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Supply Chain Disruptions and Firm Performance: Proffering Feasible and Sustainable Solutions to Mitigating Futuristic Disruptions in the COVID-19 Pandemic Era

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ABSTRACT
Recently, the two significant causes of supply chain disruptions globally are the Ukraine-Russia conflict and the COVID-19 pandemic. Concentrating on the Ukraine-Russia conflict, the crisis is said to substantially impact supply chains in five vital sectors: agriculture, chemicals, manufacturing, metals, and oil and gas. It is highly worrisome that there is a recorded significant reduction in the production rate for agriculture & chemicals and a correspondingly significant reduction in demand for metals, oil & gas. On the other hand, manufacturing has also witnessed a moderate decrease in production and demand. This research study is highly motivated by the historical record of extreme supply chain disruptions, which often translate to untold hardships for the government, firms, employees, and consumers. Furthermore, the current level of supply chain shortages has been termed worse off compared to historical levels during the Nixon administration in the early 70s. The broader objective of the research studies is to proffer feasible solutions to never-ending supply chain disruptions. The landscape is changing, negating the proponents and believers in certain pitfalls, especially unavailable data, few relevant talents and skills, and low adoption rate. The occurrence of significant events such as COVID-19, extreme weather-related events, other natural disasters, logistic failures, and tariff disputes have available and reliable data organizations can utilize in a range of analytical fact-finding projects.

Keywords: *COVID-19, supply chain disruptions, firm performance*

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I. Introduction

Lambert, Stock, and Ellram, in their book, "Fundamentals of Logistics Management," defined supply chain as the arrangement of firms responsible for initiating products or services to market. Ganeshan and Harrison (1995) expanded the previous definition, stating that a supply chain is a host of facilities and distribution alternatives performing procurement functions, transforming raw materials into intermediate and finished products, and distributing various channels to the final consumers. On the other hand, supply chain disruptions are the collection of possible factors obstructing the free flow of raw materials and finished products from the producer to the consumer. Supply chain disruptions are not limited to natural disasters, political & economic sanctions, and consumer expectations. Some other stakeholders categorize the disruptions under process, demand, supply, and environmental.

In most cases, B2B and B2C suffer greatly during significant supply chain disruptions. For example, in 2014, a devastating explosion at Evonik in Mari, Germany, induced a shortage of a specialty resin popularly called nylon 12. Nylon 12 makes auto seat fabrics, brake components, and fuel tanks. As a result, Ford reeled from the disruption, and Evonik took six months to restart the resin manufacturing process. Another example is a Merck chemical plant in Onahama, Japan, which in 2011 closed operations due to an earthquake and tsunami raging near Fukushima. The plant was the only source of a particular pigment used by autos to give cars a glittery shine. Consequently, the shortage forced Ford and Chrysler to hold back on car orders. This research study is highly motivated by the historical record of extreme supply chain disruptions, which often translate to untold hardships for the government, firms, employees, and consumers. Furthermore, the current level of supply chain shortages has been termed worse off compared to historical levels during the Nixon administration in the early 70s. The broader objective of the research studies is to proffer feasible solutions to never-ending supply chain disruptions.

The COVID-19 pandemic and the Ukraine-Russia conflict

Recently, the two significant causes of supply chain disruptions globally are the Ukraine-Russia conflict and the COVID-19 pandemic. Concentrating on the Ukraine-Russia conflict, the crisis is said to significantly impact supply chains in five vital sectors: agriculture, chemicals, manufacturing, metals, and oil and gas. It is highly worrisome that there is a recorded significant reduction in the production rate for agriculture & chemicals and a correspondingly significant reduction in demand for metals, oil & gas. On the other hand, manufacturing has also witnessed a moderate reduction in production and demand. Logistic disruptions are common for transport channels: Air cargo, ports, and shipping. Roads possess a more significant impact than rails in the presence of the former Soviet-Union renewed conflict. As a result of the aforementioned logistic disruptions and decline in production and demand, the most affected end industries include the automotive industry, energy and travel, and logistics. Other sectors affected are restricted to particular regions and scenarios, as stated thus: consumer, aerospace and defense, technology including semiconductors, and real estate and construction. A McKinsey & Company report released in May 2022 posited that the five categories (agriculture, chemicals, manufacturing, metals, and oil & gas) face three crucial challenges following the invasion of Ukraine: a) substantial reduction in several manufacturing plants or total shutdowns b) lower purchases of goods sourced from Russia, because of economic sanctions or self-imposed sanctioning by companies c) logistics disruptions across air cargo, ports, road and rail, and shipping.

II. The Global Challenges

The challenges resulting from the conflict have a devastating effect on product lines, evidenced by the reduced production of multiple automotive companies in Germany due to the shutdown of wire-harness suppliers. Furthermore, transport delays and increasing input costs are more constant than pre-crisis periods. Since the conflict's inception, several companies announced to the public their intention to ground operations in Russia or transport Russian goods. This reason buttresses political, economic, and corporate sanctions, prompting several adverse effects and unimaginable unpredictability since disruptions are more challenging to track and estimate. Countries and business entities dependent on Russian raw materials, intermediate and finished goods, faced severe difficulties accessing the goods promptly, thereby projecting disruptions in the supply chain. For example, recently, breaks in the transmission of fossil fuels from Russia to EU member states spiked the cost of electricity and availability of PMS and its derivative products to citizens in recipient countries.

Multiplier effects on European Union member states result in the downsizing of the workforce, production decline, demand decline, and reduction in business activity. In the case of Ukraine, a handful of African countries depend on certain crops to produce bread and other cereals. The disruption in the supply chain has increased the price of bread and a corresponding increase in production inputs, thereby reducing revenues. A cohort of business leaders perceives rising inflation as another point of worry alongside the unavailability of crucial supply chain inputs. The latter is perceived to possess a more significant impact on product line continuity and company revenues.

III. Prior Studies

The COVID-19 pandemic presented a back-and-forth pattern that switches the problem from services to products and products back to services. The never-ending lockdowns during the pandemic's peak contributed to the shifts in aggregate consumer spending from services to products, culminating in the source of supply chain disruptions. Similarly, as demand tilts back to services, demand for products is headed downwards, creating a scenery with alarming uncertainty. For example, key inputs such as semiconductors became scarce, impeding the production of many downstream industries. As soon as major global economies re-opened, stacked-up aggregate demand faced an array of low inventories, a sluggish production restart, clogged logistics, labor shortage, and supply-demand mismatches (Igan*et al*., 2022). The stockpiling approach adopted by some firms during the pandemic proved to be a short-term solution. As the stocks depleted, disruptions became more substantial and frequent. However, lessons learned from the pandemic translate to the decentralization of logistics, taking advantage of regional nomenclature during a specific type of disruption-causative factor.

China Effect and COVID-19 Pandemic

Furthermore, a more recent lockdown in China emerges as the third phase of supply chain disruptions aside from the COVID-19 pandemic and the Ukraine-Russia conflict. Government-imposed lockdowns in major cities in China, such as Shanghai in March 2022, stalled shipping and production of intermediate parts. Also, COVID-19 restrictions have discontinued logistics and container transport, creating an excessive backlog and standstill at the ports. Identified goods for healthcare, gaming, luxurious home accessories, and construction produced in Chinese regions around Shanghai are trapped in China due to the restrictions, thereby creating a clog in the supply chain.

Aside from pandemics and conflict, other known causes of supply chain disruptions are categorized under demand, supply, process, and environmental. There is a need to discuss a few to deepen the readership's

understanding further. Transportation failures or delays are antecedents of pandemics, conflicts, political sanctions, economic sanctions, rising costs, and natural disasters. Globalizationorchestrates increased business opportunities, prompting congestion at various international and local ports. In other cases, as stated above, the emergence of pandemics and natural disasters in hot spots and significant trade routes may prompt authorities to impose restrictions to avoid viral spreads, affecting freight carriers' ability to deliver goods as scheduled via land, sea, road, and air. Secondly, problems associated with the product deter quality, which is the backbone of supply chain management. Issues identified with the product during and after production break the supply chain as the manufacturer retrieves such goods for corrective measures.

In most cases, the goods may have gotten to the firm's customers, contributing to a decline in the firm's image and credibility. Therefore, customer shipments may be delayed to retain the firm's image and product credibility in the marketplace. Thirdly, price fluctuations from individual suppliers of raw materials required for proper production create supply chain disruptions. The decision to switch suppliers to cheaper alternatives, raise your final product prices, and bear the loss takes crucial time, which impedes the normal flow of products from the production firm to the final consumer. Fourthly, financial crises and labor strikes also contribute to supply chain disruptions. In the former, demand, production, and inventory levels are impacted. At the same time, affected manufacturing firms experience a sudden inability to maintain production levels due to a depleted workforce that is out of work for various labor demands such as increased pay and good working conditions.

IV. Conclusion

The final part of this article is based on proffering feasible steps to combating supply chain disruptions. First, deploying a solid supply chain analytics strategy is imperative in improving firm resilience to future disruptions. The landscape is changing, negating the proponents and believers in certain pitfalls, especially unavailable data, few relevant talents and skills, and low adoption rate. The occurrence of significant events such as COVID-19, extreme weather-related events, other natural disasters, logistic failures, and tariff disputes have available and reliable data organizations can utilize in a range of analytical fact-finding projects. The prime aim is to leverage analytics to discover disruption and discern its magnitude and overall impact on the supply chain to devise a solid response depending on the direction of analytical projections.

Furthermore, adopting machine learning and AI algorithms allows the organization to track unfolding events and real-time forecast data and train models incorporating changing business needs brought about by the disrupting event. Secondly, organizations must develop predictive capabilities to anticipate shortages. Depending on analytical tools under business intelligence, four indicators must be watched closely: suppliers' delivery time, number of items scheduled for production, customer demand forecast, and maintenance forecast. Specifically, data from the KPIs afford companies to mitigate the negative impact of supply chain disruptions through the ability to show the perfect timing to increase stock levels and optimize replenishment strategies, increase manufacturing capacities in specific locations, diversify suppliers, and prepare for future price increases.

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