-19 on India's agri-export. However, as per the quick estimates on export released by Directorate General of Commercial Intelligence and Statistics (DGCIS), India's agri-export seems to be recovering from the recent disruptions caused by the pandemic. Data also suggests superior performance in terms of export of major agricultural products for the last three consecutive months (i.e. June, July and August) compared to that of the previous year (i.e. 2019).

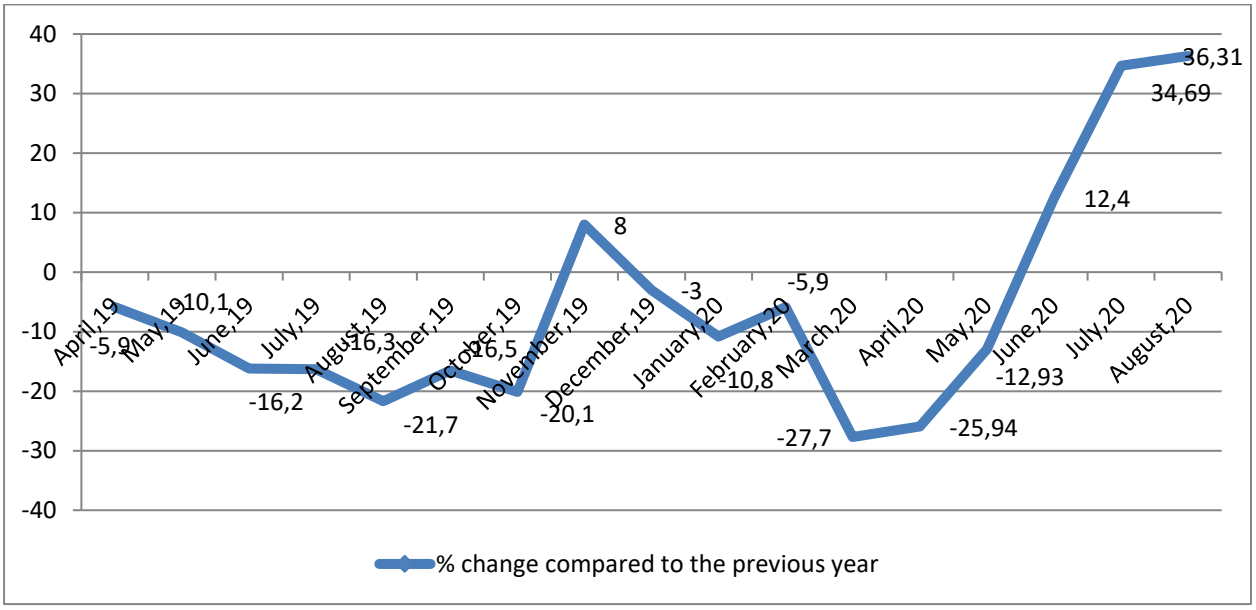

Figure 3: Export trend of APEDA's major products

Source: Author's own composition based data published by DGCIS

Consumption: The Covid-19 pandemic is expected to have a major impact on the consumption of food in India. Price is one of the most important factors which influence the consumption of food. Media reports suggest significant increase in price of key staples in the initial phase of lockdown (Haq and Dutta, 2020). Factors such as massive decline in arrivals of farm commodities in APMC markets, sharp rise in the transport costs due to inter-state travel restrictions and acute shortage of labour had caused severe disruption in the food value chain which in turn increased price. Moreover, supply disruption consequent to the lockdown had reversed the declining trend of food price existing before the lockdown

(Naryanan and Saha, 2020[7]). Being unsure about the trickle-down effect of the lockdown, customers across the country resorted to panic buying and hoarding of foods which had triggered a price rise (Pandey, 2020; The Economic Times, 2020c). However, the situation is restored to normalcy as people were made aware about the availability of essential products (The Economic Times, 2020c). Moreover, an analysis of consumer food price index in India also revealed a trend of rise after August, 2019 with weakening in January, 2020 and continued till March, 2020 (figure 4). However, after March, 2020 (since the announcement of lockdown in the last week of March) the index has climbed up but soon stabilized in May, 2020. On the other hand, global trend of food prices (as revealed by FAO's food price index) exhibited a fairly consistent downward trend since February, 2020 which continued till the month of May. But, since June, 2020 a clear upward trend is observed for both global and Indian food price index.

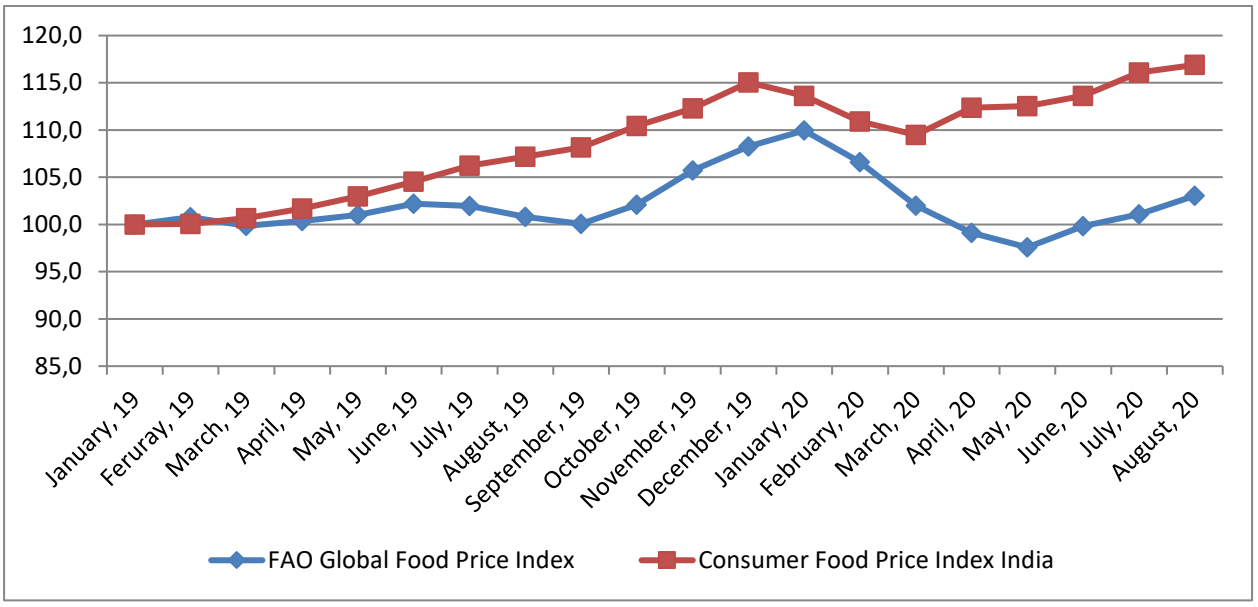

Figure 4: Trend of FAO Global Food Price Index vis-à-vis India's Consumer Food Price Index[8]

Source: Author's own composition

[7] In this study the authors have tried to examine the consequence of lockdown on food markets by focusing on wholesale and retail prices in urban India. For this purpose, they have used publicly available data on wholesale and retail prices for 22 commodities from 114 centers in urban India. The authors have found significant surge in retail and wholesale food prices since the lockdown and no signs of reverting to the pre-lockdown levels as of April, 21, 2020.

[8]Data on Global food price index (FAO) and India's Consumer food price index (MOSPI) are measured on different base years. To make a comparison on the global trend vis-à-vis India, we have employed base shifting methodology by considering a common base period, January 2019=100.

Furthermore, there was also a dip in consumption of milk and poultry products largely due to supply and demand issues (Kumar, 2020). Besides, misinformation on Covid-19 had a major adverse impact on consumption of foods (animal meats in particular). Media reports indicate substantial decrease in the consumption of chicken meat, egg and fish across the country owing to the fake rumors (Gupta, 2020). Besides, the outbreak of the Covid-19 pandemic is expected to have significant adverse impact on consumption of foods especially for the poor vulnerable communities in rural India[9]. Media reports indicate a change in food consumption pattern (particularly in the urban areas) with the extension of lockdown. Reports shows a considerable shift in buying patterns of consumers from basic necessities to high-value items like snacks, processed foods, packaged food products and frozen desserts etc. in the second phase of the lockdown (The Economic Times, 2020d).

POLICY IMPLICATIONS

The Covid-19 pandemic and subsequent lockdown is causing severe disruptions in the activities all along the agri-food supply chain. Several policy measures were taken by the government with the objective to ameliorate the effect of the shock exerted by the pandemic on economic agents in the agricultural sector and to help them to tide over the crisis. In this section, we have tried to analyze the policy measures taken by the government of India in order to prevent the disruption of agri-food supply chain and to revitalize the agriculture.

In order to prevent the disruption of agricultural supply, the govt. of India enlisted agriculture related operations (such as farm work and farming operations, procurement of agricultural produce by govt. agencies and other traders, inter and intra-state movement of harvesting and sowing related machines, and manufacturing, packaging and distributing units of fertilizers, pesticides, seeds and others) in the essential activities, and thereby exempted from lockdown (Tripathi, 2020). Despite the government guidelines to exempt the agricultural operation, there remained several challenges of implementation. Media reports suggest that many circulars did not reached to the appropriate local authorities and in many cases local authorities have interpreted these circulars differently. As a result, there was a severe disruption in agri-food supply chain. In addition, several cases of harassment

[9]In this context, a collaborative study (with a sample size of 5000 households) was undertaken by several NGOs in 47 districts in 12 states of the country. The study report shows that owing to the Covid-19 induced lockdown 50 percent of the rural families have cut down their usual diet, while 68 percent have reduced the number of items in their meal (VikasAnvesh Foundation and Sambodhi, 2020).The study has also found that due to loss of income because of the lockdown many people (particularly those working in dairy and poultry sector) were forced to change their food habits and reduce expenditures as a part of their coping mechanisms to deal with this unprecedented situation.

of farmers, vendors, farm harvest transporters, truck drivers were highlighted in the media (Chaudhary, 2020; Mukherjee, 2020).

On May 12, 2020 the prime minister of India announced that the government will unveil an INR 20 trillion (estimated at 10% of the country's GDP) package to help nurse the economy back to health and also unleash a new set of reforms focused on land, labour, liquidity and legal frameworks that would power India's push for self-reliance. Accordingly, a five part stimulus package has been announced by the finance minister to provide relief to various segments of the economy. The third tranche of the economic stimulus has been rolled out sweeping long-pending reforms for farm sectors as well as building agri-infrastructure to raise productivity and make the sector globally competitive. The first of the three major agri-reforms announced aimed at amending the stringent 'Essential Commodities Act' by adopting a few measures such as, deregulation of agricultural commodities, imposition of stock limits only during emergencies so that the farmers are able to get better prices for their produce. In the second major agricultural marketing reform, the govt. has proposed for the enactment of a central law to give farmer option to choose the market where they want to sell their produce by removing inter-state and intra-state trade barriers prevailing under state APMC legislations and to provide a framework for e-trading of produce. Additionally, the agri-reforms contained the government's plan to create a legal framework to enable farmers to engage with processors, aggregators, large retailers, exporters in a fair and transparent manner and to allow private sector investment in agricultural inputs, knowhow etc. These three major legislative reforms were later approved by the government of India through issuance of ordinances. Later, these ordinances were replaced by three bills i.e. The Essential Commodities (Amendment) Bill, 2020; The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Bill, 2020 and The Farmers (Empowerment and Protection) Agreement of Price Assurance and Farm Service Bill, 2020. However, many farmer and farmer associations specially in Punjab and Haryana have protested against these bills. Critics view the dismantling of the monopoly of the APMCs under the newly introduced 'The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Bill' as a sign of ending the assured procurement of food grains at minimum support prices (MSP). They argue that instead of making the APMCs redundant, the govt. should ensure that a large number of farmers get the MSP for their produce and strengthening kinks in the APMCs. However, in reality, a very small percentage of farmers (6%) specially in Punjab, Haryana, Uttar Pradesh and Madhya Pradesh could participate in the government procurement at MSP (Singh, 2020). Critics highlighted that 'The Farmers (Empowerment and Protection) Agreement of Price Assurance and Farm Service Bill' (for

promoting contract farming) does not prescribe any mechanism for price fixation in order to protect the farmers against price exploitation. Many fears that free hand given to private corporate houses could lead to farmer exploitation. Critics are also apprehensive about formal contractual obligations owing to the unorganized nature of farm sector and lack of resources for a legal battle with private corporate entities. However, contract farming was practiced in majority of the Indian states under the legislative provision of the state governments, and no such gross violation of negotiations arises. This model of farming often excludes small and marginal farmers which accounts for 85 percent of the total cultivators of the country. It necessitates the role of Primary Agricultural Cooperatives (PACs) and Farmer Producer Organization (FPOs)[10] to act as a role of aggregators in agricultural marketing. They also argue that deregulation of agricultural commodities from the essential commodities act may lead to irrational volatility in the prices of essentials and increased black marketing. However, this policy may encourage private investment in gross capital formation specially in the channels of agricultural marketing operations.

The third tranche of the economic package also included measures to strengthen infrastructure logistics and capacity building for agriculture, fisheries and food processing sectors[11]. The aforesaid reforms and investment announcements are in the direction of a long-term vision of the government to strengthen the sector that provides highest share of employment in the country. More importantly, these policies are also expected to strengthen the agri-food supply chains in the country that feeds more than a billion of Indians every day.

POLICY CHALLENGES

The COVID-19 pandemic holds a number of implications for Indian agri-food supply chains. The nation-wide lockdown has shown the fragility of the country's agri-food supply chain. Moreover, as the country continues to be hit hard by a more devastating second wave of the pandemic, few states in India have imposed fresh restrictions, including partial

[10] PACs and FPOs played an instrumental role in procuring agricultural produce successfully for FCI in many states like Madhya Pradesh, Uttar Pradesh, Bihar and Chhattisgarh (Singh, 2020).

[11] A financing provision worth INR 1 trillion has been made for the development of farm-gate & aggregation points (such as, primary agricultural cooperative societies, Farmers producer organizations, agricultural entrepreneurs, start-ups etc.), affordable and financially viable post-harvest management infrastructure. Furthermore, the package included a few notable financing promises such as, INR 20 billion to support aquaculture and fisheries (with specific emphasis on promotion of fishing activities as well as infrastructure development), INR 15 billion to animal husbandry infrastructure development (promoting private investment in dairy processing, value addition and cattle field infrastructure), INR 10 billion towards formalization (technical upgradation, building brand and marketing) of micro food enterprises, INR 500 million for strengthening supply chains for fruits and vegetables and INR 500 million for bee-keeping related infrastructure development.

lockdowns and night curfews to curb the spread of the infections. Amidst this, there are growing concerns about the ability of the already weakened country's agri-food supply chain to withstand the devastating effect of further lockdowns. Therefore, on policy ground, the first and foremost need is to focus on maintaining and enhancing supply chain resilience by building robust and reliable relationships among the supply chain actors. Collaborative buyer-seller relationships build trust among supply chain partners and flexibility in responding to unexpected shifts in demand or unanticipated supply disruptions (Hobbs, 2020). In addition, the paper has suggested a few specific potential strategies for mitigating disruptions and ensuring smooth running of supply chain.

In order to mitigate any adverse impact the Covid-19 pandemic and subsequent lockdown(s) on agricultural production, the policy makers need to ensure the availability and timely delivery of necessary agricultural inputs at affordable prices. The implementation of an efficient transportation system (such as 'Green channel' model) for imports and distribution of agro-inputs can address this issue. Besides, in order to deal with disruption in import of agro-inputs and agro-input raw materials (due to the trade protectionist policies by other countries), the policy makers may consider re-strategizing (or diversifying) their supply chain to hedge against large scale disruption. Alternatively, a self-reliant policy of building capacity at a local level is expected to reduce the dependence on agro-inputs (specially pesticides and fertilizer imports) from other counties of the world (specially China). Furthermore, the policy makers may consider temporary waiver of tax on key agricultural inputs (such as seeds, fertilizers and pesticides) to make these affordable, especially to the small and marginalized farmers.

The labour issues can be addressed by adopting few measures such as, allowing movement (both intra-state and inter-state) of labour through careful monitoring, encouraging the farm owners to adopt safe operating procedures in workplaces, providing health insurance schemes to the migrant farm workers. Furthermore, the benefits of Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)[12] can be applied to help farming activities. The inclusion of farming activities under MGNREGS can be a great help especially for small and marginalized farmers struggling with lack of labour during lockdown. Besides, the leveraging of MGNREGS funds to pay the farm labour will definitely lessen the monetary burden on farmers. Moreover, to ease the increasing financial burden on farmers, policy makers may consider providing of immediate reliefs such as direct cash transfer, waiver of interest on outstanding crop loans and expanding the crop

[12]MGNREGS is the world's largest employment scheme which provides social security to rural households in the country by guaranteeing them a minimum of 100 days non-farm labour-intensive work.

insurance schemes to compensate the farmers affected by the pandemic. In addition, farmers need access to finance for the purchase agricultural inputs so that they can continue their farming activities. In this context, expanding the institutional lending of crop loans (especially to the marginalized farmers), relaxing the payback periods may be considered.

The mitigating strategies for the post-harvest level includes, improving the post-harvest management and storage infrastructure, addressing the logistic issues, and strengthening the producer-market linkage. To deal with the current storage problems, the government could explore leasing in unutilized capacity in warehouses and cold storages to extend support to producers, linking them to warehouse receipts. However, in order to address the storage related issues in the long-run, it is necessary to strengthen the existing storage infrastructure in the country. It could be done by building storage facilities at a micro level. The logistical disruptions due to lockdown can be avoided with clear directives from the govt. authorities prioritizing the logistical activities (such as movement of labour and transportation) and giving precedence to the health of workers engaged in storehouses and transportation services. Additionally, in order to mitigate disruption and to ensure smooth running of supply chain, the policy makers must focus on strengthening the producer-market linkage through various market linkage measures such as contract farming, producer companies and other aggregation models. The present situation also calls for the restructuring of government procurement under price support mechanism. The prevailing public procurement process can be decentralized by bringing the collection centres (with adequate capacity) closer to the producers to ensure smooth and timely procurement of agricultural produces. It can be carried out via primary agricultural credit cooperative societies, self-help groups and FPOs. Moreover, the electronic trading platforms (such as e-NAM[13]) can be utilized with greater efficiency for carrying out procurement operations.

At the processing level, the problem of shortage of raw materials can be addressed by creating a sustainable supply of raw materials. The food processing and packaging industries need to enhance their resilience through strategic inventory management plans and flexible procurement strategies. Similarly, the staffing challenges can be handled by creating a trained pool of workers to fill positions temporarily in the event of absenteeism. Furthermore, it is necessary to ensure proper coordination between the central and state governments and also between the state governments and local authorities regarding the

[13] Even though there registration of farmers and commission agents are encouraging, but as of April, 2018, only 5% of the farmers had transacted on the platform and less than 1% of the total arrivals in these markets had passed through the eNAM (MSC, 2018).

lockdown guidelines, so that any further disruption of food processing and packaging activities can be prevented. In order to ensure uninterrupted supply of foods, policy makers may consider adopting few measures such as, encouraging the delivery personnel return to work by arranging proper health and safety measures for them, allowing unhindered transportation of foods, implementing 'Green channel' model for transport of perishables to minimize hurdles in delivery and to avoid loss, removing the barriers of international trade of agricultural produce. Besides, local authorities could consider opening-up of additional market places (to avoid crowds), altering marketing dates (to give a room for disinfecting the market places on the off days), relocating markets to larger premises, allowing people to transact by keeping their physical distance, and applying all the possible prevention mechanisms. Similarly, hotels and restaurants can be allowed to operate by changing their mode of delivery (i.e. travelling food door-to-door to customers place) with necessary health precautions. Moreover, the applications of online platforms can be considered as a viable option (given the current scenario) to deliver foods from the local providers to consumers. For this purpose, the policy makers need to prioritize reforms and investment in online platforms for formalization of online delivery services.

At the consumption level, policy measures such as, controlling prices (minimizing artificial price increase) by way of monitoring wholesale and retail markets, providing transparent, reliable and stable information on food safety, enhancing access to foods by expanding emergency food assistance programs (through mobilization of Public Distribution System[14], food banks and other community-based organizations), expanding social safety net programs (such as, cash transfers and other complementary entitlements to offset loss of incomes) for the vulnerable communities, reducing consumption tax and GST rates of food items temporarily to drive consumption might be considered.

CONCLUSION

The Covid-19 pandemic has posed an unprecedented challenge for almost every sector of the economy. Agriculture, the backbone of Indian economy has been severely hit by the outbreak of the pandemic. Moreover, the Covid-19 pandemic and subsequent lockdown continues to exert a significant shock on Indian agriculture. In this paper we have tried to assess the potential impacts of the shock by considering their implications along the different stages of supply chain, namely, production, post-harvest handling & storage, processing & packaging, distribution and consumption. Evidences indicate severe disruption in activities along the supply chain, which mainly caused by Covid-19 induced lockdown. At

[14]Public Distribution System (PDS) consists of a large network of government-sponsored fair shops entrusted with the work of distributing basic food and non-food commodities to the needy sections of the society at very cheap prices.

the production level, the outbreak of the pandemic and subsequent lockdown has adversely affected crop and livestock production mainly due to non-availability of necessary agricultural inputs such as fertilizers, pesticides, agricultural machineries and labour. At the level of post-harvest handling & storage, the Covid-19 induced lockdown posed several key challenges in the form of labour shortage, lack of adequate transportation and storage facility, loss of foods due disruption in procurement process etc. Processing & packaging also observed to be severely affected through cessation or reduction of production due to shortage of raw materials, manpower and transportations as a result of the lockdown. At distribution level, restriction on movements due to lockdown also created several key challenges such as shortage manpower, lack of logistic services, loss of food due to delay in delivery, closure of restaurants, wholesale agricultural markets and retail points, restrictions on foreign trade etc. These factors are instrumental in causing severe disruption in supply of food from the production to the consumption centres. At the consumption level, the pandemic has adversely affected consumption of foods through rise in food prices, shortage of supply, misinformation and loss of income. In conclusion, it can be said that the outbreak of the Covid-19 pandemic has provided us an important lesson about the existing vulnerabilities within the system, particularly with respect to logistics and distribution. Moreover, as the pandemic unfolds in coming days, much can be learned about how food supply chains respond to the crisis and about strategies to enhance supply chain resilience.

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