

COVID-19 and Supply Chain Disruption: A Conceptual Review

Akintokunbo, Oluwarotimi Odunayo Ph.D. and Adim, Chidiebere Victor

Department of Management, Faculty of Management Sciences, Rivers, State University,
Nkpolu-Oroworukwo, PMB 5080, Port Harcourt, Nigeria

ABSTRACT

COVID-19 crisis has created a new set of challenges to which supply chain managers must respond. As demand for home delivery services surge, supply chains have to adapt their supply replenishment processes, their order fulfilment processes and hire new employees to be trained in the specifics of order picking and home delivery. The COVID-19 pandemic has emerged as a significant health risk, and countries around the world have responded with partial shutdowns of their economies to slow the pace of infections. These measures have reportedly led to massive disruptions in the global and domestic supply chains. The findings in extant literature show that supply chains during COVID-19 are more fragile for products that travel long distances before reaching their final point of sale. Our work highlights how online data can be used in conjunction with other data-sets for real-time policymaking. This paper conceptually examines the impact of COVID-19 on supply chain disruption and response strategies adopted.

Keywords: Supply Chain Disruption, COVID-19 Pandemic

INTRODUCTION

Supply chain disruptions can occur due to natural calamities or man-made disasters. There are several global calamities that have occurred in the past such as, the Gujarat earthquake of 2001, the tsunami in Japan in 2011, the Indian Ocean earthquake, and tsunami in 2004 (Gou and Lam 2019). In the same vein, there have also been various outbreaks of highly infectious diseases like the coronavirus (COVID-19) which has caused a global catastrophe not only for human lives, but also economic activities like manufacturing operations, supply chain, logistics, and several other sectors (Dolgui, Ivanov, and Sokolov 2020; Golan, Jernegan, and Linkov 2020; Haren and Simchi-Levi 2020; Hobbs 2020). The COVID-19 pandemic has severely impacted the automotive sector, the tourism, aviation, oil, construction, telecom, food and healthcare industries (Chamola, Rajnik, Cuomo, Dulebohn & Di Napoli, 2020). Early cases of the virus were reported in December 2019 but was regarded as symptoms of pneumonia in the Wet Markets of Wuhan City in Hubei Province, China (Rothan and Byrareddy 2020), it was not until later that it was named COVID-19 and declared a pandemic.

The spread of COVID-19 and the significant restrictions on travel has caused a lot of damage to the economy globally. Usually, the loss of lives during any pandemic leaves a gaping hole and irreparable damage to a society. The COVID-19 pandemic has nonetheless followed in this order, as it has seriously demobilized the global economy. In order to curb further transmission of the infection within communities, many affected countries decided to implement a complete lockdown within its territories. Major international and domestic flights, including other local transports have been postponed or grounded in different countries. Railway services (except goods-trains), bus, truck, and vehicle transports were also not permitted to operate but with the exclusion of those that convey essential commodities. In almost all the COVID-19 stricken countries, most of the educational, commercial, sporting,

and spiritual institutions are closed, while some who may be operating restrict their activities to virtual operations. Industries are suffering a lot as many of these are closed for a long time in many countries, except those that manufacture essential amenities. People in the tourism and transportation industry are facing extreme difficulties and production level has gone very low. The economy of many so-called powerful countries are now faced with the threat of high inflation and an increase in unemployment rate as a result of lack of productivity and excessive expenditure for the treatment and rehabilitation of the COVID-19 victims and their families (OECD Interim Economic Assessment, 2 March 2020).

The various governments of different countries have geared all resources towards the stoppage and control of the transmission of COVID-19 within communities in order to curtail the damage the infection leaves on its trail. But, with the mode of transmission of the coronavirus infection, it has made the efforts of these governments to almost look feeble. To exacerbate the situation, there is no known clinical cure or vaccine developed that can take care of the disease. In the interim, treatment is based on symptomatic cases presented, and the oxygen therapy still remains the primary medication for patients showing signs of a severe infection. Also, mechanical ventilation is used in cases of respiratory failure to provide oxygen treatment, while the hemodynamic support is used in managing septic shock (Casella *et al.*, 2020).

As the government of different countries attempt to contain the COVID-19 outbreak, various firms have also collaborated with government's effort to treat those infected. Some firms have made steps towards protecting their employees and have collectively attempted to develop vaccines, medication, and provide effective care mechanisms to reduce the global health impact of the virus. As the situation progresses, it is obvious that there will be an enormous cost on people, firms and government economically, socially, and emotionally, which will create opportunities and prospects for a "new normal". Unfortunately, the inability

of many countries and firms, to respond to the COVID-19 outbreak lies in its supply chain- the transportation of goods; be it groceries, masks, ventilators, other pharmaceutical items or even services, such that when any of these is affected, response to COVID-19 will also be affected (Ranney, Griffeth and Jha 2020).

REVIEW OF EXTANT LITERATURE

The COVID-19 Pandemic

The COVID-19 outbreak was caused by a novel strain of coronavirus called SARS-CoV-2, which originated in China and has infected millions of people all over the world. Its spread has left businesses around the world crumbling and struggling. The virus is posing a growing threat to the economy of many nations as the ban on individuals travelling have invariably affected to business activities (Davidson, 2020). Again, in order to ensure that the pandemic does not cripple commerce entirely, many consumers were encouraged to avoid large gatherings of people in commercial places and beyond. The outbreak of the novel coronavirus infection, originated from the Huanan seafood wholesale market in Wuhan district, Hubei China in December 2019, where live animals like bat, frog, snake, bird, marmot, and rabbit were frequently sold. In a few months' time, the outbreak turned out to be a global health crisis (Wang, Horby, Hayden & Gao, 2020).

Genomic analysis revealed that COVID-19 is phylogenetically related to Severe Acute Respiratory Syndrome-like (SARS-like) bat viruses and that bats could therefore be the possible primary source. Although the intermediate source of origin and transfer to humans is not known, the rapid human to human spreading capability of this virus has been established. Based on the latest update of the World Health Organisation (WHO) on 1st July 2020, the outbreak of COVID-19 had spread in more than 200 countries. Out of nearly 10,848,916 confirmed cases, approximately 519,953 people had died after contracting the respiratory

virus, whereas more than 6,066,672 people have recovered from the disease and because of the evolving and endemic nature of the disease, these numbers are rapidly changing upwards (website at <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>). In time past, the coronaviruses has been confirmed to be carried among animals, but not known to spread among humans, although with an exception to the SARS and Middle East Respiratory Syndrome (MERS) which usually spread through close contact with infected people. This is later evident in the discovery of cases among medical staffs with no connection whatsoever with the seafood market, thus, an indication that there is a human-to-human transmission of the virus (Liu, Hu, Kang, Lin, Zhong& Xiao, 2020).

The government of different countries resorted to lockdown strategy to prevent the spread of this virus because of the mode of transmitting COVID-19, that is, droplet transmission, contact transmission, and aerosol transmission. These processes of transmission make the spread of the virus wild that was why the WHO declared it a pandemic in January, 30th 2020. The transmission through droplets occurs when an infected person coughs or sneezes and a non-infected person in a close environment inhales it. The transmission through contact is when an infected person touches a surface that is touched by a non-infected person or the infected person comes in contact with a non-infected person and ends up touching his or her mouth or nose. Aerosol transmission is when respiratory droplets mix with air is inhaled into the lungs of a non-infected person usually in a closed environment (National Health Commission of People's Republic of China, 2020).

The COVID-19 Lockdown Impact

Lockdown is a crucial decision in the short run, to reduce the growth and spread of infection to a local transmission rather than a community spread. The fall outs of lockdown gives rise to scarcity in labour force and disrupts logistics, leading to supply-side shocks to the food

supply chain. Also, it brings a quick rise in the demand-side of the food supply chain as people resort to hoarding behaviours and panic buying (Hobbs, 2020). Ultimately, lockdown can severely cripple the economy and bring the global world to an alarming standstill.

All sectors in an economy is connected through a complex network of supply chains and logistics, but during the COVID-19 pandemic, activities were put on hold. At some point throughout the world, economic activities got to its lowest point, such that the World Economic Forum (WEF), the World Bank, and the International Monetary Fund (IMF) predicted that the world will be rocked with an economic recession and global financial crisis that has not been faced in recent times (Lucchese and Pianta, 2020).

During the pandemic, essential items like food and medical equipment became very much needed in the supply chain and its lack, bared a serious weakness in the current global supply chain occasioning in revenue loss and an unevenness in the demand and supply needs (Linton and Vakil 2020). As mentioned earlier, a prolonged epidemic coupled with stringent lockdown measures can affect food supply in many ways. First, it can directly impact the transportation of food products. Second, it can affect the availability of packaged goods from food-processing industries as manufacturing activity slows down due to social distancing guidelines and labour shortages. Third, it can reduce agricultural production in the future by reducing current incomes. These are very important issues for developing countries to worry about especially in the case where the food supply chains are long, fragile and many live under the poverty index. (Reardon *et al.*, 2020; Aggarwal, 2018).

Haren and Simchi-Levi (2020) observed the impact of the COVID-19 outbreak on manufacturing operations and the supply chain. They further predict that there will be a lot of repercussions on the global supply chain during the second quarter of 2020, which will lead to the need for a resilient supply chain that seeks innovative approaches for its recovery

(Remko, 2020). For the full recovery of supply chain and managing disruptions, the logistics system is very essential. (Choi, 2020). This situation serves as a lesson and motivation for the adoption of resilience and robustness in the supply chain in order to help the economy that is almost at the brink of collapse (Dolgui, Ivanov, and Sokolov, 2020). In this regard, a detailed analysis of the ongoing crisis as well as necessary measures needs to be pursued.

The Healthcare Supply Chain and COVID-19

Many health care providers in conjunction with the media have emphasised that the most basic strategies to avoid human to human transmission of the COVID-19 infection is by observing social distancing, the use of masks as well as using handsanitisers. And this has mounted its own pressure on the healthcare supply chains since the general public require masks and sanitisers and the health care staff need Personal Protective Equipment (PPE). This has caused a shortage in the supply of N-95 masks, as people and companies are unable to meet the ever-increasing demand. Rowan and Laffey (2020) agreed that in the Republic of Ireland, there is a critical shortage of supply chain planning for PPE during the COVID-19 pandemic.

This global shortage of ventilators and PPEs have become a big concern as the coronavirus infection spread across the world. In India for instance, there is a monopoly in the purchasing process for PPE by a single government-owned agency which has constituted a serious scarcity. To address this, initiatives need to be encouraged in the area of developing efficient transportation for medical equipment, medicines and relief materials across the supply-chain. Furthermore, the WHO has recommended strategies to optimise the availability of PPEs by using them appropriately, better supply chain coordination, and minimise waste (WHO 2020).

Food supply chain and COVID-19

All types of food supply chains have been severely affected during the COVID-19 pandemic, for example, fresh vegetables, fruits, baking items, perishable goods, and finally, food grains (Ivanov and Dolgui 2020). The scarcity of food items is inevitable during lockdowns especially if the government is strict about it, because most logistics activities are being stopped. Previously, Manning, Baines, and Chadd (2005) in describing the impact of biological infections in the food supply chain on a regional basis, national and international food contamination problems referred to it as food terrorism.

Similarly, although the COVID-19 pandemic was primarily seen as a health crisis, it can also be seen as a food crisis. In the USA, the food supply system has evolved over decades from being locally and regionally based, to becoming a global network of relatively few large multinational companies (Roth *et al.*, 2008). Although previous researches have addressed environmental and social sustainability within the food supply chain, the prevailing focus had always been based on the cost performance with an emphasis on efficiency, predictability, and tight control of inventories ((Pullman *et al.*, 2009; Charles, 2020). The degree of the COVID-19 crisis has uncovered the delicateness of the entire food supply system, providing a rare opportunity for researchers to explore this system and its underlying dynamics in real-time.

Venuto (2020) posits that the COVID-19 pandemic has brought the food supply chain into the public arena as consumers and supply chain organizations react to the crisis. Consumers have reacted by hoarding products in the face of real and anticipated food shortages. Some have gradually adjusted their shopping behaviour to online purchase/delivery options, thereby affecting the supply chain's immediate ability to cope (Dunkley, 2020; Smith, 2020). Many consumers are struggling to afford food, given the sudden loss of employment and shifting

demand to food pantries (Charles, 2020). Within the supply chain, the sudden shifts in demand and health-related regulations have caused profound disruptions such as farmworkers not being available to harvest crops, the collapse of the foodservice/restaurant sector, and changing working conditions in food processing plants inhibiting productivity (Cagle, 2020; Corkery and Yaffe-Bellany, 2020; Hall *et al.*, 2020; Yaffe-Bellany and Corkery, 2020).

Supply Chain Strategic Response to COVID-19

Akintokunbo and Adim (2020) posit that organizations today are realizing that their level of innovativeness in the supply chain is an integral part of strategic success and long-term survival. Supply chain innovation underpins the achievement of sustainable competitive advantage and an ability to respond effectively to rapidly changing markets as organizations strive to be innovative despite intense technological uncertainty. Innovativeness is seen as a complex process that handles environmental and technological uncertainty to seek and adopt new processes, ideas, products, and technologies for satisfying customers. This is vital in providing the necessary strategic response to the COVID-19 impact on supply chain disruption.

To respond to the crisis on ground through changed service operations, particular attention must be geared towards changes in the supply chain ecosystem that targets the well-being of all those involved. This should become paramount in order to ensure the safety and health of employees and customers. Across the supply chain, significant challenges must be overcome to keep employees at safe distances from each other to minimise disease transmission (Tuzovic and Kabadayi, 2020). While some work occurs in traditional production environments such as meat processing facilities (Parshina-Kottas, Buchanan, Aufrechtig & Corkery, 2020), much food supply chain work also occurs in service operations such as distribution centres or call centres. So far, some organizations have responded with

changed work routines, flexible hours, and work locations (work-from-home options), protective barriers between employees, to name a few operational changes.

Retail operational processes, or retail logistics, have attempted to respond to the pandemic by moving from a focus on store image, satisfaction, and loyalty intentions (Bouzaabia, van Riel & Semeijn, 2013) to minimising exposure risk, from shifting shelf-restocking to off-hours. Also, retail stores manage the flow or volume of customers at a time and directional movement within the stores by putting safety measures through floor markings, in-store signage and sanitation stations throughout the store (Bove and Benoit, 2020). In addition to these, they separate employees from customers, make contactless payment options, implement store operating procedures such as opening hours and dedicated shopping hours for vulnerable consumers and to protect both employees and other consumers (Dietrick, Trischler, Schuster & Rundle-Thiele, 2017).

Technological solutions also allow shoppers to shop online but pick-up their pre-packed orders with minimal contact (either in designated locker locations or at a kerbside), with concomitant changes in workers' responsibilities and customers' engagement in the food shopping experience. Shoppers' behaviours have also changed with mask-wearing, contactless payment procedures, or store navigation behaviours. Both shoppers and store employees are taking on co-creation responsibilities to protect their health during the shopping experience (Vargo and Lusch, 2008).

With the growth of e-commerce, home delivery logistics services have grown rapidly in the past decade (Jaraet *al.*, 2018). Food retailers have been developing an online presence with home deliveries for years (Heim and Sinah, 2001) but with the COVID-19 crisis, there has been a sudden rise with the level of demand that has proved difficult to fulfil (Bhattarai, 2020). Scholars have been documenting the customers' expectations of last-mile logistics

services since the early days of e-commerce (Esper, Jensen, Turnipseed & Burton, 2003) as well as operational service challenges that increasingly include managing crowdsourced delivery services (Castillo, Bell, Rose & Rodrigues, 2018).

The COVID-19 crisis has created a new set of challenges to which supply chain managers must respond. As demand for home delivery services has surged, supply chain organizations have had to adapt their supply replenishment processes, their order fulfilment processes and hire new employees to be trained in the specifics of order picking and home deliveries (Dodds, 2020). While retailers have faced the majority of this demand, other supply chain organizations that are traditionally further upstream, such as wholesalers or even farmers, are also now providing home delivery service provision (Criddle, 2020; Rao, 2020). Some retailers have adapted quickly to the increased demand and have innovated new operational approaches to serve customers through the development of “dark-warehouses”, which are essential distribution centres with retail store layouts catering solely to online customers with no physical customers present (Broughton, 2020).

The safety and health issues of employees and consumers have become important elements of the last-mile service provision. Customer service expectations now include the desire to stay safe and healthy during the shopping experience (Esper, 2020). Thus, contactless delivery becomes an important service attribute in addition to traditional measures of timeliness and order accuracy (Wolfe, 2020). Work environments that foster healthier and more protective situations for both employees and customers will need to be incorporated into the systems that have focused on traditional measures of order fulfilment efficiency and quality.

CONCLUSION

The findings in extant literature show that supply chains during COVID-19 are more fragile for products that travel long distances before reaching their final point of sale. Our work

highlights how online data can be used in conjunction with other data-sets for real-time policymaking.

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