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The attached educational project, by VAIVA RAKEVICIUS, entitled GLOBAL SUPPLY CHAIN CHALLENGES IN THE FAST-EVOLVING WORLD: THE NEED TO ACHIEVE A BALANCED SUPPLY CHAIN, when completed, is to be submitted to the Graduate Faculty of the University of Wisconsin- Platteville in partial fulfillment of the requirements for the (MASTER OF SCIENCE IN INTEGRATED SUPPLY CHAIN MANAGEMENT) degree.

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Project Advisor

Professor Xiaotong Liu

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THE NEED FOR A BALANCED SUPPLY CHAIN

A Seminar Paper

Submitted to

the Graduate Faculty of the

University of Wisconsin - Platteville

in Partial Fulfillment

for the Degree of

MASTER OF SCIENCE IN INTEGRATED SUPPLY CHAIN MANAGEMENT

By

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Year of Graduation: Fall 2021

Abstract

This paper aims to review the supply chain evolution from domestic to global, the characteristics of each, and the reasons that initiated the transitions. The report will also examine what worked and what did not work during this transition. Additionally, this paper will discuss the benefits and risks introduced by the globalization of the supply chain. The root causes of the current supply chain constraints will be analyzed in light of recent events such as the COVID 19 pandemic and the Suez Canal blockage. The impact of these unprecedented events will be used to discuss the mitigation strategies that the organizations should develop and employ to experience zero or minimal impact of any future unusual events. Further, these events will serve as evidence for the need for drastic changes in the global supply chain processes and alternate supply chain variations**.**

Finally, the paper will focus on why organizations should establish a balanced and robust supply chain containing a contingency plan vital to their success.

Table of Contents

Global Supply Chain Challenges in the Fast-Evolving World: The Need to Achieve a Balanced Supply Chain

Vaiva Rakevicius

Under the Supervision of Professor Xiaotong Liu

Introduction

Recent events in the world, such as COVID 19 pandemic and Suez Canal calamity, exposed and highlighted the challenges that the current supply chain is dealing with. Due to the pandemic, many things were brought into focus, and the significance of the supply chain was one of them (Miller, 2021). There was no industry that did not get impacted by the outcomes of these disasters. Pharmaceuticals, automotive, PPE are only some industries that had to take a long pause, review their supply chain models and make some drastic changes. To say that a balanced supply chain is of vital importance is an understatement. Yet in order to develop a robust supply chain, difficult tasks, must be approached systematically (Breskin, 2002).

A study of the supply chain evolution from domestic to global, the characteristics of each, as well as the reasons that initiated the transitions, will enable us to understand the core principles of a balanced supply chain. Analysis of what worked and what did not bring value during the transition will lay the basis for understanding why the balanced and stable supply chain would be vital for the organizations. The delays in the supply chain that were brought about by recent events such as COVID 19 pandemic as well as the Suez Canal calamity will be used to highlight the drawbacks of the current situation. The combination of port congestion, severe weather, and COVID-19 disruptions has had a negative impact on product availability, resulting in major shortages (Brown, 2021). The focus of the analysis will fall on several industries that were impacted most, such as the pharmaceutical and automotive industries.

The supply chain experienced significant changes over the last hundred years. As the APICS dictionary defined, “supply chain – the global network used to deliver products and services from raw materials to end customers through an engineered flow of information, physical distribution, and cash” (Blackstone, 2013). Having emerged as no more than logistics, the activity involved purchasing, maintenance, and transportation of military equipment, material, and people (Ballou, 2007, p. 333). As the concept of supply chain entered the picture, it referred to the opportunity that can be realized from integrated product flow processes across functions and between channel members (Ballou, 2007, p. 340).

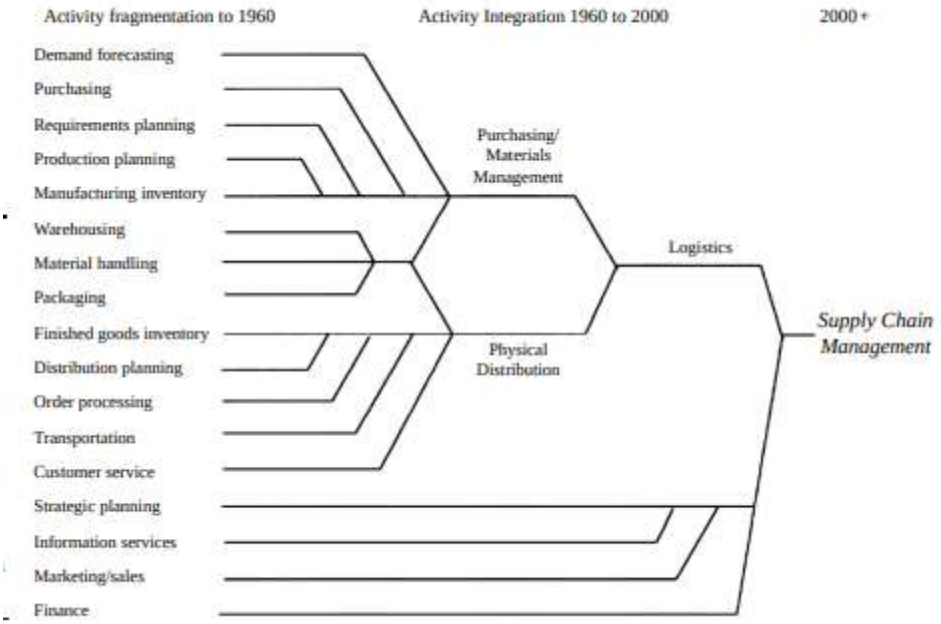

Figure 1. Ballou, 2007, p. 340

All the aspects of how the goods are sourced, manufactured, and transported were affected immensely. Many of the supply chains started as domestic, typically defined, and focused on the local markets. With new means of transportation developing in the 20th century, the horizons of the supply chain started expanding. The railroad enabled the companies to obtain goods from more distant areas; the invention of semi-truck allowed companies to transport assets

faster and cheaper. Post-World War II, international ocean trade was also growing, yet it was not very well developed and quite inefficient. The companies were mostly relying on the local suppliers and building their networks based on their capacity and availability. The 1980s introduced a great shift to globalization. Logistics/SCM continued to grow in popularity due to increasing globalization, free trade, and outsourcing (Ballou, 2007, p. 341).

Computerization alongside the various software presented opportunities to start reaching out overseas, exploring cost-saving and profit-maximizing opportunities. Airfreight, ability to optimize and consolidate shipments, international supply chain networks, and agile software systems brought much-needed improvements and possibilities to build greater success. Production processes became more global; each producing country specialized in one specific stage of good's production flow (Costinot et al., 2012, p.109). One of the major expansions overseas was the connection with Asia, i.e., China, Japan, and Korea, by establishing them as main suppliers and points of outsourcing for goods. Globalized manufacturing, i.e., the growth of manufacturing in Asia, brought the supply chain to a new level, i.e., a new dimension of supply chain activities. Supply chain outsourcing emerged as a great strategy for organizations as it opened a wide variety of options to choose from and extremely competitive pricing. Globalization of the supply chain became so solid and prevailing that there was hardly a company that was not running some of their operations on an international scale. Organizations started heavily depending upon the international suppliers redirecting all their raw materials and assets to the organizations across the world. Expanding their business horizons internationally brought the organizations to the new markets providing them with more opportunities, yet it brought about greater competition and additional risk. This drastic switch highlighted an even greater negative impact with the supply chain disruptions that occurred over the past couple of

years, namely COVID-19 and Suez Canal port congestion. The implications of these two phenomena are overarching and have an impact on all industries. Yet several aspects of it had a massive impact in the field of pharmaceutical and automotive industries. To ensure future supply chain crises are averted, a balance must be struck for companies to rely on local as well as global supply chain. One or the other is not an answer.

Literature Review

The evolution of the supply chain in the subsequent research highlighted the challenges the supply chain encountered at each of its phases, demonstrating how neither purely domestic supply chains nor entirely outsourced supply chains could sustain the uninterrupted business. The unprecedented recent events, such as COVID-19 and Suez canal blockage, provided a substantial amount of data activities, proving the need for a diverse and balanced supply chain so that any future supply chain disruptions are minimized or prevented. The following four literature reviews attempt to demonstrate and support this statement.

Ballou (2007) examined the evolution of the supply chain starting at its very foundation and described the key events as well as the impact they had over the course of about 45 years. The author explained the supply chain development and the challenges that shaped the status of the current status of the global supply chain situation. He came to the conclusion that supply chain success is definitely defined by the level of collaboration the members can achieve among themselves as well as within the channel (Ballou, 2007, p. 344). In addition to that, the author acknowledged the significant impact supply chain management had, namely, because supply chain management is the foundation of the organization's competitive strategy(Ballou, 2007, p.347). Yet Ballou (2007) also discussed several challenges that the supply chain management would encounter, cautioning the supply chain leaders to pay close attention and to attend. One of

them to mention was building a strong supply chain relationship between the organizations and immediate suppliers, the necessity of building a good boundary-spanning circle of suppliers in order to avoid disruptions.

Collins and Anjoran (2016) examined the importance of simplifying the supply chain as well as continued the discussion of building a trustworthy circle of immediate suppliers. The authors identified the main factors influencing risks to the supply chain, defined the types of risk these factors generate as well as provided the techniques of addressing these risks in order to reduce or minimize them. By the example of the case study that was employed in their research, Collins and Anjoran (2016) presented the significance of examining suppliers and subsuppliers upfront and concluded that the suppliers should be regarded as an investment in the organization's business in ensuring the successful and uninterrupted operations.

In a study article by Robinson (2020), the question of events causing major changes in supply chains was discussed. The author reviewed the majority of the events, that were simulated as well as natural emphasizing the effect they had on the supply chain in the recent events. According to Robinson (2020), COVID-19's effects on supply and demand, and the resulting quality, would be the subject of debate, influencing market changes for years to come. The focus of the study was on how deep and disruptive the impacts of COVID-19 were as well as what the long-term and short-term effects were going to be. The challenges that the pandemic brought about to the supply chain were discussed and consequently, the discussion points were defined for business leaders to consider moving forward. The results of the study focused on several main aspects for the organizations to consider in order to be prepared for any other disruptions (planned or unplanned) when it comes to an efficient supply chain moving forward. The article did emphasize that encountering the unknown should become a new normal and that COVID-19

interference just proved that the supply chain role is going to become more and more important (Robinson, 2020).

Sundblad (2020) continued examining the problems that the global COVID-19 pandemic exposed within the global supply chain in his article. The author claimed that the recent events just proved once again a dire need to review and restructure current global supply chain processes. The main focus when revamping the supply chain processes fell on building resilience into our supply chain by switching gears more towards domestic production (Sundblad, 2020). The possible risks of that step are also reviewed and discussed, yet explaining that the outcome of this change would bring more benefits than negative impacts. The shifting away from centralized global supply chains was also stressed in the article. According to Sunblad (2020), a global supply chain with single points of failure has proven to be incredibly unstable. As a result, drastic changes for the global supply chain would be required in order to prevent more disasters to come.

The evolution of the supply chain, as well as the global impact of pandemic and Suez canal blockage, demonstrate the need for a balanced and well-established supply chain with a contingency plan embedded in it. The studies demonstrate the areas that require improvement, the changes that need to take place. A supply chain that is well balanced and diversified would allow organizations to keep their production lines running smoothly and withstand any future disruptions without major impact on procurement and supply chain.

Methodology

The primary method of approach for this project consists of a secondary data analysis retrieved from research about the supply chain and its evolution. The data collected focuses on the history of the supply chain, its globalization, the risks presented by globalization, and the

implications of the recent calamities of the COVID-19 pandemic and the Suez Canal event. Scholarly publications, case studies, and articles will be reviewed to support the desired end-goal of this research. The analysis conducted will be of a thematic nature, i.e., the data collected via studies and articles will be analyzed via literature review to review and emphasize the main statement of the need for a balanced supply chain derived from domestic and global supply chains.

Discussion

The findings of this paper suggest that the current situation of the global supply chain needs to change. The recent events of the global COVID-19 pandemic and Suez Canal blockage amplified the existing challenges within the global supply chain to a level that is difficult to ignore again. The last 40 years resulted in manufacturing moving to where the production is cheapest (Sundblad, 2020). As a result, such a shift has pushed manufacturing farther and further from domestic markets. Organizations chose to go global without much consideration or evaluation, leading to unprecedented levels of globalization. Though outsourcing had considerable benefits, a few high-profile disasters demonstrated just how risky it could be. The businesses forgot or ignored domestic manufacturing's advantages of increased employment and job creation, fueling money into the local economy, protecting the environment due to shorter delivery routes decreasing the pollution, and consumers benefitting as manufacturers could provide better customization (Sundblad, 2020). Yet neither of these extremes, absolute globalization or relying on only domestic suppliers, is the correct answer to the issue.

Industries should set up diversified supply chains balanced with the global and domestic suppliers equally distributed within the supply chain. A regional strategy of producing a substantial proportion of goods from the region in which they are consumed should be

considered by managers (Shih, 2020). By manufacturing or creating locally, the organizations would support the domestic economy. A social and environmental impact driven by the suppliers dealing with short transits is also of importance. Quality would be another aspect much easier to handle and control if collaborating with local suppliers. Still, it would also be prudent to keep the global suppliers, especially China, in a balanced supply chain. As Shih (2020) stated, with a deep supplier network, an able workforce, and an efficient and large port and transportation infrastructure, China will remain a highly competitive supplier for years to come. However, some limitations of the data should be noted. First, the events that occurred are very recent, and it is not easy to provide accurate calculations of how one or the other scenario would affect the global supply chain. The world is continuing to recover from the global pandemic and Suez Canal blockage. Therefore, it is evident that some uncovered aftereffects and uncertainties could shape a different path forward for the future global supply chain.

Supply Chain Evolution

Over the past 100 years, supply chain matured from simple logistics processes to complex global networks managing intricate processes. The evolved supply chain processes spanned from the products' raw materials phase to the very end of reaching the consumer, focusing on maximizing the customer's value. Before the 1950's the supply chain activities, to be more exact, logistics processes mostly referred to military terms. Specifically, the functions were related to equipment, personnel, facilities, procurement, maintenance, and transportation (Ballou, 2007, p. 332). By the 1960s, the trend started shifting from carrier by truck to transportation by rail. Shortly after, newly purchased ships became an even faster way of transporting freight. Computerization was launched around the same time, which boosted supply chain development in logistics planning, storage optimization, and building routes. A new name of supply chain

management emerged. Supply chain term, as a consequence, got introduced and widely accepted in the entire business world. As Ballou (2007) explained, many across a wide range of business fields seemed to embrace supply chain terms right away, seeing how they were already embedded in their activities (p. 337). The following eight key sub-processes were identified as representing the supply chain as a whole:

1. Customer relationship management;
2. Customer service management;
3. Demand management;
4. Order fulfillment;
5. Manufacturing flow management;
6. Supplier relationship management;
7. Product development and commercialization; and
8. Returns management (Ballou, p. 2007)

The supply chain was also perceived as a linear, functional view of the flow of processes, as described in Figure 2. The diagram shows materials, information, and finances flowing toward the customer, focusing on order fulfillment between the supply chain players (Kopczak & Johnson, 2003, p. 29).

Figure 2. Kopczak & Johnson, 2003, p. 29

Supply chains were not stagnant; they "have emerged to meet the diverse needs of human societies, to exploit natural resources and to enable humans to engage profitably in commerce and trade" (MacCarthy et al., 2016, p. 1697). Therefore, supply chains were going through the

stages in the lifecycle, which consisted of emergence, growth, maturity, and decline. Understanding all of these phases enabled the market to determine and emphasize the factors impacting supply chain evolution over time. MacCarthy et al. defined six factors that were of utmost importance in supply chain evolution (Figure 3.).

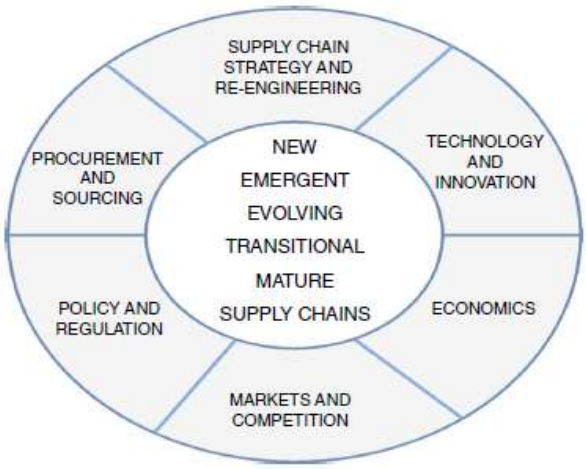

Figure 3. MacCarthy, 2016, p. 1708

These six factors played an essential role in determining why the supply chains were in one phase or another. Even though the level of impact of these factors varied, neither of them could have been singled out. As MacCarthy et al. (2016) explained, in general, these factors had a considerable impact on supply chain development, with varying timelines, phases, and effects (p. 1710). Consequently, this may have indicated why different organizations implemented different supply chains.

Supply Chain Globalization

In the early 1990s supply chain experienced rapid expansion into global markets as many post-soviet countries were branching out into the global economic system. Other countries started opening up their economies for the rest of the world (Soni & Soni, 2019, p. 242). In addition to that, the globalization of manufacturing that followed shortly introduced a new term

of the global supply chain. This was mainly related to manufacturing expansion to Asia. Additionally, the companies started facing a huge challenge in finding ways to reduce the cost of their supply chains with the markets growing (Milovanović et al., 2017, p. 32). To meet their expectations, the organizations moved their production and services to the countries with low costs, minimizing their expenses. The organizations started focusing on integrating multiple business processes throughout the entire supply chain. As Gundlach et al. (2006) stated, the researchers started focusing on integrating business processes throughout the entire supply chain and redesigning the chain to meet customer requirements better and improve customer service (p. 430). The scope of operations grew exponentially and became even more complicated, expanding supply chain operations across multiple countries and diverse control. More and more businesses started operating on an international scale, which meant expanding goods, services, and people worldwide. Companies expanded their presence globally mainly through mergers, acquisitions, and strategic alliances (Milovanović et al., 2017, p. 33). The scope of the supply chain at that point expanded immensely. As Soni & Soni (2019) defined, supply chains consisted of numerous levels of suppliers, manufacturing plants, warehouse and distribution centers, and retail locations that are geographically dispersed and linked by transportation routes (p. 243). The prevailing thought of that time dictated that organizations needed to be part of global supply chains to survive. Multiple factors such as globalization, outsourcing, and fragmented businesses made it imperative that the issues were approached from the perspective of the entire supply chain, rather than the more limited one of the individual organization (Kopczak & Johnson, 2003, p. 28). The constantly growing real-time information exchange introduced by information technology progress was another factor contributing to the global supply chain evolution. Globalization brought many advantages: it provided the opportunity to reach more customers in

new markets, allowed them to choose from many more suppliers worldwide, and expanded the scope of services and goods provided. As Kopczak & Johnson (2003) explained, businesses started integrating across companies rather than integrating within them as a way of coordination and improving supply (p. 28). This expansion ensured a stronger introduction in new markets and reaching new customers around the world. The expansion also meant a stronger focus on the flow of raw materials, finished products, services, expenses, and information, increasing the level of satisfaction of stakeholders, and consumers. Another important factor brought about with the globalization of the supply chain was shifting from supply focus to demand focus. People in operations faced a challenge in quantifying the impact of poorly understood and poorly managed supply chain performance on sales (Kopczak & Johnson, 2003, p. 30). Expansion globally also allowed the organizations to offer a larger selection of goods and services while increasing the pool of potential sourcing opportunities at the same time. Getting access to a larger pool of suppliers meant many simultaneous benefits. The organizations chose from many more suppliers in terms of better materials and advantageous prices. Whenever the companies acquired a large number of components from different markets, they also could use hubs, which reduced transportation costs drastically (Milovanović et al., 2017, p. 36). Globalization enabled organizations to understand the value of the product design as well. More and more companies started incorporating their partners and sub-supplier perspective into the product design at early stages. As Kopczak & Johnson (2003) explained, when retailer Dillard's collaborated with its manufacturing suppliers on its private-label apparel designs, sales grew, and product shortages decreased as the new products were rushed to market (p. 32). Supply chain globalization also provided the companies with opportunities for cost reduction and profit increase. As Milovanović et al. stated (2017), transportation costs could have been significantly reduced by

developing products that use transport equipment to their fullest capacity (p. 35). Globalization of supply chains also taught the organizations how to shift from mass-market to customized offerings. For example, Kopczak & Johnson (2003) highlighted IKEA, which used the build-to-stock strategy and increased inventories to dominate their build-to-order rivals (p. 30). With the supply chain expanding overseas, the organizations learned that the customers should provide tailored services and goods to satisfy their demands. Organizations learned that investing scarce resources in loyal, profitable customers effectively enhances long-term loyalty and profitability (Kopczak & Johnson, 2003, p. 32). More and more organizations started gravitating towards customized offerings as they realized that tailored customer experience builds customer loyalty and development. Figure 3 demonstrates the benefits of organizations applying customized offering scenarios.

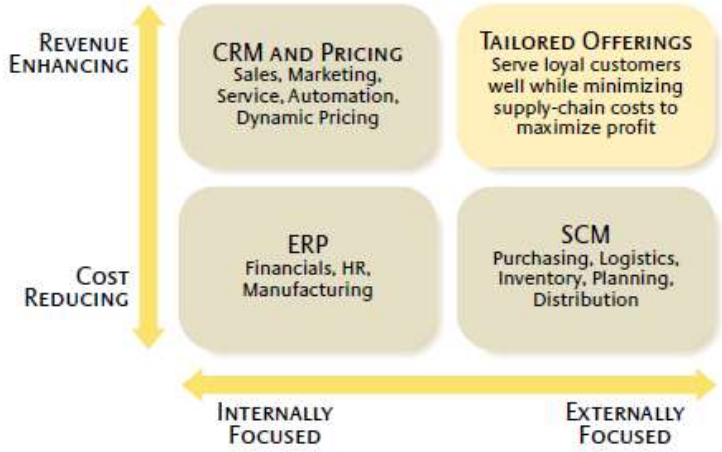

Figure 4. Kopczak & Johnson, 2003, p. 32

Because of globalization, the organizations discovered numerous opportunities for growth and development, which dramatically influenced the factors that determined organizations' success. Yet, the globalization of business was not a simple process. Focusing on globalization as the

processes bringing only positive effects, the companies failed to realize how complicated and challenging globalization was.

Global Supply Chains Risks

Exposure to the new markets meant greater reward but also exposure to greater risk, competition, and challenges. Multiple organizations leaped and expanded their supply chains globally, not fully assuming the danger they were undertaking. As MacDonald (2006) indicated, an increased number of the organizations started sourcing overseas directly or through their suppliers, with only a few opting not to sell their goods internationally (p. 66). With globalization introduced, it became apparent that even if the organization had only domestic suppliers, it should constantly research the opportunity to go overseas. Yet, not all businesses realized that when taking advantage of globalization, new risks would arise. Globalization introduced a high level of complexity into supply chains. As Savitz (2013) indicated, companies were outsourcing their business processes to globally distributed suppliers, making operational processes more complicated than simple supply chain processes before. When expanding globally, the requirement emerged to manage different modes of transportation, issues with ports coming into play, and the need for knowledge on tax and tariff information become of utmost importance. Because it is impossible to know how international shipping works for every country globally, the companies strategically had to leverage the contacts and experience of the logisticians established in different countries (MacDonald, 2006, p. 69). Yet all this required additional investments. Another critical aspect to consider was the lack of data. Operating with the information that the organizations had available for them at that time may not have resulted in the most prudent decisions. Globalization increased the companies facing or being impacted by more adverse events, such as natural disasters, political and economic uncertainty, supply

disruptions, and economic volatility (Savitz, 2013). Cultural differences, risk management, and security were among the other factors that the organizations did not seem to evaluate well enough before taking a plunge into expanding their supply chain globally. MacDonald (2006) was convinced that even though companies may have worked globally, tactical operations were often blending local and global (p. 66). Not to mention that several factors, such as visibility, technology, and flexibility, were significant facets of the supply chain to be managed regardless of whether it was global or domestic.

What is more, all of these three elements of technology, visibility, and flexibility were all tied to information flow, which made information management a key area of the supply chain (MacDonald, 2006, p. 68). Managing information flow, unfortunately, was drastically different in terms of domestic and global supply chains. As MacDonald (2006) emphasized, in North America, most industries were at a high maturity level of transferring information electronically (p. 70). Yet, the situation was different with operations in Europe and even more in Asia. It required significant investments in technology to maintain the necessary level of visibility. Expanding globally also increased the risk of information leakage as well-decreased flexibility and speed of operations conducted. The organizations were so fast to extend their supply chains globally that they underestimated all the risks. The supply chain stalled in multiple cases due to discounting these risks. Numerous factors were scrutinized and evaluated before defining the path for the company's supply chain. It was evident that there was no straightforward answer when deciding on these paths. One of the options for the organizations to choose was for a company's domestic supply chain to be managed as part of a global supply chain, depending upon its size and operational structure.

Regretfully, at the same time, domestic supply chains were unreasonably ignored. The companies were neglecting how much easier it would have been to leverage domestic supply chains that global suppliers could not match. The absence of freight forwarders, ocean/sea transportation, and customs factors provided the organizations a much higher degree of control over the suppliers' deliveries, shortened the transition times for the supplies to be delivered. Moreover, the domestic suppliers maintained the ability to address shortages much more efficiently than their global counterparts did. Another advantage of collaborating with local suppliers was quality control. International suppliers struggled to meet specific quality standards, and it became another challenge. Gray (2020) used one of the examples of sourcing cast steel parts from the seemingly great supplier in China. Once the first shipment was received, the engineers started conducting quality inspections and realized that some of the items were lighter than they should have been. "After a close examination, most of the parts had problems – which made the entire shipment unusable" (Gray, 2020). The outcome: time and expenses wasted on the dispute, time spent searching for a new supplier, downtime for the production throughout this process, consequentially halting all of the operations.

Additionally, the environmental and sustainability impact was much more challenging to manage when interacting with global suppliers. As Gray (2020) indicated, regardless of the fact that North American manufacturing protocols are not perfect, but regulations do exist to encourage contract manufacturers to run their businesses more responsibly. Ultimately, entering global markets mostly meant encountering a new set of risks and challenges that could have been crucial to the company's survival. Therefore, the organizations should have weighted their situation in the market to understand whether expanding globally or staying locally would be more beneficial for their business. Recent world events that caused significant delays in the

supply chain, contributing to extreme shortages and price increases, highlighted the need for alternate supply chain variations.

Global Supply Chain Constraints in Light of Recent Events

COVID-19 pandemic and Suez Canal blockage had a crippling effect on the global supply chain. In the past, natural disasters meant that the supply chains would resume upon restoration of the power. These recent events proved different: the supply chains must transform into more resilient and balanced.

An outbreak of COVID-19 in January 2020 disrupted nearly all of the businesses in various ways (Lawrence, 2020). The demands for specific products became unpredictable; the supply was abruptly interrupted, the travel restrictions, implemented instantaneously, changed the global supply chain processes immediately. Additionally, the far-reaching global impact of the pandemic was challenging to estimate. As Robinson (2020) emphasized, for years to come, COVID-19 will affect supply and demand, as well as the quality of products. Significant changes to the market will follow (p. 16). According to Robinson (2020), "in mid-June 2020, 21 million people in the United States remained out of work" (p. 16). Furthermore, industries such as auto, medical device, travel were crippled immensely, driving some of their operations to a complete stop.

Several factors affected almost all of the businesses. The lead time was one of them. As delivery times extended to unprecedented timelines, the quality of the supplies delivered suffered immensely. Consequently, the quality inspection standards increased, dictating even higher prices. Product availability became another bottleneck. Almost a national crisis has swept the nation as consumers fight over toilet paper, hand sanitizer, wipes, and masks (Robinson, 2020, p. 16). The stay-at-home requirements in some states have resulted in businesses ceasing their

operations, which created a shortage of specific product availability at the stores. Certain companies such as food supply establishments or beauty suppliers had to rearrange their operations to satisfy the existing demand instead of their regular business operations. For instance, thousands of restaurants have drastically changed their business models to sell their products curbside (Robinson, 2020, p. 17). Some manufacturing facilities had to reconfigure their business scope to make a profit by adjusting to current market demands. For example, while some auto manufacturers have temporarily shifted to making ventilators, others focus on making masks and gowns (Robinson, 2020, p. 17). All of these changes and adjustments demonstrated how flawed the global supply chain is. Therefore, different business organizations dealt with various challenges. As Lawrence (2020) indicated, managing legal and commercial risks with suppliers and customers can be a significant challenge for those who source, manufacture, and transport goods. Yet, the operations, purchasing, and sales teams should focus on redesigning their business operations and relationship with customers. Contracts relating to the services provided or products delivered need to review for shipping and delivery timelines, responsibilities, and variations. Organizations will analyze the detrimental impact of COVID-19, aiming to identify business continuity risks.

Primarily, the complexity of the current global supply chain proved to be one of the main culprits that the businesses ended up at. As Thalbauer (2020) indicated, almost all supply chains are still based on a transactional, reactive model, so when there is an unexpected spike or drop in demand, the ripple effect takes time to propagate through the multitier supply chain. Supply chains will require an extensive amount of time to regain the balance.

Another primary concern focuses on economies relying on foreign countries to supply the subcomponents for their products. Building a supply chain focused on global suppliers proved to

be one of the biggest culprits in the worldwide supply chain. The importance of sourcing and manufacturing has gained renewed attention, as have the efforts to reshore and revive domestic manufacturing (Sundblad, 2020). The local suppliers allowed the organizations to capitalize on proximity, saving expenses and time on transportation. After considering all the expenses, sourcing globally could no longer compete with domestic suppliers for cost savings. The higher margins dictated by the local providers create multiple benefits and wins in different areas. However, if speed and reliability were considered one of the significant factors valued by the organizations, the choices do shift drastically.

Workplace adjustment was another impact that COVID-19 brought into the global supply chain. Multiple employees were placed on involuntary temporary leave, asked to work remotely, or went through permanent job position changes. As Hansen (2021) observed when reporting results of the 2020 QP Salary Survey questionnaire, "in fact, more than 66% of respondents told us they anticipated the changes in their work environments would become permanent. Almost 15% said their job position had changed. Nearly 60% said their organization—when the crisis began—already had the technology in place to enable remote work, which seems fortunate." The workforce's ability to adjust is another aspect impacting the recovery of the global supply chain activities after the pandemic occurred.

Another event that disrupted many aspects of the global supply chain was the Suez Canal blockage caused by Ever Given running aground. It immediately drew international attention as one of the leading global trade flows went to an absolute halt. Analysts stated that a nearly weeklong Suez Canal closure revealed a new bottleneck for global supply chains already plagued by epidemic-related shipping delays. They suggested diversification, automation, and digitalization could make supply chains more robust (Spiegelman, 2021, p.1). As the ship was

stuck, the supply chain analysts started running scenarios of what impacts the material flow would incur. The event's timeline was highly unclear. It became impossible to predict when the situation will be rectified and its effect on the global supply chain operations.

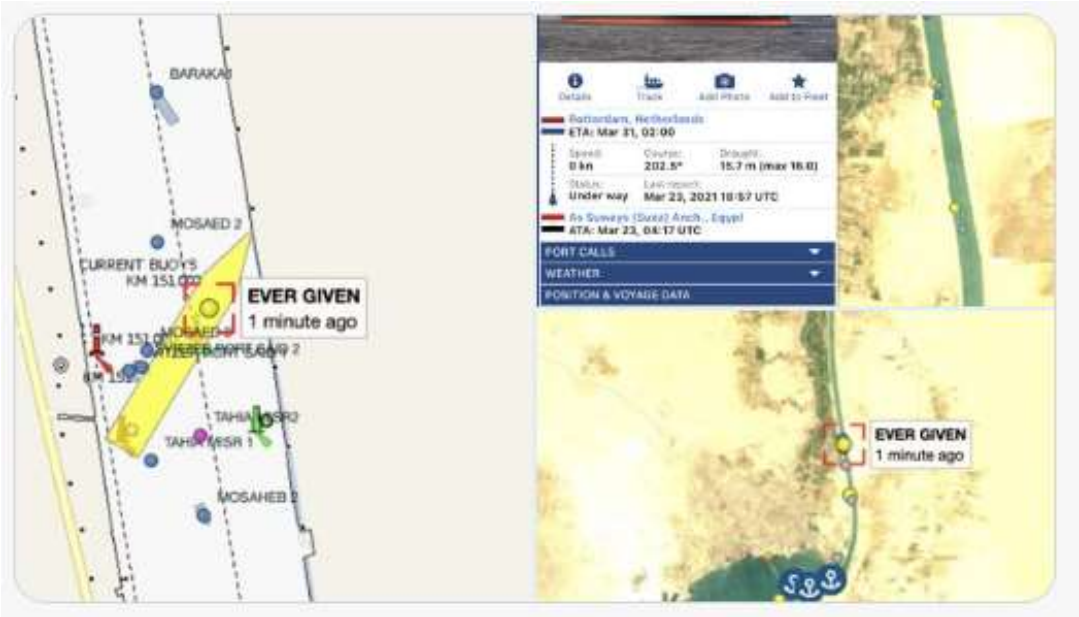

Figure #5. Position of the ship at the time of incident, retrieved from www.vesselfinder.com

When Ever Given lodged itself in the Suez Canal, and no effort immediately freed it up, after several consecutive days, the number of vessels on both sides of it started growing at an extremely high pace. With that in mind, the carriers attempted to reroute their vessels around the southern tip of Africa in an attempt to avoid Suez Canal. After multiple rescue tries and with more than 350 ships stuck in the canal, Ever Given was finally dislodged from the banks of the Suez Canal. The damage was significant. It took quite some time for the canal to get back to its regular routines. While the channel has reopened, the backlog of ships passing through may result in further delays in ports worldwide (Spiegelman, 2021, p.1). Suez Canal blockage just augmented the global supply chain issues as the ports were already struggling with the

overloaded and unplanned volumes fueled by pandemic consumer behavior. As multiple analysts noted, creating a more efficient, more resilient supply chain requires more than just localization and diversity (Spiegelman, 2021, p. 1). Businesses cannot rely on global suppliers to be able to conduct their operations successfully. Having alternate suppliers proved to be a necessity. Another factor emphasized by the Suez Canal blockage was that automation should become more and more prevalent in the world of manufacturing. Automating local assembly could reduce cargo traffic by assembling products locally (Spiegelman, 2021, p. 2). COVID-19 and Suez Canal accident, very different yet very similar in their effects on the global supply chain, highlighted how fragile the global supply chain is and emphasized the need to reinforce it.

Global Supply Chain Risk Mitigation Strategies

COVID-19 pandemic was a call for action. As Shih (2020) stated, "the supply shock that started in China in February and the demand shock that followed as the global economy shut down exposed vulnerabilities in the production strategies and supply chains of firms just about everywhere". Organizations should focus all of their effort and resources to ensure the global supply chain risks are mitigated to the minimal effect. Risks in the corporate world come from threats to the value that the stakeholders or owners have in the company (Mentzer et al., 2007, p. 320). Consequently, the risk for the global supply chain is defined by the course of movement of materials from supplier to the organization; it can also relate to the reliability of the supplier, or unintentional disruption of the supply chain, technology-related matter, or issues related to quality (Mentzer et al., 2007, p. 321). As Chopra & Sodhi (2004) indicated, the supply chain problems stem primarily from natural disasters, labor disputes, supplier bankruptcy, acts of war and terrorism, and other causes, which can halt or delay the flow of information, materials, or cash, and damage sales or increase costs (p. 53). Every organization should have a certain level

of preparedness for any of these possible disruptions. However, the management must understand both the underlying risk categories and the factors that bring them about before they can devise effective strategies for reducing supply chain risks (Chopra & Sodhi, 2004, p. 54). The following table presents supply chain risks and their main drivers (Table 2)

Category of Risk	Drivers of Risk
Disruptions	▪ Natural disaster ▪ Labor dispute ▪ Supplier bankruptcy ▪ War and terrorism ▪ Dependency on a single source of supply as well as the capacity and responsiveness of alternative suppliers
Delays	▪ High capacity utilization at supply source ▪ Inflexibility of supply source ▪ Poor quality or yield at supply source ▪ Excessive handling due to border crossings or to change in transportation modes
Systems	▪ Information infrastructure breakdown ▪ System integration or extensive systems networking ▪ E-commerce
Forecast	▪ Inaccurate forecasts due to long lead times, seasonality, product variety, short life cycles, small customer base ▪ "Bullwhip effect" or information distortion due to sales promotions, incentives, lack of supply-chain visibility and exaggeration of demand in times of product shortage
Intellectual Property	▪ Vertical integration of supply chain ▪ Global outsourcing and markets
Procurement	▪ Exchange rate risk ▪ Percentage of a key component or raw material procured from a single source ▪ Industrywide capacity utilization ▪ Long-term versus short-term contracts
Receivables	▪ Number of customers ▪ Financial strength of customers
Inventory	▪ Rate of product obsolescence ▪ Inventory holding cost ▪ Product value ▪ Demand and supply uncertainty
Capacity	▪ Cost of capacity ▪ Capacity flexibility

Table #2. Chopra & Sodhi, 2004, p. 54.

After identifying the events and the risk category, the management may develop a customized solution to address one or most supply chain risks. It is worth mentioning that these risks cannot be organically discerned in terms of attributing the causes to one or another group. Thus, the organizations must develop a process of risk management regarding the supply chain disruptions.

Without adequate measures to reduce risks, managers could adversely affect their ability to create efficient supply chains (Milovanović et al., 2017, p. 34). It is also essential to understand the domino effect of addressing one risk resulting in augmenting other risks. Increased inventory levels, for example, reduce the risk of delay in supply but increase the risk of obsolescence (Milovanović et al., 2017 p. 34). Therefore, once the organization determines its supply chain risk, a corresponding mitigation strategy can be chosen, allowing trade-offs between risks and cost increase from the table below.

Approach to reducing risks	*Specific strategies to reduce costs*
Increasing capacity	Focus on cheap, decentralized capacities for foreseeable demand. Build centralized capacities for unpredictable demand. Increase decentralization as costs of capacity fall.
Providing new suppliers	Favor larger number of suppliers in case of procurement of products in large quantities. Focus on a smaller number of suppliers in case of procurement of products in small quantities. Centralize procurement of products in small quantities from several flexible suppliers.
Increasing responsiveness	In the case raw materials, favor costs relative to responsiveness. In the case of short product life cycle, favor responsiveness in relation to costs.
Increasing inventories	Decentralize inventories of lower value whose demand is predictable. Centralize inventories of greater value, whose demand is less predictable.
Increasing flexibility	Favor costs compared to flexibility of products with high and predictable demand. Favor flexibility of products with low and unpredictable demand. Centralize flexibility to a small number of locations if it is expensive.
Aggregation of demand	Increase aggregation as unpredictability grows.
Increasing supply opportunities	Favor supply opportunity in relation to cost of products of high value and high risk. Favor costs in relation to supply opportunity of products of lower value.

Table #3. Chopra & Sodhi, 2004, p. 60

The most important aspect is to be prepared to mitigate the risk by compiling various forms of reserves that include inventory, capacity, redundant suppliers, and responsiveness. By balancing these scenarios, the organizations may have prepared for the significant factors impacting global supply chain processes and have as minimal impact as possible, translating into the minimized risk of loss, delayed orders, and reduced quality.

The strains created by these events created immense shortages of vital supplies, exposing problems that the current global supply chain is dealing with. From these examples, it is evident the supply chain is broken (Thalbauer, 2020). Yet multiple instances across the world are showing that the situation can be fixed. Several businesses have begun to repurpose their production, from brewing companies and distilleries making hand sanitizers to fashion brands making masks to automotive firms looking to make ventilators (Thalbauer, 2020). These examples demonstrate that the world does not stop even when calamities such as COVID-19 or Suez Canal incident occur. All that is needed is to regroup and recreate the global supply chain.

First and foremost, multiple quality tools exist that would enable organizations to rectify the results of pandemic and other force majeure and to address any other disruptions happening in the future. As Schvaneveldt & Neve (2021) indicated, the process decision program chart (PDPC), one of the quality management and planning tools, would be highly beneficial in this case (p. 27).

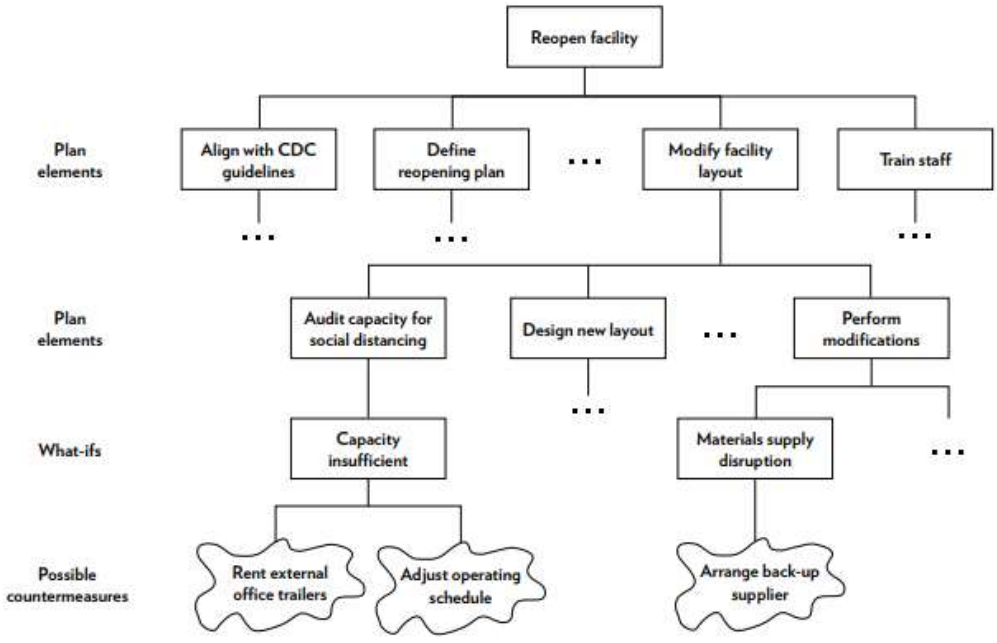

Figure #6. Schvaneveldt & Neve, p. 2021, p. 27

Using the chart, the organizations can develop a plan, identify possible risks and failure points, and create appropriate countermeasures and contingency plans to address them (Schvaneveldt & Neve, 2021, p. 27). This tool can be of great benefit when preparing for the uncertainty and ensuring more efficient communication of the plans derived by using the formats provided by the tool.

Another approach would be developing more robust business continuity plans. By now, many organizations have been developing business continuity plans that could be employed if an emergency happens. The current pandemic events and the Suez Canal incident are great examples of why organizations need a business continuity plan to protect their resources and the supply of products and services to the customers (Reid, 2020, p. 48).

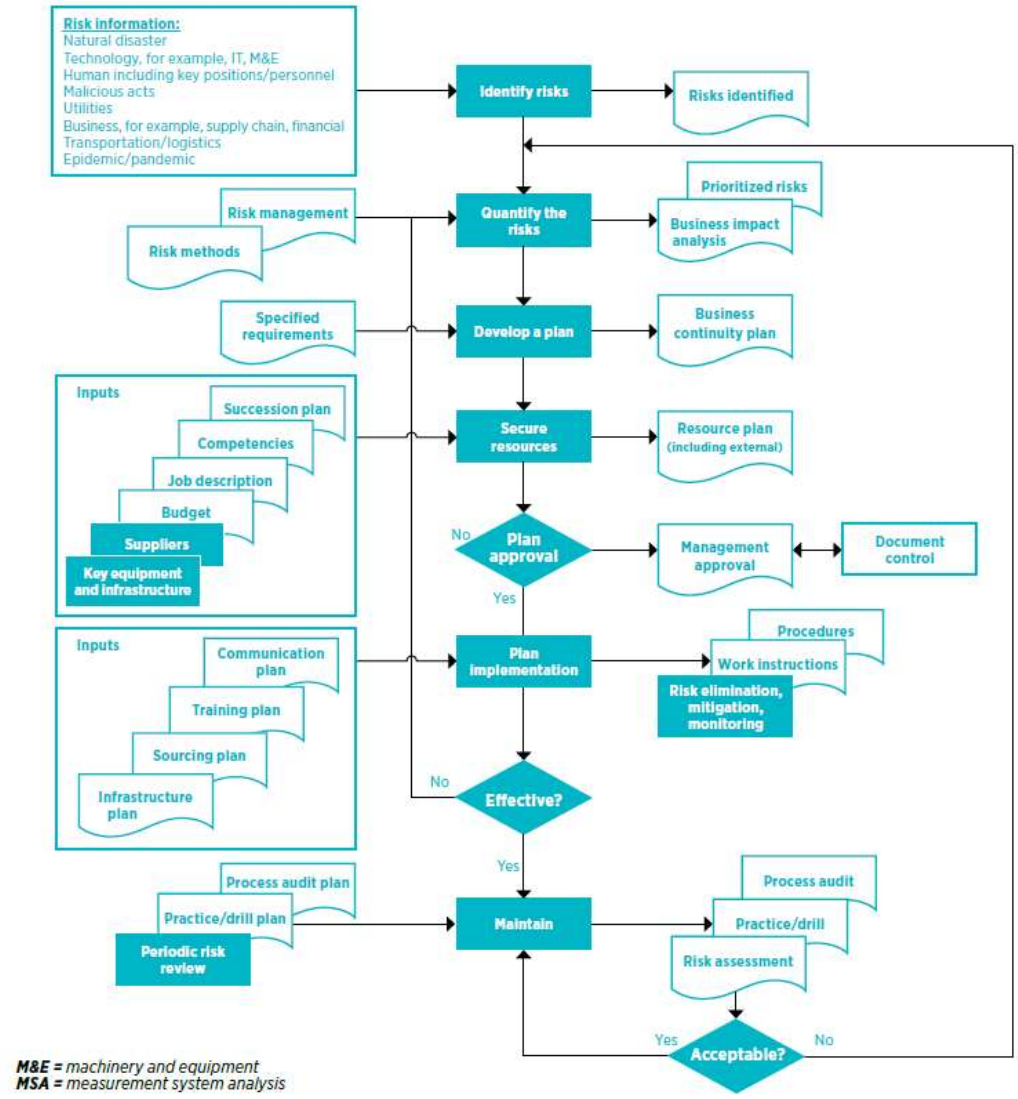

Figure #8. Reid, 2020, p. 49

According to Reid (2020), suppliers must periodically review contingency plans for effectiveness and conduct contingency plan reviews at least annually with the help of a multidisciplinary team comprised of top management (p. 50). Another aspect of maintaining a business continuity plan is to ensure the employees in organizations are familiar with its details and know what steps should be taken in the case of an emergency according to that plan.

In the wake of the recent events, the organizations have to develop a sense of adaptability to prepare for any disruptions constantly. The supply chain needs to be scrutinized and tested to

ensure no weak links exist in the immediate supplier or the upstream tier. Therefore, it is crucial to invest time and resources ensuring the supplier network is impeccable or diversified to withstand business interruptions. As Ramu (2020) stated, delays in the supply chain across value streams could impact turnaround times and raw materials for subsequent stages (p. 51). All of this creates a risk for business operations. It is critical that organizations take every opportunity to develop, implement, test, and continuously improve their ability to detect essential disruptions and identify risks (Ramu, 2020, p. 52). All of the recent events highlighted that every measure should be considered to ensure that the organizations prepare for any disruptions. One cannot predict the disruptions but can undoubtedly prepare to react to them when they occur. Multiple tools and scenarios exist to enable the companies to mitigate and minimize the impact of these disruptions. Thus, to ensure uninterrupted supply chain processes and the needs of society are satisfied, the supply chain needs to be resilient and redundant to withstand any of the situations arising (Sundblad, 2020).

Conclusions

The general recommendation for the global supply chain would entail reviewing the current processes with the strong attempt to perceive the entire end-to-end supply chain aiming to uncover the vulnerabilities and risks and derive a well-balanced supply chain. The analysis should scrutinize immediate suppliers and suppliers up the stream to ensure consistency and build a well-knit network. The organizations would then need to identify their biggest vulnerabilities and build a contingency plan capable of withstanding any disruptions further down the road. Building a new global supply chain would also necessitate ensuring diversified suppliers across the globe with a strong base of alternates within the domestic market. Even though the low-cost labor was of the main drivers for the organizations to expand globally, it is

no longer a valid or sole argument. As Gray (2020) indicated, from a cost standpoint, North American production - especially in the low- to the mid-volume range - is becoming more competitive. The cost of tooling and parts is within 10 percent of what it is overseas. While the price is of utmost importance for the business, organizations must work toward multiple other ways of winning the market. Technology stands out as one of the most important factors. Promoting manufacturing technologies that focus on innovation and automation will ensure efficient, secure, and reliable supply chain processes. Since centralized supply chains proved to be incapable of withstanding the disruptions, the balance between global and local within the supply chains will require review and re-invention.

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