

SUPPLY CHAIN DISRUPTIONS AND COVID-19: IMPACTS AND RECOVERY STRATEGIES

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ABSTRACT

COVID-19 has exposed the supply chain vulnerability of firms to global disruptions. The major reliance on China as the 'World Factory' for order fulfilments by global firms have created a rippled effect worldwide and intensified supply chain risks. This paper presents the impacts of COVID-19 on global supply chains and summarizes the strategies for ensuring continuity of operations amidst the pandemic and post COVID-19. Going forward, the main focus of organizations should be enhancing supply chain visibility, flexibility and resilience.

KEYWORDS: *COVID-19 Pandemic, Supply Chain Disruptions, Supply Chain Risk Management, Supply Chain Resilience*

INTRODUCTION

Global supply chains are rapidly growing and this growth increases their complexity and enhances their potential for risks and disruptions (Hohenstein, et al.2015). Revilla & Saenz, (2017) defines Supply Chain Disruptions (SCD) as unplanned events that interrupt the normal material flows within a supply chain. This means that due to their unexpected nature, SCDs can be very devastating. When the normal flow of goods is interrupted, it leads to a shortage at all levels of the supply chain which can be very frustrating to customers as they cannot get their orders met on time. Companies also suffer losses as besides their profit margins going down due to their inability to meet consumer demand, production machines are left idle and so are the storage spaces in the warehouses.

The great Tsunami in Japan in 2011, the big freeze in the U.S in 2021 and the drought in Taiwan in 2021 are just a few examples of unplanned risks that disrupted supply chain activities all from material sourcing, manufacturing and transportation and their impact were felt in a global scale. Practitioners both in the industry and in academia are aware of the occurrence of supply chain risks and have recommended the integration of supply chain risk management (SCRM) in their operations. According to Waters & Waters (2011), SCRM ensure that supply chains continue to work normally without any interruptions from material sourcing to the final distribution of goods and services to the customers.

SCRM include but is not limited to accomplishing goals of designing a supply chain risk strategy and integrating it with the organizational risk strategy; adopting important procedures; technology and information planning practices for managing supply chain risks; continuous monitoring of performance, and forming collaborations with supply chain partners as a way to mitigate risks (Waters & Waters, 2011). This means that disruptions are unattractive and most supply chain managers do not like them and would rather eliminate them but proper ways to manage these risks should be put in

place as most risks cannot be avoided but they can be managed. For better management of risks, firms should identify changes, respond to them proactively or reactively and recover from them (Shekarian, et al. 2020).

Baryannis, Validi, Danib, & Antoniou (2019) asserts that SCRM involve four major steps which are risk identification, risk assessment, risk mitigation, and risk monitoring and reporting. Supply chain resilience has been included in SCRM by some authors such as (Hohenstein, et al. 2015; Hendry, et al. 2019) as they find it critical to a firm's competitive advantage. This is to mean that firms that prepare for risks by having mitigation measures and are able to quickly get back to normal once disrupted, are able to beat their competitors. This article aims at highlighting lessons to be learnt to gain resilience post COVID-19 by supply chain firms.

The Black Death, Spanish Flu and Ebola have been labeled to be among the worst communicable diseases in the world. In late 2019 a new virus was identified in Wuhan, China. It was recognized as a new member of corona virus and successively named COVID-19. Within a very short period of time, the virus had spread across the whole world from Huanan wet market in Wuhan where it was originally identified. According to the World Health Organization, COVID-19 presents pneumonia-like symptoms such as fevers, cough, tiredness and loss of taste and smell. Other less common symptoms such as headaches and skin rashes may be experienced by some patients. Other COVID-19 waves have occurred and the delta variant has been the most contagious variant so far (Maragakis, 2021). The new variant B.1.1.529 subsequently named Omicron, first identified in South Africa is highly concerning due to the fear of its outbreaks and despite the fact that scientists are still examining its transmissible rates (Du & Naidoo, 2021), it is expected that the COVID-19 virus will be here to stay for some time and the question is how SCs will deal with this disruption.

Rodriguez, Vos, Belwo, & Sapir (2010) inserts that when a major disruption occurs, its impact is felt globally but developing countries are affected the most. This disruption is not different due to the overreliance on global suppliers by non-mature economies. In 2020 the global impact of COVID-19 led to a GDP loss of 3.4% with the forecast estimating a rise of the GDP by 5.7% in 2021 (Szmigiera, 2021). It is also expected that the GDP will rise by 4.5 % in 2022 and just over 3% in 2023 with most advanced economies returning to their pre-pandemic output path but with more debt and restrained potential for growth (Organization for Economic Cooperation and Development, 2021).

Across Africa, an additional 40 million people have been pushed into poverty since the beginning of the pandemic with 2 million of these being in Kenya. This is as a result of the rise in unemployment rates as incomes levels drop and industries continue to shut down (Warah, 2021). On the 22nd November 2021, The World Health Organization reported over 113bn COVID-19 cases since the 30th December 2019 with over 7bn people having been vaccinated as at 3rd December 2021. In Kenya, from 3rd January 2020 to 2nd December 2021, the cumulative COVID-19 cases were 255, 164 with 5,335 cumulative deaths and a total of 6,939,559 vaccine doses administered as at 27th November 2021 (World Health Organization, 2021). These have had a major impact on all sectors including manufacturing, transport, healthcare and education.

COVID-19 AND ITS DISRUPTION ON SUPPLY CHAIN ACTIVITIES

Due to the high uncertainties that COVID-19 initially presented, governments took some measures to flatten the curve. These measures included the use of face masks, hand sanitizers, social distancing and complete lockdowns. These measures especially the lockdown posed a major effect in supply chains. One of the major effects realized is the halt of production activities. This is due to shortages of raw materials, parts and components. China is a global manufacturing base and its logistics value increases by approximately 26.2% annually (Zhang & Maina, 2019) and its cheap labour costs, lower

tax rates which lowers the costs of production and lower regulatory compliance make it attractive for outsourcing goods by global countries (Bajpal & Boyle, 2021). This explains why production was affected as the lockdown measures were aimed at reducing movement of people to curb the virus; therefore this affected the labour intensive manufacturing companies which created a rippled effect globally.

Congestion of goods in the China ports was experienced. This congestion leads to goods damage and products may become obsolete. The partial closure of some of the busiest ports in China like Yantian caused bottlenecks that affected international trade (LaRocco, 2021). The backlog of cargo leads to changes in consumer behaviour and this impact highly on a company's profits. Logistics constraints occurred as the restriction of the movement of people means that there was a shortage of truck drivers and ocean carriage also cancelled sailings. This labour shortage has a huge impact on the supply side of commodities to the market. As a result of this, the demand side is affected and this imbalance between demand and supply creates panic buying as was observed worldwide during this crisis (Singh, et al. 2021).

The preventive measures of using sanitizers and face masks created a strain in the health care supply chains. There was a shortage of N-95 masks globally as the supply could not to meet the increasing demand. The shortage of ventilators and PPE's in hospital posed serious threats to human lives and (Ranney, et al.2020) presents that this partly contributed to the loss of lives of patients and frontline health care workers. Every month (WHO, 2020) estimates 89 million surgical masks and 76 million examination gloves for the response of COVID-19. While it is estimated that 10% of COVID-19 patients need ventilators globally, an additional 880,000 ventilators are required worldwide with the US needing about 75,000 ventilators to respond to the crisis (Parker, 2020). In Kenya there were only 256 ventilators as at July 2020 (Mohiddin & Temmerman, 2020). With the growing population of the country and the number of COVID-19 cases rising every day, more collaboration between the government, private sectors and donors is required to acquire ventilators to save lives of the citizens.

STRATEGIES FOR CONTINUITY OF SUPPLY CHAIN OPERATIONS DURING COVID-19 AND BEYOND

A lot of pressures are being faced by supply chain managers to manage the effects brought about by COVID-19 disruption as the executive don't want to disappoint their customers and are therefore looking upon supply chain personnel to hedge the risk. Suppliers also want to know how it will go in terms of the existing projects and the effect on the changes of the contractual terms. Customers are also posing pressures as they want the company to fulfill their orders. With such a scenario where everyone wants continuity here are some of the lessons that organizations can learn to ensure continuity and resilience of their supply chain operations.

Companies should consider the reconfiguration of their global value chains. A value chain is a strategic tool that internalizes a firm's activities during the input-output transformation stage in order to reduce costs and create a differentiated product that allows a company to gain a competitive advantage (Perera & Gunatilake, 2020). According to Pla-Barber, et al. (2021) this reconfiguration may involve 'reshoring' where previously outsourced manufacturing done offshore is returned to the home country. Another option is creating regional value chains. These relocation decisions should be based on evidence and foresight based approaches linking tangible and intangible aspects that are supported by their industrial policies (Elia, et al. 2021). This is however not an easy decisions due to the costs involved in relocating and meeting regulatory and technological requirements and the destruction of the current industrialized base may pose supply shortages which poses a crisis in the short run (Pla-Barber, et al.2021).

Firms should also consider accelerating the adoption of technology. While firms in the past have adopted technology due to the pressure of innovating their management practices and for new product development purposes, more companies have accelerated the use of technology since the start of COVID-19 pandemic (Valero, et al.2021). The lockdown measures made firms invest in remote technologies as most employees were working from home. Therefore software like zoom had to be used to facilitate meetings. Customers had to buy products online and companies therefore needed to invest in automated technologies like robots. The online buying boosted amazon's company retail sales to nearly double by May 2020 (Semuels, 2020). Even after re-opening of global economies, employees continue to prefer working remotely and customers continue buying online. Companies will therefore need to invest in technologies like the internet of things, cloud computing and data analytics for continued sustainability of their operations as solid on-premise system only won't work anymore.

Focusing on flexible manufacturing systems (FMS) could help firms become more sustainable. Based on an article by Tyrrell (2021) a flexible manufacturing system is a production method designed to adapt easily to the type and quantity changes of the product being manufactured. Amongst the companies that adopted FMS during the pandemic were Ford, Zara and Bacardi who manufacture vehicles, apparel and rum respectively but they adapted FMS to manufacture ventilators, surgical masks and hand sanitizers respectively (Kumar, et al. 2020). Although adopting FMS is initially expensive (Hayes & James, 2021), firms adopting FMS would benefit from saved costs in future and especially during disruptions as FMS are able to easily adapt to product changes thereby creating efficiency by reducing operation costs, delays and bottlenecks, and ensuring resources like machinery are in operation and not idle. Companies adopting FMS during COVID have helped to reduce the shortage of masks, sanitizers and ventilator crisis.

Knowledge management is a key strategy to gaining supply chain resilience amidst and post the pandemic. Knowledge management focus on how organizations create, retain and transfer knowledge (Samuel, et al. 2011). COVID-19 pandemic has caused numerous and untimely deaths including those of talented supply chain executives. Organizations should plan on how they manage talent and knowledge transfer through frequent trainings on supply chain management practices to ensure continuity of their operations. Organization should have a preparedness plan which includes the succession plans of key positions during emergency situations. Due to the change in consumer behaviour to online purchasing and digitalization of products, employees need training on robust technologies to keep up with these changes. Institutions of higher learning should also revise their supply chain curriculums to include disruptive technologies to keep up with knowledge acquisition which will help in managing future complexities and disruptions in supply chain networks (Maina & Perera, 2020). Organizations should also share the knowledge gained with other supply chain actors like the government health care providers to minimize the risks of the pandemic by ensuring timely responses (Chaturvedi & Singh, 2021).

Another key strategy to gain SC resilience is through diversification of suppliers and proactively managing them. Firms have for a long time considered single sourcing as key to partnering supplier relationships (Lysons & Farrington, 2019) but this 'black swan' event have proved that to ensure continuity, it's important to have multiple sources of supply. Although multiple suppliers are complex to manage they eliminate the supplies vulnerability posed by single sourcing (Azad & Hassini, 2018) and getting the right balance between these two strategies is crucial. Consequently, prioritizing suppliers by grouping them in quadrants based on their level of importance to your business continuity will help managers manage the relationships with them. Suppliers should be contacted frequently to assess any changes they have on their

business that would affect their continuity. It is paramount to also get to know their health and safety plans in regards to hedging COVID-19 risks. Shen & Sun (2021) argue that collaborating with suppliers through frequent information sharing will enhance agility in meeting customers demand and strengthen resilience during COVID-19.

SUMMARY AND DISCUSSION

COVID-19 pandemic continues to illustrate how numerous companies may not fully appreciate their vulnerabilities to supply chain disruptions. The major disruption to supply chain activities were as a result of the lock down measures which seized movement thus creating shortages of goods, back log of cargo that resulted to delays, and this caused production halts, changes in consumer behaviour, and have impacted on the international trade. Companies should appreciate the role of frequent supplier risk assessment to identify the major areas of risks and mitigate them. Enhancing their supply chain resilience can be accelerated by technology adoption, reconfiguration of global value chains through proper supply chain mapping, adoption of flexible manufacturing systems, knowledge management and diversification of suppliers.

Although supplier diversification and reducing the extended networks from global suppliers to home suppliers have been recommended by various authors and practitioners, this remains a key issue of consideration and research. While China is known as the ‘world factory’ due to the multiple global companies outsourcing and importing goods from her, the puzzle of who will replace China as the world factory is yet to be solved. Does this mean that other countries are ready to take up what China does or will companies consider sourcing supplies from China plus an(other) country or will China still remain the world’s factory in future?

As organizations also strive to manage talent and knowledge, concerns are on the health and safety of employees. Despite the numerous efforts of the government safety measures of hand sanitizing, wearing of masks, social distancing and vaccination, the latter issue has brought a lot of controversy even as more research and education continues globally about this topic. For the economy to thrive, cooperation is required amongst all stakeholders. Increased visibility is not only required by firms but also by governments in industry policy formulations particularly on those policies of managing disruptions including donations, procurement and distribution of emergency items and equipment.

Future empirical studies are required to find out what challenges specific firms have encountered amidst the pandemic and the strategies they have employed to continue their operations. Studies on supply chain sustainability with a major focus on the environment during COVID-19 could be done as hypothetically, the partial closure of manufacturing and transportation firms had a positive impact on the environment due to reduced noise and air pollution. Lessons learnt from this and how companies can be more sustainable to the environment even after ‘going back to normal’ could enrich the literature. Specific empirical studies in Kenya could be done to explore the impact of COVID-19 on food supply chains as the country rely heavily on agriculture and the pandemic had a huge blow on this sector. Another area of focus in Kenya is the logistics constraints associated with the vaccines and insights on how this issue can be solved.

CONCLUSION

COVID-19 is a ‘wake-up call’ for supply chain managers to rethink their business strategy for continuity of their supply chain operations. While most companies focused on strategies like single sourcing, on-premises activities that promoted efficiency and cost reduction, the pandemic have proved that effectiveness and flexibility which may be achieved by remote activities and multiple sourcing is also a key consideration and not a trade-off to minimize supply chain risks.

Organizations are therefore tasked with the responsibility of conducting end to end supply chain risk assessment and despite the fact that this is a very difficult thing to do due to the huge resources required; integrating digital and innovative capabilities in the process could pose numerous rewards like reduced risks and assured resilience.

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REFERENCES

1. Azad, N., & Hassini, E. (2018). *Recovery strategies from major supply disruptions in single and multiple sourcing networks. European Journal of Operational Research*, 275: 481-501.
2. Bajpal, P., & Boyle, M. (2021, May 18). *Why China is "The World's Factory"*. Retrieved November 25, 2021, from Investopedia: <https://www.investopedia.com/articles/investing/102214/why-china-worlds-factory.asp>
3. Baryannis, G., Validi, S., Danib, S., & Antoniou, G. (2019). *Supply chain risk management and artificial intelligence: state of the art and future research directions. International Journal of Production Research*, 57 (7): 2179-2202.
4. Chaturvedi, S., & Singh, T. (2021). *Knowledge Manangement initiatives for tackling the Covid-19 pandemic in India. A Journal of Management Research*, 20 (1): 25-34.
5. Du, L., & Naidoo, P. (2021, November 26). *What we know about the new coronavirus variant now spreading. Retrieved November 26, 2021, from Bloomberg: https://www.bloomberg.com/news/articles/2021-11-26/what-we-know-about-the-new-virus-variant-that-s-rocking-markets*
6. Elia, S., Fratocchi, L., Barbieri, P., Boffellid, A., & Kalchschmidt, M. (2021). *Post-pandemic reconfiguration from global to domestic and regional value chains: the role of industrial policie. Transnational Corporations*, 28 (2): 67-96.
7. Hayes, A., & James, M. (2021, February 13). *Flexible Manufacturing System (FMS)*. Retrieved November 20, 2021, from Investopedia: <https://www.investopedia.com/terms/f/flexible-manufacturing-system.asp>

8. Hendry, L. C., Stevenson, M., MacBryde, J., Ball, P., Sayed, M., & Liu, L. (2019). Local food supply chain resilience to constitutional change: the Brexit effect. *International Journal of Operations & Production Management*, 39 (3): 429-453.
9. Hohenstein, N.-O., Feisel, E., Hartmann, E., & Giunipero, L. (2015). Research on the Phenomenon of Supply Chain Resilience: A systematic review and paths for further investigation. *International Journal of Physical Distribution and Logistics Management*, 45 (1/2): 90–117.
10. Kumar, A., Luthra, S., Mangla, S. K., & Kazançoğlu, Y. (2020). COVID-19 impact on sustainable production and operations management. *Sustainable Operations and Computers*, 1: 1-7.
11. LaRocco, L. A. (2021, June 17). Satellite images show backlog of containers awaiting export at Port of Yantian after Covid outbreak. Retrieved November 26, 2021, from CNBC: <https://www.cnbc.com/2021/06/17/covid-outbreak-satellite-images-show-container-backlog-at-port-of-yantian.html>
12. Lysons, K., & Farrington, B. (2019). *Procurement and Supply Chain Management*. 9th edition: Pearson Education Limited.
13. Maina, J., & Perera, T. (2020). Simulation as an integral part of the Supply Chain Curriculum. *British Journal of Education*, 8 (8): 33-48.
14. Maragakis, L. (2021, October 21). Coronavirus second wave, third wave and beyond: What causes a COVID Surge. Retrieved November 25, 2021, from John Hopkins Medicine: <https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/first-and-second-waves-of-coronavirus>
15. Mohiddin, A., & Temmerman, M. (2020, July 27). COVID-19 exposes weaknesses in Kenya's healthcare system. And what can be done. Retrieved November 27, 2021, from The Conversation: <https://theconversation.com/covid-19-exposes-weaknesses-in-kenyas-healthcare-system-and-what-can-be-done-143356>
16. Organization for Economic Cooperation and Development. (2021, December 1). *The OECD Economic Outlook: A vigorous but incomplete recovery in OECD*. Retrieved December 2, 2021, from OECD: <https://www.oecd.org/coronavirus/en/themes/global-economy>
17. Parker, T. (2020, March 25). 880,000 more ventilators needed to cope with coronavirus outbreak, says analyst. Retrieved November 27, 2021, from NS Medical devices: <https://www.nsmmedicaldevices.com/analysis/coronavirus-ventilators-global-demand/>
18. Perera, C. S., & Gunatilake, S. (2020). Value chain management in Sri Lankan construction industry: contractor's perspective. *International Journal of Construction Management*.
19. Pla-Barber, J., Villar, C., & Narula, R. (2021). Governance of global value chains after the Covid-19 pandemic: A new wave of regionalization. *Business Research Quarterly*, 24 (3): 204-213.
20. Ranney, M. L., Griffeth, V., & Jha, A. K. (2020). Critical Supply Shortages: The need for ventilators and personal protective equipment during the Covid-19 Pandemic. *The new England Journal of Medicine*, 1-3.

21. Revilla, E., & Saenz, M. J. (2017). *The impact of risk management on the frequency of supply chain disruptions: A configurational approach*. *International Journal of Operations and Production Management*, 557-576.
22. Rodriguez, J., Vos, F., Belwo, R., & Sapir, D. G. (2010). *Annual Disaster Statistical Review 2008: The Numbers and Trends*. Retrieved from Centre for Research on the Epidemiology of Disasters (CRED): http://www.cred.be/sites/default/files/ADSR_2008.pdf
23. Samuel, K. E., Goury, M.-L., Gunasekaran, A., & Spalanzani, A. (2011). *Knowledge management in supply chain: An empirical study from France*. *Journal of Strategic Information Systems*, 20 (3): 283-306.
24. Semuels, A. (2020, July 28). *Many companies won't survive the pandemic. Amazon will emerge stronger than ever*. Retrieved November 26, 2021, from Time: <https://time.com/5870826/amazon-coronavirus-jeff-bezos-congress/>
25. Shekarian, M., Nooraie, S. V. R., & Parast, M. M. (2020). *An examination of the impact of flexibility and agility on mitigating supply chain disruptions*. *International Journal of Production Economics*, 220, 107438.
26. Shen, Z. M., & Sun, Y. (2021). *Strengthening supply chain resilience during COVID-19: A case study of JD.com*. *Journal of Operations Management*, 1-25.
27. Singh, S., Kumar, R., Panchal, R., & Tiwari, M. K. (2021). *Impact of COVID-19 on logistic systems and disruption in food supply chain*. *International Journal of Production Research*, 59 (7): 1993-2008.
28. Szmigiera, M. (2021, November 23). *Statista*. Retrieved November 26, 2021, from *Impact of the coronavirus pandemic on the global economy - Statistics & Facts*: <https://www.statista.com/topics/6139/covid-19-impact-on-the-global-economy/#dossierKeyfigures>
29. Tyrrell, M. (2021, July 20). *Flexible manufacturing to support covid-19 recovery*. Retrieved November 25, 2021, from *Production Engineering Solutions*: <https://www.pesmedia.com/metlase-flexible-manufacturing-20072020/>
30. Valero, A., Riom, C., & Cunha, J. O. (2021, November 22). *Covid-19 spurred a wave of new technology adoption by UK business*. Retrieved November 25, 2021, from LSE: <https://blogs.lse.ac.uk/businessreview/2021/11/22/covid-19-spurred-a-wave-of-new-technology-adoption-by-uk-businesses/>
31. Warah, R. (2021, July 26). *Covid, debt and taxes are plunging million of Kenyans into Poverty*. Retrieved November 27, 2021, from One: <https://www.one.org/africa/blog/covid-debt-poverty-kenya/>
32. Waters, D., & Waters, D. (2011). *Supply Chain Risk Management: Vulnerability and Resilience in Logistics*. Kogan Page Limited.
33. WHO. (2020, March 3). *Shortage of personal protective equipment endangering health workers worldwide*. Retrieved November 26, 2021, from World Health Organization: <https://www.who.int/news/item/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide>
34. World Health Organization. (2021). *Kenya Covid-19 Situation*. Retrieved December 3, 2021, from World Health Organization: <https://covid19.who.int/region/afro/country/ke>
35. Zhang, L., & Maina, J. (2019). *Emerging Issues of Green Logistics in Manufacturing Firms of China: A Literature Review*. *European Journal of Logistics, Purchasing and Supply Chain Management*, 7 (4): 35- 49.