

Disruption in Global Food Supply Chain (FSCs) Due to Covid-19 Pandemic and Impact of Digitalization Through Block Chain Technology in FSCs Management

ZERIN TASNIM

Southeast Business School, Southeast University, Dhaka

Abstract

The different pandemics that humanity had experienced, such as the Spanish Flu, Asian Flu, Hong Kong Flu, HIV/AIDS, SARS, Ebola, and Swine Flu, had a great impact on the global economy, the environment, social lifestyle, agricultural sector, manufacturing and service industries, hospitality and tourism, education sector, aviation industry etc. Currently, humanity is facing another pandemic, the infection of the new coronavirus known as COVID-19. The objective of this paper is to present a theoretical review of supply chain disruption due to COVID-19 impact, analyze and discuss the effects of this turbulence in global food supply chain management. For the analysis, various contents from published articles, blogs, reports, newspaper publications have been collected. There was sufficient evidence to affirm that the pandemic caused by the COVID-19 has an important effect on global supply chain management process. The purpose of this paper was to highlight the reasons of disruption in global supply chain management especially in food supply chain management. This paper also has depicted the long term impacts of COVID-19 in food supply chain management. By analyzing various documents, few policies and steps were suggested to apply for managing global supply chain management in post pandemic era. Finally it was suggested to implement digitalization in the platform of block chain technology to build-up a robust and sustainable global supply chain management to handle any such situation arise in the future.

Keywords: Supply chain management, COVID-19, Global food supply chain (FSCs), Digitalization, Block chain technology

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1. Introduction

A local health authority in Wuhan, China alert people as several pneumonia cases outbreak due to some unknown causes that was later assumed to initiate from a Huanan sea food market, on December 31, 2019 and as a consequence the market was shut down by January 1, 2020 (Huang et al., 2020). It spread out very rapidly in entire Wuhan region though was disregarded by the political leaders of other part of the world (Washington Post, 2020). To lessen the spread, Wuhan was kept under lockdown starting from January 23, 2020 and the lock down officially ended on April 8, 2020. This lockdown includes home and regional quarantine, travel ban. China effected cases grew up to 80,000 by mid-February (ECDC, 2020). Since then it spreads rapidly, evolving into a full-blown pandemic and spreads globally. By Mid-March it has affected 146 countries around the world. The number of confirmed cases quickly doubled worldwide by mid-April through community transmission and reach up to 2 million of confirmed cases at around 200 countries (ECDC 2020). Both Hong Kong and Singapore could able to manage the accelerant speed of Covid-19 confirmed cases by adopting strict lock down policy, early government steps and by maintaining social distancing (Anderson et al., 2020). Later, on in June, 2020 New Zealand has declared themselves as corona free country after maintaining months of lockdown, social distancing, travel ban and by applying other non-pharmaceutical steps and lift up all Covid-19 restrictions except border controls (<https://www.bbc.com/news/world-asia-52961539>). Since 21 May 2020 and as of 29 May 2020, 915 478 new cases of coronavirus disease (COVID-19) have been reported, including 37 606 new deaths. Globally, the number of cases has increased from 4 861 456 cases to 5 776 934, and the number of deaths has risen from 322483 to 360 089. In the EU/EEA and the UK, 60 520 cases have been reported during the same period, bringing the total from 1 324 183 cases to 1 384 703, including 6 381 deaths, with the total number of fatalities increasing from 158 134 to 163 515 (ECDC, 2020). Coronavirus disease (COVID-19) outbreak situation as updated on 10th June, 2020 by world health organization are 7 127 753 confirmed cases, 407 159 Confirmed deaths and 216 Countries, areas or territories being affected. Table 1 shows the previous pandemics situations around the globe.

Table 1 Main pandemics from the 20th century

Name	Time period	Type	Death toll	Reference
Spanish Flu	1918-1920	H1N1	More than 50M	Barro et al. (2020)
Asian Flu	1957-1958	H2N2 virus	1.1M	Wikipedia
Hong Kong Flu	1968-1970	H3N2 virus	1M-4M	Wikipedia
HIV/AIDS	1981-present	Virus	32M (estimate, March 2020)	WHO (2020b)
COVID-19	2019-Present	Coronavirus	7127753 (10 June 2020)	WHO (2020c)

The real number of confirmed cases in most countries are still unknown as lack of test kits and no proper vaccination is available to prevent the pandemic situation. So governments in almost all countries are trying to implement various non-pharmaceutical interventions to mitigate the high rate spreading of Covid-19 including, regional lockdown, home quarantine, maintaining social distancing, banning of social gathering, closure of educational institutes, travel ban, postponement of conferences, tradeshows, and closure of shopping malls, trades, business and offices. As lockdown continues, it immediately affects national economies including the supply chain process of every kind of manufacturing and service companies. By imposing national and international travel and trade ban, affect directly supply chain process of manufacturing like FMCG goods, car manufacturing, electronics manufacturing as well as services like transportation sector, food sectors, tourism, restaurants, cafes, entertainment events etc. (Gössling et al.,2020).

In such a vulnerable situation the companies through all over the world are in most turbulent situation. In this article, FMCG sectors' supply chain management process specially the food supply chain (FSCs) management processes are taken in consideration. Because of pandemic outbreak the companies are facing various unrest situations related to supply chain management as the length of lockdown period, how to prepare their labors to handle such situations, how long they need to manage production with less number of labors, what should be the policies in post pandemic era to handle supply chain efficiently, what changes they need to bring in their supply chain management process, initializing of digitalization and list goes on. In this paper first, some literature review on Covid-19 impact on supply chain management has been given including a comparative view between developing and developed countries' food supply chain management process. Second, the long run impacts and changes of pandemic outbreak in FSCs have been investigated, discussed and analyzed. Then the measures, steps and policy implications to lessen the impact of this turbulent situation due to Covid-19 has been discussed. A case of Nigerian KOBO 360 has been presented here to reveal the fact of digitalization in their supply chain management process that can set an example for many firms who are still away from digitalization. Long-term shifts in global supply chains in post Covid-19 era has been discussed in next section. On the basis of all the analysis, the paper is concluded by summarizing the most important insights including recommendations in the areas for supply chain digitalization.

2. Literature review

Within countries, the virus affected virtually all parts of the hospitality value chain that includes even managements, hotels and tourisms. Shut down of these businesses immediately felt in other parts of the supply chain, such as food services, catering, restaurants and laundry services, transportation etc. Though some restaurants and other service sectors are allowing online services and continuing to operate in limited scale. Many are facing financial crisis due to less operation that leads to layoffs and declaring bankruptcy (Business Insider, 2020).

The situation is unparalleled. Within the space of months, the framing of the global supply chain system especially FMCG sectors has moved from overburdened to under-burdened. These situations are illustrated in newspaper articles, blogs and in various reports. Some are trying to depict the declination of global supply chain, some are providing comparison of present and previous situation and also some photographs and videos on how the future supply chain process will be like after the pandemic is over . (The financial Express, 2020). However, there is much evidence that COVID-19 will be different and transformative for the supply chain sector. Vietnam and Kazakhstan are the world's one of the large rice and wheat exporter , They both has temporarily suspended rice and wheat export contracts.. Due to lockdown situation, trade barriers have created extreme volatility through the world. Majority citizens' Panic-buying tendency has disrupted food distribution. Also many are hoarding staples temporarily, leaving markets empty and unbalancing the demand and supply ratio.

Food supply chain is complex web including the producers, agricultural inputs and other suppliers, transportation, manufacturing plants, distributors, retailers, shipping etc. According to experts current restrictions on transport and other lockdown measures, various policy measures like implementing higher control on cargo vessels, production process is getting disrupted. As distribution process is also getting disrupted and disturbing the fresh food supply chain. This results in shortages of labor, and spikes in product's prices and might lead to food loss and waste. These obstructions are likely to impede farmers' access to markets, curbing their productive capacities, and hindering them from selling their products(The financial Express, 2020).

Food demand is also getting affected as reduced income and peoples less visit in food markets due to

movement restrictions. The government must take steps for several sectors or groups. For instance, the hatchery businesses(related to crab, shrimp, fish production) in developing countries which are mostly depends on exporting to run their business have substantial economic loss.

A report published in IT supply chain on May, 2020, mentioned that food supply chain decline over 10% on last month due to supply chain disruptions and plant shutdowns. Hundreds of workers in food processing industries become sick due to Covid -19 affect and thus disrupting the whole food supply chain process. According to this report in US, 10-15% dropped in shipped loads over the past months across meat, dairy, alcohol and pet food. Total shipment volume has declined 17% on April 13, 2020 in major meat processing companies in us compared to its peak week on March 23, 2020.

Covid-19 will have different impact on Food Supply chains(FSCs) in poor vs. rich countries, mentioned in a blog posted on April 2, 2020 in International food policy research institute(IFPRI). As per this report, Covid-19 is affecting and will affect the FSCs in developing countries widely but unevenly. Farm operations and SMEs may face significant problems due to this disruption. So government must implement policies to minimize the disruption of supply chain, reduce higher food price.

Some statistics are given in Table 2 about FSCs in developing countries.

Table2 Three stages of FSCs and their prevalence in the food economy

	<i>Traditional FSC</i>	<i>Transitional FSC</i>	<i>Modern FSC</i>
<i>Approximate prevalence in Africa and south Asia as share of food economy</i>	10%	70%	20%
<i>Approximate prevalence in southeast Asia and Latin America</i>	5%	50%	45%
<i>Main enterprise type</i>	Home micro-enterprise	Wet markets & SMEs	Super markets, Large processors
<i>Length</i>	Short, local	Long, rural-urban	Long, rural-urban, international
<i>Use of Arrangements</i>	No contracts, no standards,	No contracts, Public standards	Emerging contracts, private standards
<i>Technology</i>	Labor intensive	Labor intensive	Capital intensive

Source: How COVID-19 may disrupt food supply chains in developing countries April 2, 2020 by Thomas Reardon, Marc F. Bellemare and David Zilberman

The global distribution of food and medical staffs become primary concern during Covid-19 pandemic situation and all efforts are given to keep open supply chain systems related to these materials (Oxford Business group, 2020). There are two commodity type of food stuffs: staple crops (capital intensive), such as wheat and maize; and high-value commodity production (labor intensive) such as fishery products, fruit and vegetables. Supply chain for staple crops face logistic related challenges whereas supply chain of value commodity face challenges because of shortage of labor, logistics facility, consumers buying power. Also there are problems for transporting goods from agricultural land or from manufacturing sites to the distribution centers as lockdown due to Covid-19 continues in almost all countries of the world. Therefore the inbound supply chain as well as outbound supply chain is getting hampered. During March, 2019, Argentina’s daily shipment was around 6000 by up-river port whereas in end of March, 2020 the figure reduced in just 1500 due to bottle neck operations in many area of supply chain. So its creating a huge disruption is global grain supply chain.

In a blog published in Deloitte, 2020, named “Reshaping food supply chains to prepare for the post outbreak era” clearly mentioned about how Covid-19 is disrupting supply chains. Food supply chains starting from downstream to upstream every silo are facing challenges and damages due to Covid-19 outbreak. In case of Europe, their Asparagus growers are suffering due to lack of labor as many of them come from eastern Europe. But due to cross border movement restrictions they are unable to come in time of harvesting. Moreover due to transport , air freight restrictions food supply becoming slower and in some case impossible and hence expensive. Some food processing plants are temporarily shut down because of labor shortage. Also raw materials can’t be supplied to the plants due to logistics limitation. Hence gradually some items are getting disappeared or appeared in limited amount in store shelves. Thus both suppliers and manufacturers are suffering huge loss.

A report “Coronavirus Is Changing Consumer Habits in the Food Industry” was published on May 10, 2020 by Amir Sharif, in blink news. Author has highlighted that in developing countries, the World Food Programme has noted that the number of people who will face acute food insecurity (availability, access and use of food) will double during 2020. Though in some developed countries the FSCs are still on going in slow pace but in UK, farmers are facing challenges because of numerous outbreak of foot-and-mouth disease . This outbreak is assumed to be salmonella contamination in eggs and mad cow disease is affecting the food supply chains. Other than these affect the rest FMCG goods and other food sectors are carrying normal scenarios.

According to World Economic Forum, Global supply chain is facing a strong turmoil both upstream and downstream due to Covid-19 pandemic situations. Companies, whether buyers or suppliers, are facing tremendous

challenges in keeping the goods and services flow at a time of global lockdowns. Countries, especially developing ones, are carrying the direct consequences of supply chain breakdowns aggravated by trade restrictions both internal and cross border. As the COVID-19 situation changes daily, it's challenging for all parties in supply chain to apply technologies accompanied by policies to rebuild supply chain system by digitalization, and making the supply chain more shock-proof in the decades to come. Thus all parties can share data, maintain visibility, traceability and data security.

Entrepreneur India, an international franchise of Entrepreneur Media published an article on April 14, 2020 on "Impact Of COVID-19 On Global Supply Chains and Opportunities In the Post-COVID World". The report shows that despite imposing various unprecedented initiatives by government, covid-19 pandemic is causing loss of life, hitting business and economy and trembling down the supply chain system across the world.

3. Long run impact and changes

A report "Coronavirus Is Changing Consumer Habits in the Food Industry" is published on May 10, 2020 by Amir Sharif, Associate Dean at University of Bradford School of Management in blink news. He mentioned, though most developed countries are not facing major challenges and have strong food security but they may face long lasting impacts to the food supply chain, post Covid-19.

As people are in lockdown situation and being quarantined, most of their consumption pattern has been affected. Consumer behaviors regarding food choice and buying capacity may affect the food supply chain in future.

Collaboration among all elements and silos of supply chain become disrupted due to present pandemic situation due to covid-19. Though suppliers are producing raw materials, but due to logistics and transportation support they can't transfer those to the manufacturers. Also the other elements like distributors, retailers are decoupled from the other supply chain operations. The movement of people and goods from a transportation hub to a final destination are becoming a problem. Even with a highly collaborative, technologically sophisticated global supply chain, the logistics and distribution of any product will always suffer from the "last mile" logistics problem.

The large cities have the greatest impact compared to non-urbanized cities. Cause the big cities are facing challenges either from demand of consumers or from the lack of supply. In contrast the small non-urbanized cities usually rely on their local production and depend less on external production sources. So they are in less vulnerable situation.

As reported in a blog posted on April 2, 2020 in International food policy research institute(IFPRI) BY April 2, 2020 by Thomas Reardon, Marc F. Bellemare and David Zilberman, so far, seven hypotheses are about the likely effects of COVID-19 on FSCs in developing regions are mentioned in following table.

Table 3 *Effects of COVID-19 on FSCs in developing regions*

Effected Area	Description of Effects of COVID-19
post-farm	"midstream" (e.g., wholesale, logistics, and processing), and "downstream," in food-service enterprises
dense urban and rural peri-urban areas	Strong transmission rapidly and easily via human contact in densely populated areas
downstream segments of retail and food service	Strongest effects on mostly informal sector SMEs due to high densities of workers in small spaces, lack of hygiene practices of suppliers and customers
Retail and food service firms in modern FSCs	Less vulnerable as they maintain mandatory shutdown. Supermarket chains are also least affected as their store can enforce the flow of customers entering in store, maintain social distancing, control food safety and hygiene of FSCs(Swinnen 2007).
farm population and farm production	Much less effected than FSC downstream and midstream as small farmers in developing countries can't hire paid labor and so depend on family members. But this sector will be affected due to disruption of input supply chains and less customer demand due to pandemic situation.
High food price and food shortage	Food price is likely to increase due to restrictions on FSC logistics, transportation restrictions, stockpiles tendency(Bellemare, 2015).
Economic Hardship	Travel ban and social distancing will impact the income level, employment and will enhance political risk.

Gray, R.S (2020) highlighted how COVID-19 has disrupted Canadian agricultural supply chains. His analysis reveals that intermodal containerized movement of grains and food products has seen some disruption from the lack of empty containers in North America. Consumers are prioritizing social distancing and that increased the demand for retail food pick up and delivery services. Some policy implications are also needed as (a) continued supply chain monitoring and industry engagement, (b) the proactive development of strategies to deal with

absenteeism and other potential threats to the supply chain, and (c) an assessment of the economic and health merits of providing additional public resources to provide greater access to grocery pickup and delivery services.

Amitava Sengupta, Executive Vice-President & Practice Head, Digital Consulting–Industry & Process, HCL Technologies mentioned about few challenges associated with Covid -19 effect in his write up named as “Impact Of COVID-19 On Global Supply Chains and Opportunities In the Post-COVID World” on April 14, 2020 . Some mostly affected areas are manufacturing, procurement, distribution. Manufacturing is a complex process which is associated with other vital factors as raw materials, machineries, labors, inventory management, distribution etc. For production purposes many companies depends on local as well as international suppliers. In many countries imports are being restricted by government and some logistics challenges also become a problematic factor for manufacturing industries. Many countries depends on China for raw materials. As China was the first victim of Covid-19 effect, so any trade with China till now, June, 2020 is still restricted. This is disrupting the production process of many companies. Eventually manufacturing disruption is affecting the demand of consumers. So many consumers are now trying to change their buying pattern and depending on local farms. Similar affect is evident in procurement and distribution. The procurement and sourcing necessities are diverting from global to local farms as lacking of logistics and transportation support. Distribution sector is facing unique challenges as international deliveries are temporarily banned due to travel ban and trade ban in almost in whole world to reduce the spread the Covid-19 effect. Locally distribution to the retailers or whole sellers are also getting disrupted as many areas are under curfew or lockdown . Also many workers are getting sick due to covid-19 and it’s creating shortage of labor in production, distribution and procurement. Also people’s tendency of panic shopping is creating supply shortage of few products in shops. This is also creating pressure in supply chain.

According to a report “covid-19-managing-supply-chain-risk-and-disruption”published in Deloitte Leveraging advanced technologies such as the Internet of Things, artificial intelligence, robotics, and 5G, DSNs are designed and these are improving visibility across the end to end supply chain. In digital supply networks (DSNs) functional silos are broken down and organizations become connected to their complete supply network to enable end-to-end visibility, minimize cost, and reduce inventories. Any disruptions in future like COVID-19, trade war, act of war or terrorism, regulatory change, labor dispute, sudden spikes in demand, or supplier bankruptcy, organizations that deploy DSNs will be ready to deal with the unexpected.

A report published in Harvard Business Review March 27, 2020 highlighted that when a disaster strikes every silo and functions of supply chain get affected. Mostly suppliers are suffering due to lack of transportation service. Therefore companies must emphasize on screening suppliers while preparing initial contract with them and also prepare supply chain map where the suppliers need o participate annually. When force majeure events like riot, strike, war, epidemic strike, those supply maps can be used as a roadmap to solutions to the crisis. For example in China suppliers made more than 3,000 force majeure declarations during the first few months of the Covid-19 crisis. As mentioned in this report in post Covid-19 era companies will be divided in two categories. One category will be operating in previous ways without digitalization and the other categories make investments in mapping their supply networks so they do not have to operate blind when the next crisis strikes.

Vietnam set an example to control the spread of Covid-19 but its supply chain management got affected as the companies in Vietnam can’t imports raw materials from mainly Asian countries such as China, South Korea, and Japan like other countries due to travel restrictions, labor shortage, logistics bottlenecks, consumers change of purchasing pattern etc. Tier 1 suppliers (ones that provide the original equipment manufacturer (OEM) with what they need) and tier 2 suppliers (the key suppliers to tier 1) have been the most affected one in the global supply chain. Some proposed strategies for addressing these supply chain issues are end-to-end analysis of their supply chain amid the COVID-19 pandemic consisting of procurement, manufacturing, logistics, distribution, and the return system. The second step recommended is to develop short-term and long-term strategies that involves production planning, procurement, logistics, and distribution channels. To improve supply chain competitiveness they have been focused on cost, quality, delivery. In addition also they recommended the 3Rs- resilience, responsiveness and configurability to prepare themselves to handle any future shock.

4. Policy implications

Visibility is considered to be an important factor for an efficient supply chain management. But due to present Covid-19 pandemic situation many countries are going under lockdown situation starting from mid of March, 2020. As a consequence many manufacturing companies are temporarily ceased their operation or continuing operations in limited scale. Also logistics providers can’t supply goods in normal flow due to transportation lacking both internal as well as cross border. In most developing countries like Bangladesh the manufacturing companies face the lack of visibility across the all elements of supply chain. Generally the sellers maintain relation with the production companies and shipment schedules. But they don’t have knowledge about other suppliers in the whole chain. Observing the recent supply chain disruption due to Covid-19 pandemic, it’s high time for companies to think alternatives to enhance visibility among all members of supply chain as well as to handle such situations more effectively in future. Here is how we can actually enhance visibility of entire supply chain

- the companies must focus on digitization over paperwork to become more resilient in future
- Ensure data privacy by using block chain technology.

Kayikci (2018) highlighted digitization characteristics in logistics as follows that can enhance visibility:

Table 4 Set of criteria for evaluation of sustainability impact of digitization in logistics

Digitization characteristics in logistics	Description	Sources
Cooperation	Cooperative action through digitization has the potential to improve the efficiency and reliability of the logistics industry. This will need inter organizational data exchange virtually. Hence to apply digitization in supply chain.	Weinelt, B. (2016), Chang et, al.(2006)
Connectivity	Connectivity in supply chain refers to maintain communication with all areas related to an operation. Digitalization can facilitate the vertical integration between upstream and downstream partners as well as promote horizontal integration among rivals. The technologies such as machine-to-machine (M2M), hyper-connectivity, super-computing and real-time big data analytics enable companies to match the supply and demand for underused assets and products.	Owen(2006)
Addictiveness	Digitization means an adaptable system in which components and their relations change over time and it can be due to external factors. A digital system is adaptable as for example smart containers or smart bins are adaptable to different sensors to track and trace.	Owen(2006)
Integration	Integrated logistic system means to link up the essential areas as Warehousing, Transportation Management System, Real-Time Location System, Inventory Management System, reverse logistics systems by computing systems and software applications physically or functionally, to maintain a smooth flow of operation. Integrations can be horizontal through value network, vertical network and end to end digital integration of logistics across the entire value chain. Software as a Service (SaaS) applications and other digital service platforms allow communication between back-end systems of organizations. Thus all users of supply chain can be connected and can ensure optimum logistic planning process based on warehouse location, delivery location and transportation mode.	Kayikci (2018), Ornig(2016), Yin(2014), Wang et, al.(2016), Weinelt, B. (2016)
Autonomous control	Digitization enables decentralized, autonomous decision making. In logistics applications, algorithm can tracks movement of delivery goods and calculates their estimated time of arrival, factoring the impact of weather conditions, port congestion and natural disasters. Adidas is implementing an Omni channel strategy by using analytics to ensure customers to buy in a number of ways (online and in physical store) and to get delivered in any way (at home, at the store or at a pick-up point) .	Kayikci (2018)
Cognition	Logistics functions are implementing technologies such as artificial intelligence (AI), robots, drones for handling domestic and international movement of goods. These type of technologies can easily improve function of logistics industry like ensuring road safety, reduce possibility of accidents. For instances, Amazon is exploring the viability of delivery of small parcels by drone technology and developing flying warehouse blimp for the large delivery. Thus cause savings in fuel costs, maintenance costs, employee costs and insurance, whereas drones will achieve \$20 billion of business impact from faster and cheaper last-mile delivery services in both rural and urban areas.	Weinelt, B. (2016), Chandra et (2016), Rodoulis (2014)

Also to enhance visibility Companies must try to reduce dependency on paper works and start moving on to

digitalization:

There are few activities in supply chain management which are maintained by paper based as “Bill of Lading” that includes a detailed list of a ship's cargo; notices filled out by hand by each involved groups. In some cases, such as with the Bill of Lading, physical paper copies are required by law. For the rest activities companies should focus on digitization to make the whole process more efficient, less time consuming, accurate, and highly secured and to avoid fraudulent.

During present crisis due to Covid-19 pandemic, many companies are facing challenges for maintaining collaboration among all supply chain elements, especially those who are doing their supply chain operations mostly by physical presence of stakeholders. In almost all countries government are declaring strong measures to reduce the spread of Covid-19. These includes temporary shutdown of companies, less working hour, presence of less labor, wearing proper protective measures while joining offices etc. So those who are mostly depend on operations which need physical presence, they are in most vulnerable condition now. Cause physical presence will increase social gathering, more paper work, meeting different people from all sectors of supply chain like suppliers, distributors. Therefore easily it can accelerate the possibility of spread of Covid-19.

In contrast those companies who are mostly or fully digitalized are in less vulnerable situation. As they can maintain all collaborations with any stakeholders virtually as they have already established digital infrastructure. Hence less possibility of spreading the disease. Also digitalization can enhance visibility, data security, ensure smooth movement despite any critical situation and lessen the likelihood of supply chain disruption.

Companies must ensure data privacy for suppliers while implementing digitalization in supply chain management :

In traditional centralized supply chain management control system, data can be shared between two parties. If data is shared among more than two parties then there is a possibility of insecurity of data like unwanted information can pass to other parties like distributors, customers or retailers that they don't need to know. But in digital communication system this problem can be easily overcome cause in decentralized digital system, suppliers can easily control the fact who should receive which data. So for maintaining privacy of all parties and to ensure suppliers privacy as well as customers visibility in supply chain it's important to apply digitization. Block chain technology can easily meet all criteria.

Firms should Start gradual movement from centralized analogue system to decentralized digitalization of supply chain management rather than trying to change drastically and get ready for future:

Due to Covid -19 both in developing and developed countries global supply chain management is facing a lot of turmoil situation due to enough and on time logistics support, lack of raw material supplies, due to absenteeism of necessary labors etc. Supply chain consists of various stages and functions which includes all functions related to receiving and filling a customer's requests, new product development, marketing, operations, distribution, finance and customer service etc. As involvement of so many activities Supply chain initiatives take time to roll out. So it's necessary to implement supply chain finance programs to support suppliers in financial straits and make the value chain more capital efficient and to make the whole chain strong and efficient enough to handle future disruptions.

As highlighted in an article published in financial express, Bangladesh, Government also should take several steps and implied some policies to overcome present supply chain challenges in developing countries (<https://thefinancialexpress.com.bd/views/mitigating-covid-19-impacts-on-food-and-agriculture-1585932264>) as follows:

-Providing funds to help agro-based micro, small & medium enterprises (SMEs), casual labors, and low salaried people.

-Avoiding trade restrictions to maintain a regular flow of food materials and other necessary supplies. The UN's food body has warned: "protectionist measures by governments during the coronavirus crisis could provoke food shortages around the world."

Also various measures should be considered to reduce food waste, provide subsidies for food consumers review taxation policy to reduce tax & VAT for imported materials.

As reported in a blog posted on April 2, 2020 in International food policy research institute(IFPRI) BY Thomas Reardon, Marc F. Bellemare and David Zilberman, food supply chain(FSCs) in developing countries are most unprotected to Covid-19 impact mostly the mid and downstream segments. All activities like the labors earnings, their presence in workplace, supply of raw materials and delivery on time facing significant challenges due to Covid-19 impact. Even the post pandemic impact can be more severe. In developing countries except few companies most of them belong to SME sector and have lack of formal operation and management processes.

So to ensure food security in developing countries, some policies need to be applied to overcome the crisis in FSCs both in short-term and long term. Like in short term government could use cash for work schemes for emergency food supply, for maintaining collaboration with farm level workers who are deprived to supply their materials to their buyers and maintain essential operations in their own enterprises. Finally, make long-term investments to help SMEs and maintain formal and standard operation process by digitalization to face any future

shock and remain competitive in market.

Hobbs(2020) mentioned that just-in-time supply chain model is efficient and effective under normal circumstances. But historical data shows that this model may be vulnerable to short-run disruptions caused by exogenous demand and supply shocks. It should be an essential priority to ensure food availability to vulnerable communities during a time of unprecedented economic disruption should be a policy priority.

5. A case of Nigerian KOBO 360 of implementing digitalization in their supply chain management process

An article published named “Nigerian logistics startup Kobo360 raises \$30M backed by Goldman Sachs” on August 14, 2019 mentioned that Kobo360 has launched in Lagos in 2017 and from then it is using an Uber like app to connect with more than its 10,000 drivers and trucks. They provide e-logistics on demand apps to mobile based connectivity and provide app in languages common in drivers. Their top clients include Honeywell, Olam, Unilever, Dangote and DHL.

In e-logistics freight delivery, two startups companies such as Kobo360 and Lori Systems have continued to compete regarding investment, scale and expansion. Kobo360 moved into Lori Systems’ HQ country Kenya on 2019 and Lori Systems expanded into Nigeria in September of 2018. The authorities of the company told that they would extend on 10 new countries by first quarter 2020. The company plan to use part of its \$30 million funding to build out its Global Logistics Operating System(GLOS) — a block chain-enabled platform that will help the company transition to more supply-chain services.

By Digest Africa’s latest ranking, Kobo360’s \$20 million Series A is the 5th largest investment in an African startup this year, after Egyptian ride-hail company Svwl’s \$42 million raise in June , 2019. These measures have helped ensure minimal disruptions to logistics services during the pandemic situation, 2020 due to Covid-19 and are key to ensuring the provision of essential services during and after the lifting of virus-related restrictions.

6. Discussion about Long-term shifts in global supply chains in post Covid-19 era

6.1. FSCs Should Be More to Digitization

In current pandemic situation many physical shops like clothing and shoe stores, restaurants, cosmetic stores, stationary and book stores have closed down for unlimited time. So companies are now focusing on online and digital functions to carry on their business (<https://www2.deloitte.com/nl/nl/pages/consumer/articles/food-covid-19-reshaping-supply-chains.html>).

6.2. End-To-End(E2E) Supply Chain Management

For E2E systems, the supply chain begins from procurement and ends with delivery to customer. A complete supply chain’s end-to-end view consists of demand planning, supplier selection and management, procurement, product design, delivery & distribution ,reverse logistics(return) and must also include after-sales customer service. An effective E2E supply chain can be designed using an Enterprise Resource Planning (ERP) system that includes top-level business processes such as Concept-to-Launch, Procure-to-Pay, Order-to-Cash functions, and Sustain-and-Retain and Hire-to-Retire human capital asset management processes that will help improve decision-making, organizational strategic planning and deployment, overall business growth, as well as reduce risk, reduce cost, less time and resource consuming. So it can be invested for new product development. Meanwhile, it’s important to invest in relationships with supply chain partners. In present situation the companies can clearly realize the fact that supplier and customer loyalty is the most focal point for developing business and to thrive post-COVID-19(<https://www2.deloitte.com/nl/nl/pages/consumer/articles/food-covid-19-reshaping-supply-chains.html>).

6.3. Industry 4.0

‘Industry 4.0’ is a new paradigm enabled by the introduction of the Internet of Things (IOT) into the production and manufacturing environment. It means to operate smart factory autonomously by depending on machines rather than labors (Tjahjona et,al.,2017).The collaboration between suppliers, manufacturers and customers is crucial to increase the transparency of all the steps in supply chain. Industry 4 revolution can also help to overcome this problem and make business less vulnerable (<https://www2.deloitte.com/nl/nl/pages/consumer/articles/food-covid-19-reshaping-supply-chains.html>).

6.4. Opportunity To Develop A Circular Economy

Covid -19 pandemic leads to months of lockdown which enforce the consumers to alter their food pattern. As global supply chain in many places in world got disrupted due to logistic support shortage and for some other factors, so people are mostly got dependent on supplies in immediate community. It also helps to get fresh food and quick delivery. Also most become health conscious and hence changing consuming and purchasing pattern. People are mostly thinking to apply 4R’s that is redesign, reduce, reuse and recycle. (i.e., circular economy concepts)(<https://www.brinknews.com/how-well-are-food-supply-chains-holding-up-in-the-developed-world>).

6.5.Changing Consumer Preferences

As world is now focusing on herd immunity to face the present pandemic situation, so consumers are becoming health conscious and looking for fresh, additive-free food with traceable origins, with an increasing preference for locally grown foods (<https://www.brinknews.com/how-well-are-food-supply-chains-holding-up-in-the-developed-world>).

6.6. Changing Global Trade Pattern

Few countries were in top positions in global trade .In Pre -pandemic era, they were doing monopoly in global supply chain. But Covid-19 has already changed the view towards global supply chain and enforcing us to think of reshaping it (<https://www.brinknews.com/how-well-are-food-supply-chains-holding-up-in-the-developed-world>).

Imposing More Hygiene Rules: Food supply chain will be further maintain more hygiene factor in all stage of processing starting from collecting raw material till delivery to customers. They will also focus on biodegradable packaging factors (<https://www.brinknews.com/how-well-are-food-supply-chains-holding-up-in-the-developed-world>).

6.7. Demographic And Social Changes

As peoples life style and preference of food will change so it can lead to less globalization and will focus on more localization. Thus in different countries SMEs will begin to capture local markets by providing fresh and quick delivery (<https://www.brinknews.com/how-well-are-food-supply-chains-holding-up-in-the-developed-world>).

6.8. Rapid Technological Advances

IT innovations are improving not just efficiency and sustainability, but also supply chain visibility, traceability, transparency, data security which is a crucial factor in supply chain management (<https://www.brinknews.com/how-well-are-food-supply-chains-holding-up-in-the-developed-world>).

7. Discussion on overall efficiency of supply chain management process as a consequence of digital transformation and block chain technology

Now the customers In today's world digital transformation and applying block chain technology in global supply chain is the most powerful requirement for all FMCG companies and both go hand in hand. It allows suppliers, manufacturers, distributors, consumers to interconnect with one another, provide data security, transparency, visibility and smooth flow of operations. In present pandemic situation caused by Covid-19 has fueled the corresponding authorities to rethink about application of digital technology that may create more transparency, more collaboration, and more information sharing . Eventually it may help the management to take better decision-making, often in real time.

Customers now are far more advanced than the previous ones. As they are more empowered. They are now exposed to online and hence prior purchasing anything they can easily come to know about details of that particular company and products. They also have the opportunity to provide feedback about products and services. In such competitive world every rival try to meet their customer satisfaction level and to retain customers. So the companies need to communicate with suppliers and others in supply chain continuously and should focus on customers feedback ,store them, analyses them rapidly via software as enterprise resource planning, distribution management software, vendor management . Thus they can provide clear understanding about customers demand, which product can sustain in market, which group of customers are the most profitable, which areas can create opportunities and which area need improvement. With all information manufacturers can take prior precautions to overcome any problematic situation. This can only be possible by applying digitization in all level of supply chain. Now a days companies are using various software for transaction purpose rather than fully depending on paper work. Among them SAP is a well-known and mostly used for producing enterprise resource planning software to manage procurement, manufacturing, services, sales, finance and HR . This can also be used to help small businesses manage marketing, sales, customer service, and inventory. Other than this Business one is designed to handle sales, customer relationship, financial operation etc. By using software for transaction companies can lower transaction costs.

8. Recommendation

Supply chain management is a complex web that consists of broad range of activities and relies on each partner of this chain starting from suppliers to customer to ultimately meet the needs and demand of customers. So to run a supply chain process efficiently and effectively, collaboration and communication among all partners are important. Through the world few companies are depending on various software and operating the whole chain digitally. As a result these companies are able to maintain communication and operations despite having disruptions because of Covid-19 effect. But many are still depending mostly on papers and so need physical presence of all partners

to run the chain effectively. This is quite difficult in such lockdown situation due to corona virus effect. As a consequence these companies are facing both tangible and intangibles losses especially companies in developing countries. Therefore in post pandemic era companies which are globally connected with other countries for supply chain purposes, need to concentrate on digitalization.

Due to Covid-19, companies are facing a lot of turbulence for various reasons as lack of logistics, employees lack of knowledge, employees absenteeism to reduce the spread of Covid-19 and illness, change in consumers buying pattern, transportation lacking etc. Due to supplier material shortage and labor, manufacturers can't produce as per demand of consumers. Also the finished goods can't be supplied as needed due to transportation shortage. So globally the supply chain is getting disrupted. Mostly companies in developing countries specially the small and medium enterprises (SMEs) have lack of technologies and most of them didn't implement digitalization. So companies need to take few initiative and prepare themselves, so that they can avoid disruption in next crisis.

Companies which are partially or fully depend on paper based work and need physical presence of all partners in supply chain, need to apply advance technology as IOT(internet of things), digital supply chain network based on available software to enhance collaboration, communication and visibility among all partners of supply chain. In such way they can minimize cost, reduce inventory and can handle any kind of adverse situations more effectively.

In post pandemic era companies must restrict non-essential travel and promote flexible working arrangements. They must prepare succession planning so that company can manage to operate and maintain smooth workflow due to absenteeism of workers in any adverse situation. Companies should extend their supply network and should not limit to few specific countries. Firms must search for inbound as well as outbound supply and source. They must maintain connections to possible suppliers so that they can collaborate with them in time of crisis.

Companies must choose different mode of distribution to continue operations anyhow at minimum cost but effectively. They must understand the demand pattern of specific area and should choose the distribution mode accordingly. They must focus on creating connection directly with possible key customers and maintain end-to-end supply chain connection with them.

9. Conclusion

The pandemic because of COVID-19 has created a long lasting impact on each and every area of this world including manufacturing, transportation, tourism, aviation industry, education sector. The Food supply chain is not outside of this impact as like other manufacturing processes food industry also depends on various suppliers, distributors, employees locally and globally. Food demand is greatly affected due to mobility restrictions, reduced purchasing power, change in purchasing pattern, growing dependency on local rather than cross border supplies, change in income level of buyers and list goes on. As most countries are limiting their lock down situation to overcome the economic loss, hence the spread of Covid-19 effect is accelerating in most of the countries till June, 2020. In such situation, the firms are struggling to come back in regular flow of production process. Especially those companies which are mostly or fully depend on paper work and need physical presence of all partners of supply chain. Also unlike other manufacturing companies as the food industry mostly deal with perishable items, so both tangible and intangible loss for these companies are unlimited. Covid-19 has disrupted the global food supply chain management process and presented few challenges for management of global food supply chain process in post pandemic era. Like adaptable to digitization, end-to-end(E2E) supply chain management process, introducing industry 4.0 by the introduction of the internet of things (IoT) into the production and manufacturing environment, opportunity to Develop a Circular Economy, cope up with changing consumer preferences, changing global trade pattern, imposing more hygiene rules, demographic and social changes and Rapid technological advances.

In this technologically advance world every firms are inspired by their rival firms policies and strategies to sustain and hold their market value. Just as in transportation sector Uber & Pathao, in travel and hospitality industry Airbnb, online purchasing and selling sites as bikroy.com come up with their new ideas to attract their potential customers and move forward with technological advancement. So as manufacturers can identify new solutions that meet the need of present situation and can handle any future disruptions.

However, in post pandemic world after Covid-19 effect most on the manufacturing firms may focus on digital technologies to build up a robust and sustainable framework of supply chain management. Some policies and steps regarding digital transformation in manufacturing sector have been notified in this paper. Also from an industrial perspective, the current situation is likely to accelerate digital transformation initiatives for businesses across the globe, as the firms which were operating mostly on non-digital system are having severe turbulence in present situation because of Covid-19 effect. Digitalization in the platform of block chain technology By applying digitalization in the platform of block chain technology, firms will be able to handle supply chain management process efficiently and effectively. y, will make the firms able to handle supply chain management process efficiently and effectively and to sustain in any adverse situation in future.

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