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Resilient Food Supply Chain of India during Covid 19 Pandemic

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Abstract: ***The continuous supply of foods to the people across various localities is always a challenging task in normal conditions, whereas in case of pandemic situations like Covid 19 it becomes most difficult due to various factors impacting upon operational efficiency of the supply chain.***
In case of crisis situations the response of the system particularly food supply chain to serve the needs of the society was evaluated in this paper. The resiliency of supply chain in food sector was studied and accordingly related literature reviewed. Indian supply chain challenges are unique in nature due to its bio-diversity and geographic location. The methodology adopted to study this resiliency of Indian food supply chain was through available literature review, and study of data related to food supply chain.
The resiliency of food supply chain was identified based on the results of price stabilization over period of time and availability of supplies during succeeding stages of Covid 19 pandemic.
The synchronization of activities involved in SCM to create value for the customers through options like information reliability, Quality standard checkpoints, transportation flexibility, adoption of technology etc. were proposed.
Keywords: Pandemic, Covid 19, Food Supply Chain, Supply Chain Risks, Resilient Supply Chain, Supply Chain Network (SCN)

I. INTRODUCTION

The economic development of any nation depends upon a well-designed and efficient Supply Chain Network (SCN) to fulfill the supply and demand at remote locations.
During the Covid 19 pandemic scenario, whole world had faced tremendous challenge in managing the flow of goods from point of origin to point of consumption. The restrictions on movement of goods forced to think about radical design changes in SCN.
The food and necessity items continuous supply to the consumers was the major requirement/challenge for government during the lock down, as an effect the supply chain design changes were the need of an hour. The country like India has special challenges in mitigating the fulfillment of supplies with demand. The geographical diversity of India creates hurdles in managing the flow of goods. The supply of foods to the wholesale market was dropped down by 64%, whereas prices of foods increased by 10% during the nationwide first phase of lockdown in India. (Hao Zhang, 2017)
The godown and warehouse operations in India majorly carried out manually compared with automation. Due to the lockdown the manpower/workers movement was at standstill causing impact on storage facilities.
Food market in India is highly fragmented in both rural and urban area which faced the similar kind of situation from farm to fork. Paradoxically, there was hike in prices of commodities in retail market whereas the prices paid to the farmers are also crashed to an extent. The infrastructural aspect of Indian Supply Chain is majorly utilizing Road and Rail resources.

A. Food Supply Chain Management.

The characteristics of Fresh agricultural products such as a short shelf life, large demand, necessities for storage facilities and transportation network, so the suitable operation mode and efficient information management system play an vital role in ensuring products quality, especially from the customer viewpoint. The expectations of the customers related to quality, safety, freshness, price is increasing day by day which forces the supply chain to meet these requirements. A typical Food Supply Chain Management (FSCM) should keep into consideration these parameters for design and development of strategy. Advanced technologies like Cloud Computing, Big Data Analysis, Internet of Things makes conventional SCM approach to shift towards smart future.
The data driven decision makings for FSCM would be accepted for achieving higher sustainable and adaptive food supply chain and FSCM implementations will be enabled by the cutting-edge technologies facilitated solutions with more customer friendliness and customization.
(Xu & Wang, 2017)

B. Resiliency of Supply Chain

Although "resilience" can be defined as the ability of a substance to return back to its original state or form after distortion, the Supply Chain Resilience is still a novel area of management to be discovered. Furthermore, as the probability of it returning back to its original form after deformation is still "theoretical", "many organizations still lack the awareness that it is necessary to take into consideration a resilient supply chain as part of their strategy when developing their risk and business continuity management" (Christopher & Peck, Building the Resilient Supply Chain., 2004)

The resilient supply chain covered in this paper focuses upon its implications at the time of crisis situation. The qualitative research method concentrating on scientific publications, related literatures, journals along with quantitative form of secondary resources also been tapped.

The objective of this research is to create a strategy which keeps all supply chain partners in to consideration and absorbs the turbulence in the environment.

The arrangement of this paper has three major aspects namely, Effects of pandemic on global food trade, supply chain management, risks involved in supply chain and resilience of supply chain. In the first section of the pandemic situation aroused due to Covid 19 was discussed along with its effects on global food trade. The earlier cases of pandemic discussed and also overall Covid 19 situation worldwide reviewed. The second section elaborates on the supply chain elements their integration, flow of materials, money and information addressing to the dynamic nature. All channel partners role and contribution in the changing business environment. Integration of other departments to make the supply chain management efficient and effective.

The risk assessment in supply chain is of prime importance as nature of area it applied decides the effect on overall supply chain. The vulnerable situation making more challenges ahead for supply chain. The resilience supply chain makes the conventional approach tailored to face and mitigate the risks. The design of strategies to restate the original situation from the crisis gives birth to resilience supply chain management.

II. EFFECTS OF PANDEMIC ON GLOBAL FOOD TRADE

The implementation of measures caused the closure of offices and educational institutions, and momentary restrictions in journeys and social gatherings. Flexible work from home and online meetings have turn out to be standard practices at the present time. However, peoples who have works in the food industry do not have this choice and hence they need to retain their typical office routines (Nicola, 2020).

As a concern of the COVID-19 crisis, response policies for food workers were established to deliver guidance for continuousness of operations in the food processing services and cope with coronavirus in the food industry. Particularly meat and poultry processing businesses can be defined as requirement of critical infrastructure in food and agriculture industry. The plan includes a order of control necessities

for cleaning, sanitation, decontamination of facilities, screening, and monitoring of workforce for COVID-19, managing the sickening employees and design of educational programs for workers and supervisors to stop the spread of coronavirus (CDC (Centers for Disease Control and Prevention), 2020b)

A most important concern shared by all food companies is conserving the employee's health and the arrangement of appropriate workforce due to those who do not want to work due to sickness or coronavirus panic. It is very imperative to protect and conserve the health of people employed in the food supply chain in the course of crisis. Maintaining the movement of food and commodities all the way through the supply chain should be safeguarded with the involvement of all stakeholders. Confirming the confidence of customers is also essential for food safety and security (FAO (Food and Agriculture Organization of the United Nations) W. (., 2020). At this time of crisis, food security is related with consumers' access to food rather than food availability (OECD (The Organisation for Economic Co-operation a, 2020).

A. Earlier Situations of Pandemic

Although the current conditions feel exceptional, the vulnerability of food systems to problems related to climate and conditions has been endured long before the COVID-19 extremity. Food systems have been unstable from colorful events and shocks preliminarily similar as the canvas extremity in the 1970s, the SARS and Ebola outbreaks, and the 2006 – 2008 food extremity. Africa Swine Fever complaint made the global commodity requests upset just a time ago and came a progressive epidemic in Eastern Europe and Asia. The world's largest swine patron (has1/3 of the global request) and biggest exporter, China, lost 37 of its pigs by the end of 2019 (IPES, 2020)

Ebola had a great negative impact on agrarian product, marketing, and trade husbandry of some African countries. On the product side, due to road constraints, growers had limited access to inputs similar as seeds, diseases, and fungicides, and utmost regions faced shortage of labour.

For this reason, further than 40 of agrarian land has not been cultivated. Still, epidemic didn't oppressively affect the product because agrarian areas were frequently in the geographic areas which are far down from civic consistence. (Agrilinks, 2020)

B. Effect of Covid – 19 on Food Supplies

The current COVID-19 extremity has changed the food trade programs of some governments, moving towards confining exports and easing significances. The main reason that countries put import restrictions is to insure the conservation of the number of products in the domestic request. Although the import restriction generally produces this result in the short term, it also has some negative goods. First, import restrictions beget domestic prices to drop, which will hurt growers financially performing in the drop in crop product and reduced impulses in the assiduity. Second, countries will lose their competitive advantage by losing their place in transnational requests. Third, import restrictions undermine exporter's character and encourage importers to reduce confidence in the world request, thereby reducing trust in transnational trade and destroying unborn business openings for exporters (Espitia, 2020) (FAO & WHO, 2020) In 2008 food extremity, although domestic food prices increased greatly, some big countries that could insulate themselves from world requests weren't affected. Compared with 2004, rice prices increased by 224, wheat prices by 108, and sludge prices by 89 (Food and Agriculture Organization of the United N, 2011)

In general, prices increased due to trade constraints, pitfalls, and misgivings in transnational requests leading to an increase in prices in the import-dependent countries advanced than they should be. Because of the import restrictions executed by major exporting countries, fear- buying has been observed in importing countries and prices have been elevated due to further demand for products. (DOS, 2011) Although world food stocks are presently high, a prolonged epidemic extremity can beget problems in the food force chain, as well as import- confined programs, which can spark the domino effect. According to the FAO 2019 grain product estimates, it was reported that there had been around2.721 billion tonnes of product conforming of1.44 billion tonnes for coarse grains, 763 million tonnes for wheat, and 512 million tonnes for rice. According to Food and Agriculture Organization of the United Nations (FAO's) 2020 estimates, wheat and coarse grain product is anticipated to be analogous to 2019. For this reason, global grain requests are anticipated to follow a balanced situation despite the concern of COVID-19 (FAO, 2020)

A aggregate of 19 countries have taken measures to circumscribe exports, which are related to 27 food products due to COVID-19 outbreak. Some of these restrictions are inactive and presently a aggregate of 8 countries are continuing their measures on 11 food. When the goods of restrictions on importing countries are estimated (expressed as Kcal unit), it's seen that Tajikistan, Uzbekistan, Afghanistan, and Azerbaijan were negatively affected by 79 %, 70 %, 61 %, and 54 %, independently (IFPRI, 2020)

In nut shell, trading provides to move the products from surplus area to deficit areas, preventing the dearth and food uncertainty related to reliance only on domestic production (Baldos, 2015) (Fitton, 2019) Still, COVID-19 epidemic caused a significant impact on food trade and led to dislocation in food supply chain due to the import restrictions. Export- restricted programs pushed up world prices of stable food goods similar as wheat, sludge, and rice and redounded in reduction of the volume and quality of food eaten (Fyles & Madramootoo, 2016)

Customers also couldn't find the product which isn't grown or produced nationally. Producers were also weakened by the restrictions because transnational request contains endless number of buyers and helps the producers to choose the stylish one. When the import restrictive programs were applied, original merchandisers couldn't find buyers and redounded in redundant force and waste along with profitable losses. Foods that aren't grown locally but demanded for processing weren't available due to the restrictions and capacity utilization of food-manufacturing factories to respond demand was also negatively affected (Arianina & Morris, 2020) (Ndemezo, Ndikubwimana, & Dukunde) (Reddy, Singh, & Anbumozhi, 2016)

Transportation challenges for air and ocean cargo were also farther issues in association with food decimation and waste (OECD, 2020).

III. SUPPLY CHAIN MANAGEMENT

Supply chain is defined, as "a group of inter-connected participating businesses that improve value to a transformed inputs from their source of origin to the end products or services that are demanded by the end-customers" (Lu, 2011) or "a broad explanation of the process integration involving organizations to transform raw materials into finished goods and to transport them to the end-user" etc. (Pienaar, 2009) "supply chain is a sequenced network of business associates involved in production processes that transform raw materials into finished goods or services in order to satisfy the consumers' demand" (Mensah, 2013)

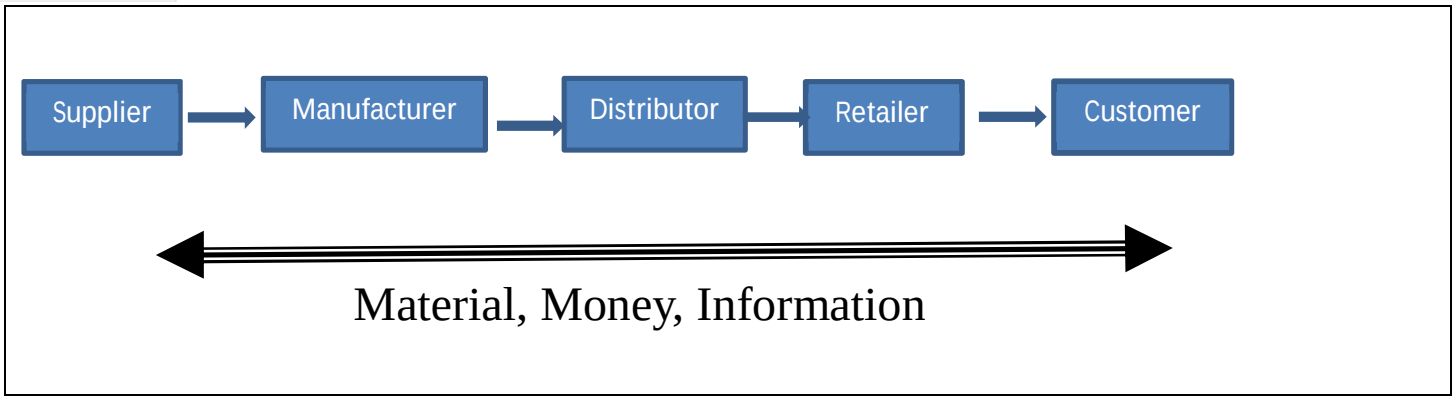

Figure- 1: Schematic Diagram of Supply Chain
Source: Created by the author

The supply chain management decision making primarily covers following broad areas in considering market demands and other operating challenges:

1) *Production:* The production refers to the term where the creation of products/services takes place through transformation process. The conversion of inputs given to the system derives outputs relevant to market demand or market requirement.
2) *Inventory:* The decision of quantity of goods to be maintained at each stage of supply chain decides the response time to the customer's request/service reaching to the customers. The optimal level of inventory leads to the lower inventory cost as well as achievement of customer satisfaction.
3) *Location:* The location factor for supply or production of goods particularly in food sector has restricted flexibility due to specific requirement of growing conditions. The placement of channel partners near to customers gives advantage for the growers to reach customers before the competitors.
4) *Transportation:* The movement of inventory/goods from point of origin to point of consumption is unavoidable because of diversity in grower's location and marketplace. The mode of transportation selected must justify the cost, safety, delivery time.
5) *Information:* In supply chain management, information plays very crucial role. The flow of information leads to better coordination and decision making. Use of modern technology in the information gives strategic advantage to the firms.

IV. SUPPLY CHAIN RISKS

Supply chain risk management states the process by which businesses take strategic steps to identify, assess, and mitigate risks within their end-to-end supply chain.

There are both internal and external risks that can disrupt your supply chain,

A. *External Supply Chain Risks*

These global supply chain risks come from outside of an organization. Unfortunately, that means that they are harder to predict and typically require additional resources to overcome. Some of the external supply chain risks contains:

1) *Demand Risks:* Demand risks occur when you miscalculate product demand and are often the product of a lack of insight into year-over-year purchasing trends or unpredictable demand. Through various forecasting techniques and previous data analysis this distortion in the figures may got minimized.
2) *Supply Risks:* Supply risks happen when the raw materials used in business relies on aren't delivered on time, thereby causing disruption to the flow of product, material, and/or parts.
3) *Environmental Risks:* Environmental risk in the supply chain is the direct result of social-economic, political, governmental, or environmental issues that affect the timing of any aspect of the supply chain.
4) *Business Risks:* Business risks occur whenever unforeseen changes take place with one of the entities you depend on to keep supply chain running smoothly — for example, the purchase or sale of a supplier company. (Marotta)

B. Internal Supply Chain Risks

This refers to any supply chain risk factors that are within your control, and that can be recognized and checked.

1) Manufacturing Risks: Manufacturing risks denotes to the possibility that a key factor or step of your workflow could be disrupted, causing operations to go off plan.
2) Business Risks: Business risks are a product of disruptions to standard personnel, management, reporting, and other essential business processes.
3) Planning and Control Risks: Planning and control risks are caused by incorrect forecasting and assessments and poorly scheduled production and management.
4) Mitigation and Contingency Risks: Mitigation and contingency risks can ensue if your business doesn't have a emergency plan for supply chain disruptions. (Marotta)

C. Supply Chain Risk Management Strategies

In today's linked and digital world, supply chain risk mitigation can be challenging due to globalization and potential cyber intervention. There are certain measures which can reduce your business' exposure to risk:

1) Leverage the PPRR risk management model. The PPRR risk management model is a renowned global supply chain risk management strategy and is used by businesses around the world. The Prevention considers the precautionary measures to mitigate supply chain risk. Preparedness develops contingency plan in situation of emergency. Response relates to execution of plan to reduce impact of disruption and finally Recovery categorizes the operations to become normal and resume the operations.
2) Manage environmental risk in supply chain. This is more important than ever given that the COVID-19 pandemic opened gaps in global retail and manufacturing supply chains that leave them prone to interruption.

As a effect, several retailers decided to change from a single-sourcing to a multi-sourcing model, which would provide them with a exigency plan should their key supplier become unavailable. Others decided to change their business model completely in order to adjust to drastic modifications in product seasonality and feasibility.

Though there's no way to avoid environmental risk in supply chain, we can plan for it. We be able to identify weak points in supply chain and collect data-driven insights to strengthen them (Marotta). Consider these strategies for development of supply chain resiliency:

a) Multiple sources categorization based on various priorities, cost, time etc which gives flexibility in case of disruption.
b) Nearness to the customer will reduce the travel time and also expenses.
c) Creation of buffer capacity of inventory results into reduction of climate related environmental risk to certain extents.

3) Data/cyber Security of supply chain network: To mitigate the cyber security related risks a robust security mechanism of vendor network along with channel partners based on advanced technology should be designed.
4) Supply chain visibility optimization: This SC visibility starts from financial stability of suppliers, in-transit shipment visibility, inventory levels which ultimately leads to greater level of customer experience. The identification of critical areas in the supply chain leads to rectification of potential problems or threats by optimizing the overall SC network.
5) Transportation network design: The movement of goods/supplies from point of origin to point of consumption has different elements like loading time, transit time, idle time (stop time), route selection, etc. An efficient transportation network design strategy overcomes the environmental risk in a very effective manner.
6) Consistently monitoring of risks: An automated system in the form of Enterprise Resource Planning can identify the risks in the supply chain. To streamline business operations based on these potential risks mitigates the risks and secures the organizational system. (Marotta)

V. RESILIENT SUPPLY CHAIN

(Christopher & Peck, Building the Resilient Supply Chain, 2004) in their publication 'Building the Resilient Supply Chain', where they emphasized the following key points in developing a resilient strategy:

1) Re-engineering the supply chain to build resilience into the system in advance of a potential disruption;
2) Establishing a high level of collaboration with supply chain parties to identify and manage risk;
3) Achieving the agility necessary to respond quickly to the unexpected;
4) Embedding a culture of risk management.

Agricultural contribution is one of the major contributors for the gross domestic product (GDP) in the Indian economy. The Per capita GDP of India is estimated to reach US$ 3274 in 2023 from US$ 2135 in 2018 and offers employment to more than 55% of the India's labor force (T. R. Ministry of Agriculture, 2016) and also contributes to a substantial percentage of the total national income. The share of agriculture contribution in national income is declining since past few years due to the growing other sectors like manufacturing, service and there is a necessity to adjust the supply chain (SC) in accord with the demands and expectations of customers and producers. An SC is the flow of material and information from source of origin to customers through various channel partners. The SCM is the overall process of creating value to the customer by synchronizing all the activities involved in the SC process. Agriculture supply chain (ASC) covers various tasks from crop production to the delivery of products like growing, harvesting, transportation, etc. Due to increasing population, there is always requirement for additional foods and therefore it requires improved SC to satisfy all demands. In India, the ASC faces substantial production loss before reaching to the customers and there are numerous other challenges that requires to be addressed. This needs strategic planning and implementation on all parts of the system (Patidar, 2018)

India is the second largest producer of grains, vegetables, and fruits. It has been observed that substantial amount of wastage takes place i.e. one-third of the output (70% of production and 40% of economic costs) due to various reasons. Wastage of food supplies takes place at production or farmers collection points, physical distribution and processing stages in the food Supply Chain. According to the estimation, (Nations, 2015) the supplies of food would need to raise by 60% (estimated at 2005 food production levels) to meet the food demand in 2050. The food demand can be satisfied by increasing in food production or decreasing the losses and wastage. The production has the restriction of natural resources like weather, land, water etc., and at the same time per family agriculture land holding is continuously declining due to population growth and other infrastructural expansion. As per a study carried by National Institute of Agricultural Marketing (NIAM)there is around 6–7 intermediaries/middleman's in the SC for fruits and vegetables in India as compared to 2–3 intermediaries/middleman's in developed countries. This state indicates that India has lack of network design of AFSC, which is accountable for enormous agricultural production losses and low profitability of growers/farmers. We are focusing to decrease the problems of the SC by increasing the service level of the system and to fulfill the demand of the increasing population of India. (Patidar, 2018).

Rural - urban supply chains are crucial to the food security of urban Indians, which was around 79 million (around 18 percent of the population) in 1961, approximately 350 million in 2010, and an estimated 590 million by 2030 (40 percent of the Indian population and greater than the current entire European Union) (India, Ministry of Home Affairs). The food supply chain is also important to the incomes of hundreds of millions of those employed in rural and urban areas as farmers, wholesalers, transporters, processors, and retailers participating in these supply chains (Reardon & Minten, September 2011).

The assessment of infrastructural and food supply chain (FSC) in Indian agricultural sector requires to be made integration of agriculture system.

The absence of emphasis on available formal and informal risk management options is observed. In practical angle the most attention will be given to improve or supplement formal mechanisms covering institutional and financial arrangements, changes in technology, improved management practices, upgrading investments in infrastructure.

To the certain level that the government is primarily focused on the position and welfare of minor farmers, then larger attention would need to be given to substitute informal mechanisms and improving their efficiency. This study also submits that little attention has been paid to areas considered as 'high vulnerability', either for specific chain members or the chain as a whole.

The consideration of substitute tactics should include at least initial attention of expected costs and benefits, possible technical / regulatory constraints, likely distribution concerns and realistic scenarios for acceptance and influence on underlying vulnerabilities.

Review of agricultural setup and supply chain has not been given its due and that should be undertaken on the needs or options for policy and regulatory restructurings that affect farmer or agro-enterprise risk management as well as the probable reform of governmental risk management tools.

Aspects like cold chain needs to be given extra consideration as it could results in the dropping of losses and holding of the quality of horticultural yield. Whereas the introduction of a cold chain facility countrywide due to some institutional, structural and financial constraints may not be instantaneously possible in India, efforts must be made to build a cool chain. Food-loss drop is less costly than an equal increase in food production (Parwez, 2016).

Decision makers must be aware of the operating environment in which a resilient supply chain would work in order to ensure that the building blocks of such a supply chain are effective. One such feature is governance structure, which lends itself to parallels with India's neighbor, China, given their similar population densities. China's centralized political framework is perfect for coordinating an epidemic supply chain response.

However, given India's federal system and the fact that various states are responsible for health, an adaptive supply chain strategy combining centralized and decentralized measures is required. – For example, central agencies should be in charge of procuring crucial supplies, coordinating aid flows into the country, and establishing initiatives to boost local output; state and local governments are best positioned to perform allocation and distribution at the local level because they have a better understanding of community needs.

When adopting an adaptive supply chain approach like the one outlined above, keep in mind the bureaucratic hurdles that may occur during implementation. The obligation for payment (central vs state governments) for centrally acquired commodities is anticipated to be a controversial issue, based on the experience of the second COVID19 wave in India. Determining fair and equitable distribution policies for the acquired products to be distributed to different states is also likely to be difficult. Given that addressing these issues will necessitate careful deliberation and negotiation between states and the federal government, we recommend taking a proactive approach and beginning work on an overarching framework that will guide procurement and allocation decisions during future health emergencies as soon as possible.

It is vital to establish robust and responsive supply networks in India and other countries in order to deal with future waves. We feel the principles outlined in this essay are a good starting point in that direction. (Natarajan & Prasad, 2021)

During a pandemic, maintaining supply in the agriculture and food sector, which is one of the most essential sectors alongside health, is critical for avoiding a food crisis and minimizing the negative impact on the global economy. Despite the fact that no serious issues have been identified in the food supply chain thus far, the future remains unknown. As a result, each country must recognize the gravity of the situation and may need to tighten or loosen restrictions in response to the pandemic's progress. The food supply chain's supply network should also be flexible enough to adjust to difficulties.

(Serpil & Mehmet, 2020)

A. Average Consumer Prices Increased, while Producer Prices Plummeted.

Existing data shows that there are two broad implications on prices. The overall loss in demand, particularly in cities—driven in part by a drop in hotel, restaurant, and catering demand as well as a massive exodus of migrants—appears to have flowed upstream, resulting in a significant drop in producer pricing. According to one producer pricing index, prices fell to about a third of pre-lockdown levels by the end of May following a brief uptick (Figure- 2).

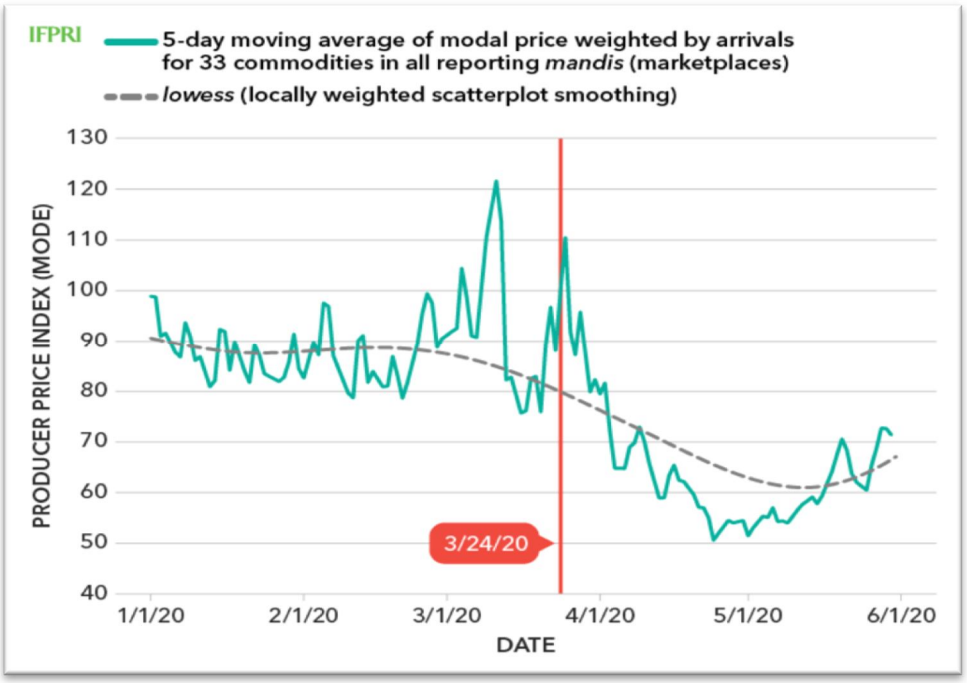

Figure- 2: Prices farmers receive have collapsed
Source: (Narayanan & Saha, 2020)

This is also supported by farmer telephone polls, which show that many farmers are reporting a sharp drop in prices, particularly for perishables.

At the same time, consumer food prices have risen in most urban locations, owing to increased supply chain frictions such as limited labour availability, greater transportation costs (in some cases, double pre-lockdown costs), and logistical uncertainty (Figure- 3).

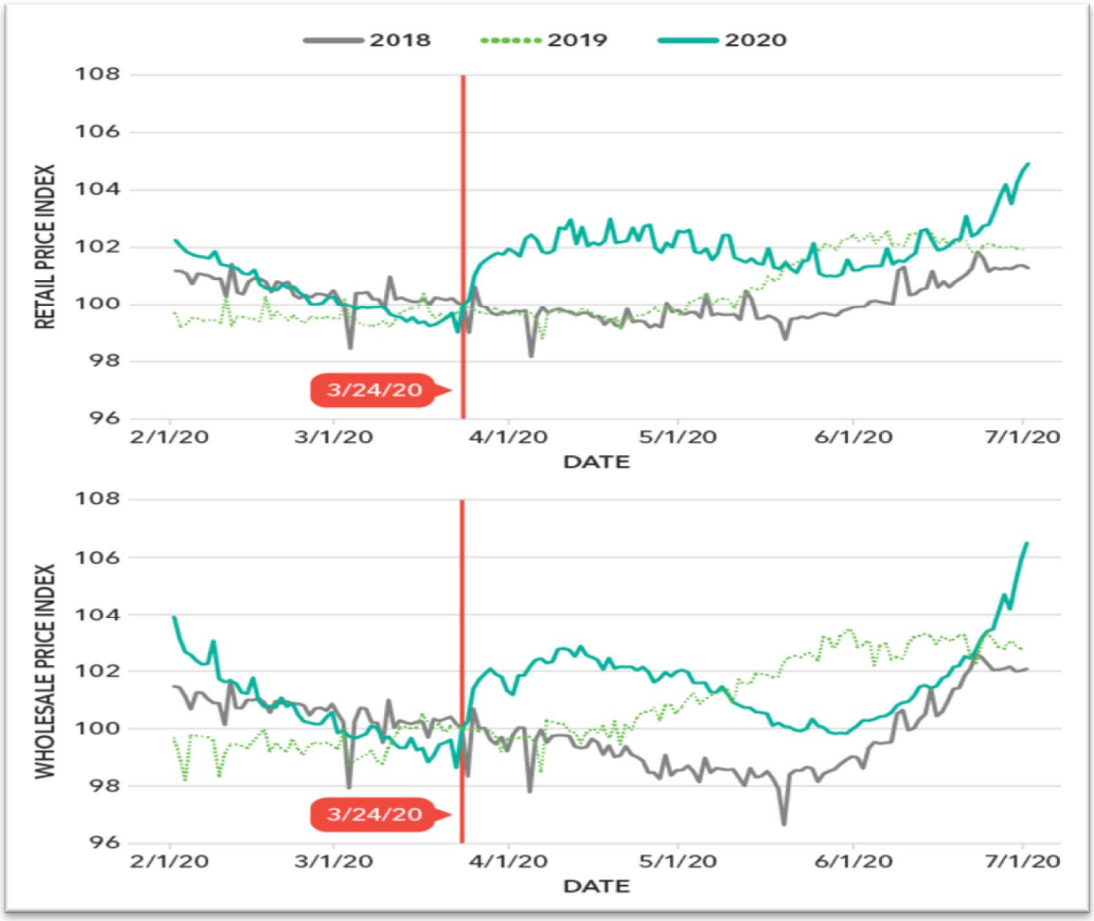

Figure- 3: Consumer retail and wholesale prices increased on average
Source: (Narayanan & Saha, 2020)

This disparity between wholesale and retail prices widened dramatically during the lockdown's first phase (March 24-April 14) and continues to widen (Narayanan & Saha, 2020).

Markets in rural and urban areas were fractured as a result of these upheavals. Average retail prices did reduce in several large cities, with only a few items seeing rises; nevertheless, in smaller cities and towns where data is available, retail prices jumped an average of more than 20% in the two months following the lockdown. Furthermore, during the lockout, the pricing range among metropolitan centres widened dramatically, indicating a lack of spatial integration; huge variances persist even two months later, implying ongoing issues.

The price trends of other commodities have also changed. Producer prices for perishables plummeted, while retail prices for fruits and vegetables changed dramatically over time and geography, climbing significantly in some areas, dropping in others, and growing in some cities following the lockdown. Producer prices for major cereals, on the other hand, have remained high, owing to active government procurement, and retail prices in urban markets have remained stable, owing to the Public Distribution System (PDS), which distributes grains to consumers, as well as large-scale grain distributions to vulnerable populations by civil society organisations. However, retail prices for pulses and edible oils, as well as processed foods like cookies and flour, increased dramatically.

B. Traditional Retailers Have Played an Important Role.

Small-scale mom-and-pop/corner stores (called kirana) and other informal players such as push-cart and street vendors supply up to 90% of the Indian market; supermarkets and other contemporary outlets serve roughly 8%, and online merchants serve 2%.

Kirana businesses and unlicensed street vendors have been the most successful in navigating the lockdown's hurdles. Informal retailers have "embraced technology," according to analysts, with help from B2B (business to business) retailing supply chain management organizations on the back end.

While traditional stores use hired workers as well, they relied mainly on family labour and were thus less affected by labour shortages than modern stores.

Fresh fruit merchants on the street have also kept supply systems afloat. According to the findings of a survey of more than 50 shopkeepers in 14 places across India, some people who lost jobs in cities and were unable to move to their villages, or who had their stores shuttered owing to lockout regulations, turned to vending fresh produce and groceries. One fruit vendor in Goa, claimed that over 30 people in his neighborhood, including a car mechanic, opened fruit and vegetable businesses since they were unemployed and unable to return home. During the lockdown, the low entry barriers to informal retail led to an increase in the number of informal food retailers.

Modern organised merchants, with their substantial back-end investments, were supposed to be the best positioned to operate throughout the crisis, but labour shortages and movement restrictions significantly impacted their operations. While online prepared/restaurant food delivery orders declined by 75% in April compared to January (and total e-commerce decreased by 83%), e-grocery demand increased by 27%.

Despite advanced procurement and stocking systems, distribution problems, such as labour availability, resulted in just a fraction of online orders being fulfilled. Most online food retailers have shut down, while others are still struggling to satisfy rising consumer demand. Meanwhile, many modern format retail businesses, including those in shopping malls, have stayed closed for the duration of the lockdown.

Procurement by the government and private innovation

Producer prices have maintained steady for crops that have been purchased in significant quantities by the government. The government, for example, has procured 38.83 million tonnes of wheat from ten wheat-producing states as of June 20. Many state governments had also made arrangements to make local milk and horticulture product buying easier for direct distribution.

The stalemate has also spurred a slew of significant private-sector breakthroughs. During this time, several farmers began supplying vegetables directly to housing cooperatives in nearby cities utilizing WhatsApp to secure aggregated orders.

Meanwhile, as many farmers' markets closed, some farmers migrated to cities to set up shop along highways. Consumer-led organizations on social media platforms such as Twitter, Facebook, and WhatsApp collaborated with Farmer Producer Organizations to identify new ways to get food to markets (Narayanan & Saha, 2020). Large-scale processing enterprises were able to continue operating, albeit at reduced capacity, as predicted by (Reardon, Mishra, Nuthalapati, Bellemare, & Zilberman, 2020). Even larger companies had to deal with distribution issues by relying on online delivery providers that formerly served restaurants. Many restaurants in major cities have also shifted to offering food and produce through online delivery services.

(NARAYANAN, 2020)

VI. CONCLUSION

The pandemic situation comes once in the decades which altogether test the various subsystems which were working very fine in normal working environments. The extra stress exerted creates a situation of reaching to breaking point or collapse of the systems. During present pandemic of Covid 19 continues from last two years and my last for some more time. In combating with this pandemic we should design and develop a sustainable food supply chain system to satisfy the food needs of the peoples in the society. The conventional supply chain management should address the risks in present context and derive the strategies to overcome the problems. Initially, there were tremendous disruption in the food supply chain to meet the requisite demand in time with keeping the prices stable.

As the resiliency of the supply chain started gained over very short span of time the prices and delivery of services came to normal and able to serve the consumers in better manner.

The absence of emphasis on available formal and informal risk management options is observed. In practical angle the most attention will be given to improve or supplement formal mechanisms covering institutional and financial arrangements, changes in technology, improved management practices, upgrading investments in infrastructure**.**

The SCM is the overall process of creating value to the customer by synchronizing all the activities involved in the SC process through following options.

1) Reliable and authentic information flow at different stages of supply chain
2) Creation of standards for Quality checking and assurance
3) Flexibility in the transportation system leading to quick and better service
4) Management of Risk in various stages of supply chain
5) Creating production of food supplies near to the point of consumption
6) Adoption of technology at different farm operations**.**

Designing of resilient supply chain is critical but it is possible to have such system which fights with global crisis like Covid 19.

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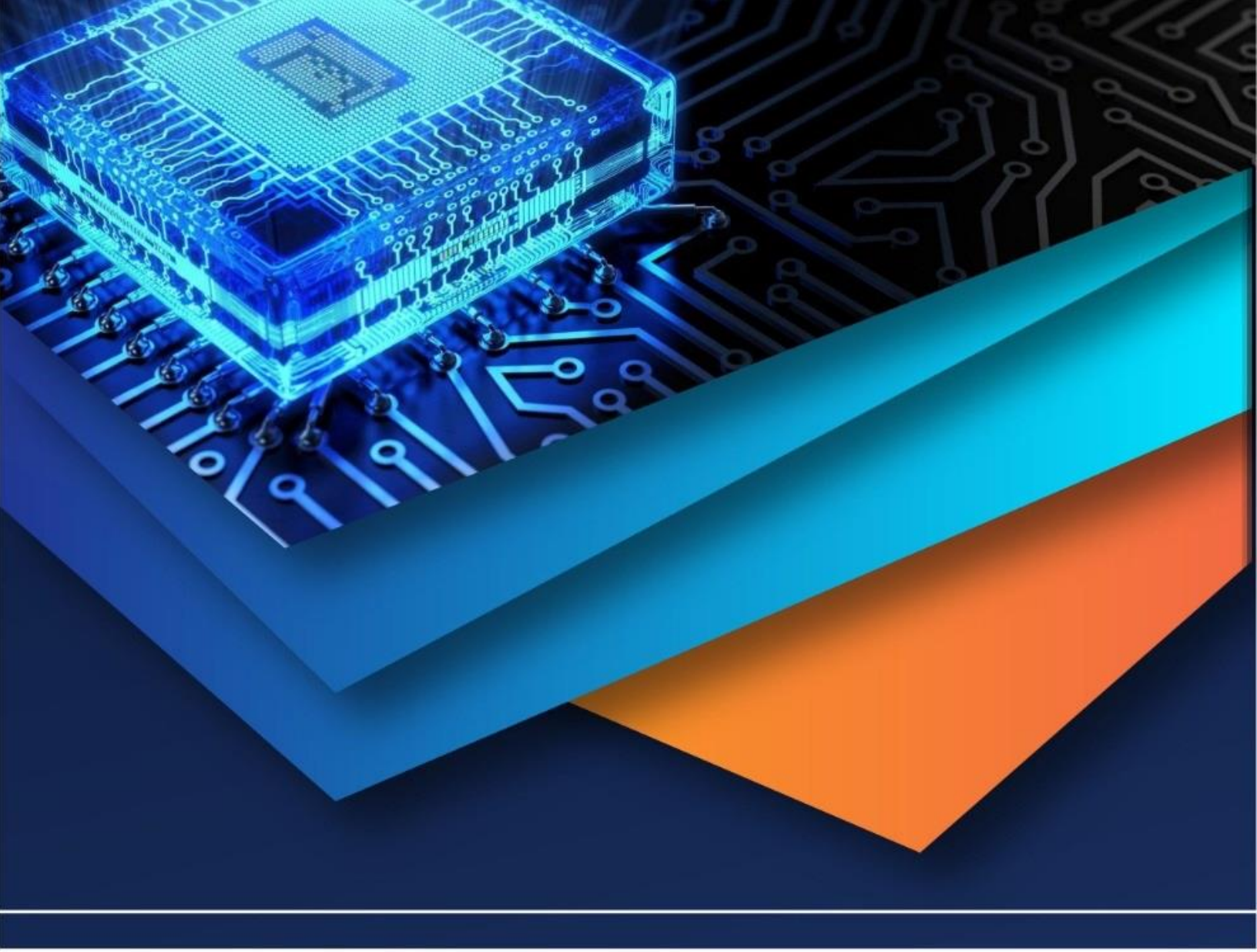

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