

Managing Supply Chains in a Post-COVID World

John Rocha¹, Kruti Lehenbauer²

¹*DBA Student, University of the Incarnate Word, United States of America, jorochoa2@student.uiwtx.edu*

²*Professor of Business Economics, University of the Incarnate Word, United States of America, Lehenbau@uiwtx.edu*

ABSTRACT: The COVID-19 disruption resulted in reactive and uncoordinated logistics behaviors creating a crisis that impacted the viability of many companies worldwide (Choi, Rogers, and Vakil 2020). The purpose of this study is to suggest how to resolve the issues facing supply chain logistics by first identifying the supply chain disruptions of the past and then analyzing the resulting consequences of these disruptions. We propose to show how fragile the supply chain system in the United States is by demonstrating how existing technologies have not yet been exploited to their full potential, which would help to reduce the vulnerability of supply chains in the United States to new and unprecedented disruptions. We conclude by offering some potential solutions to combat this vulnerability in the supply chain and related logistics by incorporating existing technologies to reduce the impact of future disruptions, whether they are created by policy, by possibility, or by pandemic!

KEYWORDS: COVID-19, Supply Chain disruptions, Logistics, SCM, Technology in SCM

Introduction

The COVID-19 disruption resulted in reactive and uncoordinated logistics behaviors creating a crisis that impacted the viability of many companies worldwide (Choi, Rogers, and Vakil 2020). The purpose of this study is to suggest how to resolve the issues facing supply chain management (SCM) and logistics in a COVID-disrupted world. The pandemic highlighted how global supply chains have been disrupted, creating ripple effects that cross-national boundaries (Yu and Aviso 2020). Interruptions in supply chain management segment are nothing new and has showed our industry how unprepared we are. The focus of business toward increasing efficiency and reducing costs has resulted in supply chains that are efficient during normal times, but at the cost of being vulnerable to disruptions. From time to time, frequent as well as rare catastrophes also disrupt supply chain operations (Stecke and Kumar 2009). These disruptions range from a small plant fire that may affect a small number of local companies to global catastrophes such as the 2002 to 2003 SARS outbreak, which affected the global economy. Regardless of the scale of a catastrophe, the consequences could be severe for a company. Some recent documented major supply chain disruption causes include the West Coast port strike in 2002, the 1999 Taiwan earthquake, Hurricanes Katrina, and Rita in 2005, the Asian tsunami in 2004, and the September 11 attacks in 2001. After the 9/11 terrorist attacks, research has focused primarily on increased security measures to reduce both the occurrence of terrorist attacks and the impact of supply chain disruptions (Lee and Wolfe 2003; Rice and Caniato 2003; Sheffi 2003; Rosoff and von Winterfeldt 2007).

Other smaller catastrophes such as snowstorms, heavy rain, excessive wind, fire, industrial and road accidents, strikes, and changes in government regulations regularly interrupt normal operations in supply chains (Craighead *et al.* 2007). Some disruptions came from technology. For example, the ineffective use of Information Technology (IT) when using supply chain mapping. By using supply network mapping, we avoid relying on human intelligence and increase the dependence on artificial intelligence networks. (Choi, Rogers, and Vakil 2020) and mitigation strategies (Tomlin 2006; Martinez- Albéniz and Simchi-Levi 2009; Swinney and Netessine 2009). Mitigation strategies must be plural since a few strategies can be effective against several different catastrophes.

We propose to show how fragile the supply chain system in the United States is by exploring the history of disruptions in supply chains and identifying the consequences of supply chain breakdown on the economy. Thereafter, we proceed to offer some potential solutions to combat this vulnerability in supply chain and related logistics since it appears that the future and viability of supply chain has not been secured as a result of not taking advantage of existing technologies.

History of Disruptions to Supply Chains and Logistics

Organizations and firms have become more conscious to the fact that they cannot compete with other firms in isolation of their suppliers and other units in the supply chain (Lummus and Vokurka 1999; Banomyong 2005). The economic growth in every country is depending much on its companies, as we can see they are growing locally as well as global business activities. Going global implies that supply chains are no more local (Waters and Rinsler 2014). Christopher (2016), argues that firms spread their operations across the globe sourcing from and selling to different organizations and or people, which adds complexity to the supply chain and if this complexity is not effectively managed it can result in disruptions and higher costs. Local business might be encountering issues pertaining to the domestic rules and regulations, socials, economics, and political areas (Crane and Matten 2016). Those issues can be anticipated by the business institutions as they have experienced them and are therefore, less constrained by them. On the other hand, when considering global business, such factors can go beyond the boundaries resulting in restricted business operations. Thus, less powerful or more rigid businesses will suffer losses and might end up closing their operations.

In recent years, there has been a surge in articles addressing supply chain disruptions, whether they are caused by natural or artificial interruptions to “business as usual.” Craighead *et al* (2007) stated that supply chain disruptions are unavoidable. However, the disruption caused by COVID-19 since January 2020 brings a whole new set of local and global issues that impact supply chains worldwide. COVID-19 could be the black swan event that might finally force companies and entire industries to rethink and transform their global supply chain model. Several events in the past 50 years have not only shaped the development of the supply chain management (SCM) profession as we know it today but will also likely affect developments in the future (Stock 2013). COVID-19 has already exposed the vulnerabilities of many organizations (Kilpatrick and Barter 2020) but it is essential for us to discuss the common types of disruptions in the Supply Chains and how they have historically been handled.

Regulatory Hurdles for Supply Chain and Logistics

By 1933, all states had some form of truck weight regulation. The Federal-Aid Highway Act of 1956 instituted the first federal truck weight regulation (set at 73,280 pounds or 33,240 kilograms) and authorized the construction of the Interstate Highway System. 23 U.S. Code 127 limited the weight limits of trucks using interstate roads to prevent the damage to the roads. This law disrupted the ability of companies to efficiently deliver goods to the end consumer and impacted supply chains. This type of regulation was not unique in the United States and several further disruptions occurred over the next few decades. For instance, during the late 1970s through the early 1980s, the major transportation modes were deregulated through a series of legislative initiatives. The most common ones are the Airline Deregulation Act of 1978, Motor Carrier Act of 1980, Staggers Rail Act of 1980, and the Shipping Act of 1984. These have all played a regulatory role in intervening with existing supply chains and have created circumstances that allowed industries to respond to these interventions in a manner that best met their own and their customers’ needs. This change fostered improvements in carrier strategies and tactics that, in turn, facilitated the implementation of programs such as quick response (QR), just-in-time (JIT), crossdocking, efficient consumer response (ECR), and others (Stock 2013).

When terrorists attacked the World Trade Center in New York and the Pentagon in Washington, D.C. in 2001, logistics and supply chain professionals recognized that the world had become less safe, and organizations were forced to become much more aware of risk and

uncertainty as they affected supply chains. While risk and uncertainty had always been a part of business intelligence and a consideration in decision-making, the terrorist attacks in the United States and in other countries around the world moved these issues front and center. Contingency planning became a requirement rather than something that was "nice but not necessary." Terrorism was not the only concern driving companies to pay more attention to risk. Businesses of all kinds were now operating in a global marketplace with vendors, suppliers, and customers located worldwide, causing the risks and uncertainties to increase significantly. While supply chains had become more efficient, effective, and responsive, they had also become much more complex and more vulnerable to disruptions caused by such things as natural disasters, labor strikes, power outages, political instability, and cyber-attacks on the Internet, to name just a few (Stock 2013). Supply chain management (SCM) executives continue to face unique challenges, with respect to integrating supply chain-specific strategies with the overall corporate business strategy.

In December 2014, a massive regulation was introduced by the Federal Motor Carrier Safety Administration (FMCSA), which is a part of the United States Department of Transportation (USDOT). It primarily addressed the issues of drivers working excessive hours on the road and limited the time that they could legally do so while putting specific constraints on how many hours of rest were required to be logged by the drivers. (49 CFR Part 395 FMCSA). This required a major overhaul in the way drivers and goods were assigned by transportation industries and changed the way they moved goods from one place to another.

In recent years, given changing business realities related to globalization, the supply chain has moved up on the list of priorities for the Chief Executive Officers (CEOs), but it's not always for the right reasons. In many cases, CEOs only pay attention to the supply chain when they want to cut costs or when something is wrong (Bala 2014). Bhatt (2014) argued that for the last two decades, the business organizations are facing unprecedented challenges to improve efficiency or productivity. An example of such push was the Black Monday of October 1987. The event came as a warning to the business world to find better ways to do business and the advent of personal computer added to the competition among the organizations to affect re-engineering. Bala (2014) argued that since supply chain essentially moves the lifeblood of the organization, process efficiency on a global scale is essential to optimized business operations.

Impact of COVID-19 on Supply Chains and Logistics

When critical supply chain disruptions hit, visibility across the supply chain becomes crucial to understanding the impact of the disruption on the rest of the chain so that others in the ecosystem can plan and take action, such as developing routes to alternative suppliers. Because COVID-19 has led to lockdowns, suppliers in the chain are temporarily ceasing production, and logistics providers can no longer transport goods as seamlessly, particularly across borders. The access to the data on inventory, distance, production, and transportation needs to be fast, dependable, and instantaneous to get the first mover advantage in many cases. The companies that have heavily been reliant on paper-based processes are struggling in this time of social distancing and work-from-home conditions to minimize the spread of the virus. Thus, in the current pandemic, governments and businesses with strong digital infrastructure and enabling regulations such e-signature and e-transactions laws, are dealing with the supply chain disruptions much better than those without (Liao and Fan 2020). Pickett (2004) suggested that in a world with increasingly complex and globally dispersed productions, supply chain resilience sets the companies that are likely to succeed apart from their non-lean counterparts.

Industrial production in China has fallen between 13.5% in January and February combined, compared with the previous year (Seric *et al.* 2020). There has also been a simultaneous drop in the demand for intermediate and final goods due to the restrictions on movements of individuals and concerns about health and safety of employees, which has led to factory closures in many places. Thus, it is to be expected that this 'second shock' from the collapse of demand and production in many industrialized economies and the divestment from developing countries will have far more long-lasting effects on global production than the temporary supply chain disruptions caused by

COVID-19 (Seric *et al.* 2020). A substantive nationalization or regionalization of supply chains, however, has the risk to further reduce diversification of suppliers in the world economy. The disruption of global value chains (GVCs) due to COVID-19 may therefore leave as a longer-term legacy: a significant reduction in developing countries' potential to industrialize through linking into global value chains (GVCs) for many years to come. The COVID-19 pandemic calls for increasing our effort towards strengthening multilateral approaches to policy making and assisting countries in opening other ways to enable inclusive and sustainable industrial development (Seric *et al.* 2020).

The effects of COVID-9 have revealed that the SCM field currently lacks the basis for a network perspective that can capture the full complexity of managing globally dispersed supply networks. The SCM field also suffers from an over-emphasis on the operational level of interactions across firms in a supply network, in detriment of knowledge processes that can truly address challenges as complex as the sustainability imperative in the face of disruptions (Marques 2019).

Potential Solutions to Supply Chain Disruptors

The solutions that logistics companies can explore to minimize the impacts of current and future disruptions in the supply chains come with several alternatives. The traditional linear supply chain model is transforming into digital supply networks (DSNs), where functional silos are broken down and organizations become connected to their complete supply network to enable end-to-end visibility, collaboration, agility, and optimization. Hosie *et al.* (2012) argued that the theory and practice of a networked approach to SCM are used to trace the evolution of management logistics. There are measures companies are taking to protect their supply chain operations: align IT systems and support to evolving work requirements, enhance focus on workforce/labor planning, focus on Tier 1 supplier risk, illuminate the extended supply network, understand and activate alternate sources of supply, update inventory policy and planning parameters, enhance inbound materials visibility, prepare for plant closures, focus on production scheduling agility, evaluate alternative outbound logistics options and secure capacity, and conduct global scenario planning (Kilpatrick and Barter 2020). Some of these potential solutions are discussed here.

A. Supply Network Mapping

The integration of Information Technology (IT) by using supply network mapping enables companies to reduce reliance on human intelligence and increase the dependence on artificial intelligence networks. Supply network mapping can be resource intensive and difficult but allows companies to identify exactly which suppliers, sites, parts, and products are at risk when supply chains are disrupted and allows them to secure constrained inventory and capacity at alternate sites efficiently (Choi, Rogers, and Vakil 2020).

B. Radio Frequency Identification

Radio Frequency Identification Technology (RFID) has been around since the mid-1970s. These systems have become widely used on roads, bridges, and tunnels around the world (Violino 2005). Organizations have been critically slow in implementing due to two reasons: cost and in-house knowledge. The use of Radio Frequency Identification Technology (RFID) helps improve supply chain efficiency by providing item-level identification and real-time information. RFID has been more and more utilized in this industry because it offers automatic tracking that creates a high volume of data at high velocity and with high variety, which facilitates real-time decision making as well as to develop rule-based knowledge based on data modeling and analytics. RFID is more operationally effective in replacing barcode technology in PC supply chain management by enabling fully automatic tracking and consequently increasing productivity. The future of SCM with RFID is excellent because of the advancements in the technology.

C. Electronic Data Interchange

One of the ways of integrating IT systems in the supply chain is via Electronic Data Interchange (EDI), which supports the exchange of electronic documents between business partners, while minimizing the time of information flow as well as cooperation costs (Rainer, Prince, and Watson 2014); Bahija, Malika, and Mostapha 2016). Inclusion of EDI enhances SCM because less money is tied to inventory and the transacting parties can efficiently and securely communicate. When created properly, suppliers can audit their data-sharing permissions directly on their own blockchain node. At the same time, their data can be securely distributed to others in the blockchain network without requiring the point-to-point integration that centralized systems do.

D. Enterprise Resource Planning (Enterprise Systems)

Enterprise Resource Planning (ERP) is an integral part of an organization technology (Wang, Hu, and Zhou 2017) and essential for accessing real-time operational information across multiple departments and businesses. The success of ERP adoption depends on external factors that include vendor support, consultant competence, and internal factors within the organization such as ERP team competence, ERP leadership, top management support and finally, the user support. ERP systems assist enterprises in automating and integrating corporate cross functions such as inventory control, procurement, distribution, finance, and project management. ERP systems are designed to integrate business functions and allow data to be shared across boundaries and divisions within the company and gives businesses increased flexibility and allows them to operate more efficiently than before. Effective sharing of information among the supply chain actors allows for production and delivery synchronization, better forecasting, coordination of inventory-related decisions, and the facilitation of a mutual understanding of performance bottlenecks (Rai, Patnayakuni, and Seth 2006).

E. Fourth-Party Logistics

We propose an additional solution, which would be to make a formal move towards fourth-Party Logistics (4PL). To be a Fourth-Party logistics provider, companies will have to develop capabilities that 3-PL are not providing like analytical and decision-support capabilities to analyze and redesign supply-chain flow structures, capabilities in change management, organizational development, and stronger relationships with its business and manufacturing customers. The emphasis is placed on the 4PL providers being a single point of contact for the shipper as an integrated part of the business solution to the client. A fundamental feature of a 4PL provider, which is considered a 'non-asset', is in the principle of being 'neutral' in selecting shipping partners. The goal of 4PL is to achieve benefits beyond the one-time operating cost by reducing the asset transfers gained from a traditional outsourcing relationship. By adopting a holistic approach, 4PL can emerge as a breakthrough supply chain solution by comprehensively integrating the competencies of 3PL providers, leading edge consulting firms and technology providers. Such strategic alliances leverage the skill sets, strategies, technology, and global reach which would otherwise take years to duplicate. As the services for Fourth-Party logistics are continually evolving it is important to draw a fundamental distinction between them. On the technological side, Fourth-Party Logistics (4PL) would use Radio Frequency Identification Technology (RFID), Electronic Data Interchange (EDI), Information Technology (IT) by using supply network mapping. Information technology (IT) plays a key role in disseminating 4PL processes. Hosie *et al* (2012) discussed why businesses should consider and embrace 4PL technologies: expansions of marketing channels, more efficient transportation modes. Accordingly, 4PL's main competency lies in sustaining long-term investment and ongoing benefits once initial cost savings are achieved. As a result of the growth of outsourcing and 3PL services, the complexity of SCM has grown in parallel, to such an extent that it is often a task falling outside the boundaries of company expertise and core competencies. (Richardson and Vitasek 2005).

Manchester (2001) preferred to describe 4PL as 'outsourced outsourcing' while Schwartz (2003) has suggested that 4PL is actually 'extreme outsourcing model' presenting sophisticated, highly coordinated solutions for 1 outsourcing logistics. Companies are gradually realizing that it has become increasingly important in the globalized economy to focus not on just core but also

non-core activities such as management of a long- distance supply chain in order to remain competitive (Win 2008). Conversely, customers can finally realize satisfaction, become more efficient and make optimum logistical decisions.

Conclusion

As logistics and supply chain professionals prepare for the future, they will face a number of challenges and issues. As the COVID-19 crisis persists, we are likely to see companies that fail to evolve in terms of their supply chain management fall to the wayside. On the other hand, companies that heed the lessons of this crisis and make investments in mapping their supply networks, incorporating technologies and artificial intelligence, and going from 3PL to a 4PL set up are likely to be even more resilient to future disruptions. Leveraging advanced technologies such as artificial intelligence, robotics, Radio Frequency Identification Technology (RFID), Electronic Data Interchange (EDI), Enterprise Resource Planning (ERP), are designed to anticipate and meet future challenges. Whether it is a "black swan" event like COVID-19, trade war, the act of war or terrorism, regulatory change, labor dispute, sudden spikes in demand, or supplier bankruptcy, organizations that deploy technology will be ready to deal with the unexpected. These companies will be long term winners.

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