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Supply Chain Disruption in the Aftermath of the Global Pandemic- A Discourse

Dr. David Annan[1]
School of Business,
Swiss School of Business and Management Geneva, Switzerland

Abstract:- This study explores the factors contributing to post-pandemic supply chain disruptions and risk and recommends improving resilience and collaboration. The danger of supply chain disruption has significantly increased in recent years (post-Covid-19), and firms' supply/demand network needs more robustness than ever. The emphasis on adaptability, flexibility, and collaboration to achieve greater resilience is discussed in the paper. This will call for new approaches to working across organizational frontiers.

Keywords*: Collaboration, Supply Chain Network, Supply Chain, Pandemic, Supply& Demand Risks, Supply management, Resilience, Mitigation.*

I. INTRODUCTION

The ripple effect of the covid-19 has devastated the landscape of the supply-chain industries across the globe and increased the risk of confronting supply chains. World supply stability and predictability are characterized by super turbulences and uncertainty that constantly trajected potential disruptions to almost all business activities.

While natural disasters and conflicts are changing the geopolitical landscapes and cannot be ignored, such as the recent war between Russia and Ukraine that is tearing the world apart with constant disruptions and the most significant risk to most industries, especially in the natural gas and oil industries, these debacles are systemic. Business leaders must constantly carry the burden of making efficient managerial decisions to mitigate the risk of supply-chain disruptions.

This indicates that the current business environment has become unpredictable and unstable. Current global circumstances have made business planning a usual standard of practice null and void, as there has to be a second or contingency plan months or years ahead. The forecast-driven passion of business now has to guess second in projecting future demands as the standard set and rule traditional system of the business forecast cannot work if the environment is unstable. As a result, companies like Badishe Anilin und Soda Fabrik (BASF) and many companies in the supply chain have become volatile and are seeking new avenues of joint ventures to sustain themselves soon as the revenue has suffered a downward slope in last quarter of 2022.

Hence, many institutions that were dependent on supply chain networks designed some years back when the global business was stable and was confident that it would remain the same in the past got their nail bitten by the current disruptions.

II. UNDERSTANDING SUPPLY CHAIN

This paper's discussion cannot go on without a few definitions and ideologies from various authors. Christopher posits that the supply chain is: "(…) the network of companies engaged in the various processes and activities that create value in the form of goods and services in the hands of the final customer through upstream and downstream connections" (Christopher 2011). It indicates that the supply chain concerns many fronts, from the flow of materials and information to a perspective from the Council of supply chain management and Professionals (SCMP, 2013). Hence, firms that outsource materials and sell products have one or more supply chains linked to the business. There is a supply chain management that puts together all the planning activities involved in sourcing and procurement, where all logistics management requires coordination and collaboration with all partners, which can be suppliers, service providers, or customers.

Supply Chain Management is an integrated function that links creating a coherent, high-performing business model by integrating key business processes and functions both within and between businesses. All logistics management activities and manufacturing operations drives coordination of processes and activities with and across marketing, sales, product design, packaging finance, and information technology (CSCMP 2013).

However, the post-pandemic disruptions have indicated one prime factor of the modern supply chain: they operate in an environment heightened by business uncertainty and risk. The continuous Covid-19 has made the current supply chain more vulnerable to disruptions such as natural disasters, hurricanes, floods, and earthquakes, which often trigger tragic consequences and capture media nuisance. A typical example is the Evergreen incident in the Sue Canal in 2021. The recent flooding in Florida (USA), where many companies shut down and evacuated, and the current Russian-Ukraine continuous war which have impacted the world and the supply chain. World oil prices have escalated, and global consumption of goods and services is not an exemption as consumers cannot afford the

increases in prices of goods and services. What is often left to recognize is that much of the risk to supply chain progression is created by decisions taken by business managers and stakeholders when designing and determining the supply channel. It cannot fall far from threat as systemic within the supply within the business rather than the wider business environment. An indication that the scope and shape of the supply risk profile are mostly emanated from managerial decisions and not just external risk exposure.

The naked exposure of the current supply chain comes from many fronts as risks are clear, and some of the reasons are below:

Covid-19 has exposed the globalization of the supply chain—a swift to offshore sourcing, manufacturing, and assembling from the local-to-local manufacturing and marketing strategies. The geopolitical exposure and exchange rate changes are more viable as the supply chain can be extended from one country to another.

Many companies have worked tirelessly to increase the effectiveness of their supply chains by focusing on just-in-time management and streamlining their processes. While undoubtedly of merit in stable market conditions, this approach may become less viable as volatility in the business environment increases.

More importantly, the managerial decision has made many organizations focus on centralization distribution to capture economies of scale. The businesses have centralized their distribution and simplified their production operations. As a result, instead of numerous smaller and usually domestic manufacturing facilities and storage facilities serving regional markets, such firms increasingly attempt to service worldwide demands from fewer but larger locations. Hence, if one of those facilities fails, the threat to the system escalates.

The rippled effect is that today's supply chain has become more complex and complicated. More work is needed than in the past when the traditional forecasting system was enough and produced results for companies. Today, companies like V.W. and General Motors (G.M.) is a different business that relies on thousands of independent suppliers and partners in many countries. As a result, the potential for unexpected events to impact any of the myriads of nodes and links in the system and disrupt its continuity is increased.

- *Supply Chain Network*

The phrase "network of organizations involved, through upstream and downstream linkages, in various processes and activities that create value in of products and services in the hands of the ultimate consumer" is a commonly used description of a supply chain" (Christopher, 1992).

Since supply networks are known to be complex webs of linked entities rather than simple linear lines, it is essential to understand the idea of a network. These organizations frequently operate autonomously and independently and do not continuously pursue the same objectives. These supply and demand networks might be considered "ecosystems" or complicated adaptive systems since they constantly alter and respond to their environment. Because of this, managing these intricate networks is challenging, if not impossible, and their behavior is uncertain.

Furthermore, the broader geopolitical environment creates an unpredictable backdrop against these complex systems. For instance, some regions are becoming more vocal in their calls for a change away from the doctrine of free trade and toward greater economic sovereignty. The United Kingdom's choice to leave the European Union and President Trump's election in the United States, which led to the nation's withdrawal from the Trans-Pacific Partnership and renegotiation of the NAFTA agreement, are recent examples of this trend. Even though it is difficult to predict how these and other international shifts will play out, their potential impact on the world's economic environment cannot be denied.

- *Supply Chain Collaboration*

Collaboration within the supply chain has grown and was previously disregarded as crucial. Organizational leaders aim for greater supply chain cooperation to reduce unpredictability, lower transaction costs, develop core competencies, optimize learning opportunities, and enhance competitive standing. To do this, they utilize the resources and expertise of significant vendors and cherished clients (Cao, et al., 2010).

Collaboration in the supply chain implies that more than one part of the network manages or implements practices and processes (Chang & Graham, 2012). The supply chain will work effectively from the original supplier to the end consumer when leaders establish and keep vertical connections between organizations in the supply chain (Hearnshaw & Wilson, 2013).

The speed of the delivery line is critically dependent on communication (Gligor & Holcomb, 2012). The ability of supply chain partners to work together can also lead to better planning and teamwork, directly affecting supply chain agility. Corporate executives can improve supply chain procedures and combine and connect their businesses for better working performance thanks to collaboration partnerships (Soosay et al., 2008).

Leaders of companies in a collaborative relationship are open to sharing crucial information about danger and events that could cause a disturbance (Juttner & Maklan, 2011). In addition, joint partnerships influence (a) exposure, (b) recovery, (c) structure, (d) flexibility, (e) prediction, (f) security, (g) marketplace, and (h) contact with external organizations (Pettit, Fiksel, & Croxton, 2010).

Information sharing and coordination among supply chain participants is an effective strategy for enhancing worldwide performance. Sharing information has aided supply chain cooperation in (a) decreasing unnecessary inventory, (b) eliminating stock-outs, and (c) reacting to demand surges (Zhou & Piramuthu, 2013). Li et al., (2012) conducted an exploratory case study using data collected from U.S. manufacturing organizations to investigate the relationship between logistics providers and manufacturers and discovered that manufacturers will commit to a long-term relationship if they believe the logistics provider is honest, passionate, and cares about their business.

All participants in the supply chain must cooperate to thrive in a global environment, leading to higher market revenue and higher-quality products with shorter lead times (Chan & Prakash, 2012). Collaboration is one of the most crucial components of using supplier networks as a strategic advantage.

Increased dialogue and information exchange between companies can lead to a higher degree of confidence and enhance working relationships (McDowell, Harris, & Gibson, 2013). Furthermore, contact between companies improves supply chain coordination and integration. Improving supply chain cooperation and collaboration includes (a) computerized interactions for purchase orders and invoices; (b) demand forecasting, manufacturing, and planning; and (c) stockpile replenishment strategies (Bandyopadhyay et al., 2010).

However, the interaction between supply chain groups is directly impacted by employees' relationships at their places of employment. Getting a competitive advantage in the business environment through (a) expanding economies, (b) entering new markets, and (c) getting market supremacy requires effective communication between businesses (Sambasivan et al., 2011).

Long-term partnerships help reduce supply chain uncertainty and disruptions (Sheffi & Rice, 2005). However, when a partner has had prior troublesome relationships beset by risks due to supply unpredictability and supply chain interruptions, the depth of relationships within the supply chain may be superficial. The degree of confidence and relationship dedication among supply chain stakeholders is closely related to the degree of supply chain unity (Park et al., 2012).

III. RISKS IN THE SUPPLY CHAIN

The more interconnections and inter-dependencies in a supply/demand network, the greater the likelihood of contagion risk. Contagion risk can be defined as the possibility for a failure in one part of the network to have a knock-on effect across the network as a whole. Thus, in the same way, a loss of financial institutions to control sub-prime lending of mortgages, primarily in the United States of America, led to the global financial crisis of 2007/8, so too can the failure of one upstream supplier cripple an entire supply chain.

One source of contagion risk is in the design of the network itself. Decisions to reduce the supplier base, for example, and to a single source, the procurement of materials and components can mean that the impact of a failure at a single node will reverberate across a company's entire product portfolio. Thus, the growing trend in the car industry to standardize platforms, sub-assemblies, and components across all of the company's models can lead to disruption in the case of a faulty part. This was the cause of many of the product recalls experienced by Toyota in recent years.

- *Supply Risks*

Risk is always evident in the supply chain, even long before COVID-19 and the current global war emanated. It is not always clear that most businesses are not fully aware of their vulnerability and the details of their upstream supply chains, which are becoming more focused on global trade and the invisibility of the bare hand from managerial decisions. Most businesses understand their suppliers well and do not know the mitigation risks the upstream suppliers engage in and can be left in the cold.

The lack of visibility and transparency in the meat supply chain meant that it was only by chance that this contamination came to light. A detailed understanding of all upstream sourcing arrangements and a more proactive approach to supplier management are required to mitigate supply risk.

- *Demand Risks*

Even without the advent of recent debacles, the markets for products have remained uncertain over the past centuries, where it was relatively stable to kaboom- the business environment has been volatile, more complicated, and uncertain nowadays. This unstableness has brought silent changes in the demand for products and services, which can expose the nakedness and put less agile firms at a greater risk of product obsolescence and the more difficult loss of sales through crazy out-of-stock situations on the other hand. Hence, the widespread adoption of sometimes lean management practices has often led to a reduced amount of slack in the system in the form of buffers of inventory and capacity, which can result in higher risk for many firms. Therefore, businesses must focus on proper data analytics to provide insight into the current market trends and propel firm readiness to respond to shifts in demand.

- *Process Risks*

Process dependability is unquestionably essential to supply chain continuity. Processes must be kept under control to keep variations to a minimum. Variation is an issue in any method because it suggests uncertainty. To find and eliminate causes of process variability, the Six Sigma methodology should be used. The procedure uses several instruments, many initially designed for quality control.

Six Sigma is a data-driven continuous improvement methodology that seeks to control processes and improve process capability.

- The Approach Adheres to the Five-Stage DMAIC Pattern Outlined Below:

✓ *Define:* What are we attempting to improve?
✓ *Measure:* What is the process's present capability? What is a typical achievement, and what variability exists around the average?
✓ *Analyze:* Map the process, conduct a cause-and-effect analysis, and prioritize actions.
✓ *Improve:* Reengineer and simplify the procedure as much as feasible.
✓ *Control:* Make process success more visible. To measure variability, use statistical process management.

➢ *Control Risks*

It is imperative to mention that a few questions must be asked if the firm wants to mitigate risk, especially in controlling risk.

- Do we have the tools to guarantee accurate performance monitoring throughout the supply chain?
- Do we have early notification mechanisms to notify us of potential problems? How current is the information we use?

Keeping track of the intended order of events along a supply chain and documenting any deviation from that plan is known as supply chain event management (SCEM). By using SCEM processes effectively, control risk can be reduced. Internet-based SCEM reporting systems and, it is hypothesized, blockchain technology may make it possible to connect even widely separated partners in international supply chains. 'Cloud'-based computer systems also make it possible for independent organizations with various information systems to share data easily.

SCEM allows organizations to take an active rather than a passive strategy to supply chain risk by increasing visibility upstream and downstream of their operations. The progression from the conventional, constrained purview of supply chain visibility to the planned objective of an "intelligent" supply chain information system is depicted in Figure 1 below.

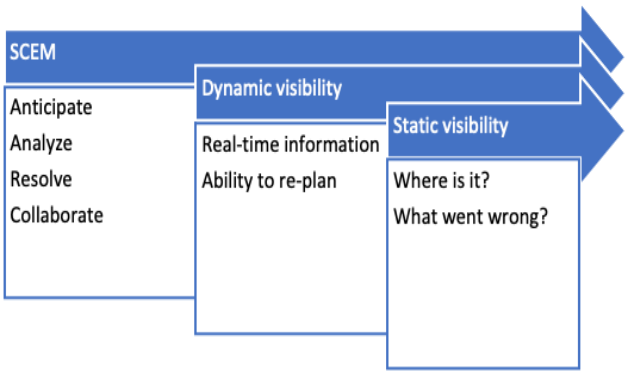
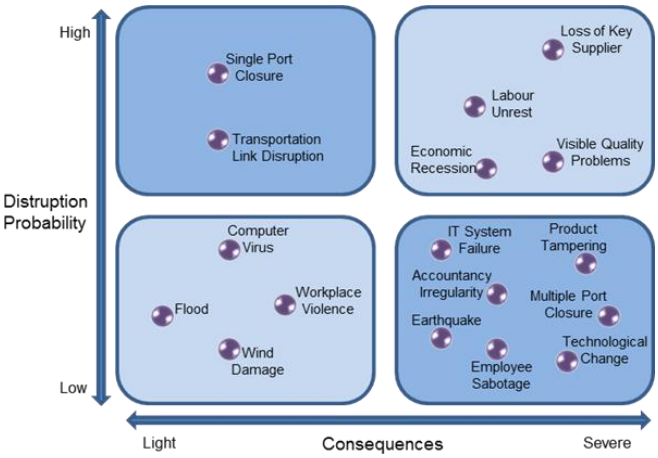


Fig 1 Progression of SCEM

➢ *Environmental Risks*

Where are we most susceptible to outside influences across the entire supply chain? Even though it may be impossible to predict the exact nature and timing of severe exterior events, their effect must be considered. It is occasionally suggested that businesses classify specific disturbing events based on their probability of happening and their potential effects on their operations. An illustration of this strategy is the grid below.



Source: Sheffi and /Rice (2005)

Fig 2 A Vulnerability Map for a Single Company

Although it may seem as though the high probability/severe consequence region should be the primary focus, the most prominent danger may come from low probability/extreme consequence events because it is difficult, if not impossible, to predict when they will occur. An illustration of this would be the 9/11 assault on the Twin Towers in New York and the impending territorial conflict between Russia and Ukraine.

Organizations should perform "stress testing" on their supply chain design even though it is impossible to predict these extreme occurrences. The concept is to examine the supply/demand network as a whole and pose the following query for each node and connection where disruption may affect an organization. To develop a resilient supply chain, it is crucial to maintain a routinely updated risk registry that examines all five sources, as mentioned earlier, of risk.

IV. GRAVITATIONAL CHANGES

The combined impacts of the "pull" of different factors on the demand side and supply side of the company decide the "center of gravity" of every supply chain. The resulting center of gravity impact choices regarding the placement of factories, the sourcing of materials, and the positioning of critical inventories. Figure 3 below suggests that some important issues must be weighed within the balance when making decisions about supply chain design.

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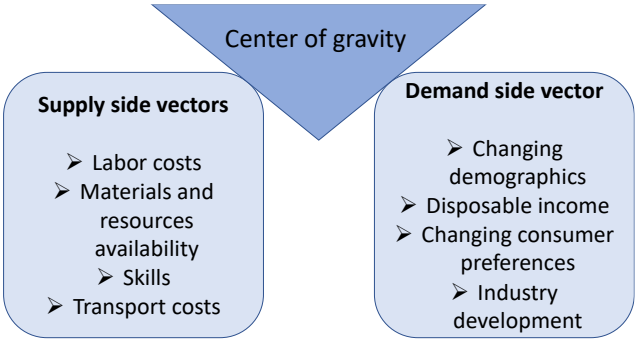

Fig 3 The Center of Gravity is Shifting for Supply Chains

➢ *Demand Gravity*

- *Demographical Changes*

Some worldwide markets are expanding more quickly than others due to population development dynamics and shifting age profiles. Similar to how some nations are aging while others are young, this influences how people invest their money.

- *Disposable Income*

The relative increase in purchasing power across nations is undergoing a significant shift. The developing countries are outspending traditional Western markets, which once controlled most global spending. For instance, Unilever now states that developing nations account for more than half of its revenue.

- *Consumer Preferences*

The spending pattern changes as people shift from predominantly agricultural to increasingly urban and as discretionary income increases. The massive growth in car demand in China and India illustrates this well. Dietary changes are now occurring in many developing countries, increasing demand for dairy and meat products.

- *Development Industry*

Trade movements and the demand for raw materials have been significantly impacted by the substantial change in manufacturing production toward low-cost countries and away from Western economies. Many companies today struggle to serve these quickly growing markets while keeping a footing in stagnant or declining markets.

➢ *Supply Gravity*

- *Labor Cost*

The desire to benefit from lower wage costs has driven many procurement decisions in recent decades. The so-called "low-cost country sourcing" aims to improve competitiveness by producing or sourcing in regions where labor costs are significantly lower than in more traditional areas. However, wage inflation frequently erodes what once significant disparities in labor costs were. Similar to this, new nations have emerged that might qualify as low-cost nations.

- *Resource Availability*

Rising demand and, in some instances, decreasing supply can significantly impact the availability and prices of these crucial input variables. Some established manufacturing firms are becoming increasingly aware that they must re-evaluate their present supply chain structures because production metrics that thrived in the past may no longer apply. The availability and expense of critical raw materials and resources like metals, energy, chemicals, and other goods inexorably influence location choices.

- *Skills*

As sectors become more knowledge-intensive and reliant on particular skills and capabilities, access to them becomes increasingly important. Even during high unemployment, many industries experience talent shortages, such as information technology experts, software designers, and engineers. Whereas the Western world once led in supplying these skills, this quickly changes as education and training levels in freshly developing countries rise.

- *Transport costs*

Because most modes of transportation still rely on oil-based gasoline, rising oil prices will inevitably affect transportation expenses. The oil expense was a fraction of today when many supply networks were established. For example, in December 1998, a barrel of petroleum oil cost about USD 9.64 (United States Dollars); ten years later, in July 2008, it reached an all-time peak of USD 147.27 (Christopher, 2012). Since then, the price of crude has been highly volatile, and it is presently on an upward trajectory. The future of transportation-intensive supply networks does not appear promising.

- *Sustainable Structural Flexibility*

Many companies have used specific supply chain solutions, such as factories, delivery centers, supply agreements, and so forth, that are frequently created for a predetermined time. Reconfiguring the network as circumstances change may be difficult as a result. Structural adaptability is quickly changing a supply/demand network's structure.

- *Enablers of Structural Flexibility*

Perhaps the most critical enabler is a company culture and "mindset" that is receptive to change and is comfortable with frequent adjustments to procedures and working practices. However, it is also the one that is hardest to accomplish. Additionally, there needs to be a desire to actively develop "win-win" alliances across the supply chain due to the wheels of structural flexibility described below requiring extreme levels of cooperative working across organizational borders. Creating a collaborative working style that applies to the entire business is feasible.

The Main Elements that Provide Structural Flexibility are as Follows:

✓ *Visibility and Info Sharing*

Having vision from one chain to the other is crucial. It is critical to be able to envision both upstream and

downstream shifts that are approaching. Sharing information offers a strong foundation for creating cooperative working partnerships throughout the supply chain.

✓ *Access to Capacity*

Accessing extra capacity as needed is a crucial enabler of adaptable supply chain management. Here, accommodation includes not only production but also transportation and storage. Furthermore, that capacity might not belong to the company in issue; it might originate from network partners, outside providers, or rival businesses.

✓ *Access to Knowledge and Talent*

A significant issue for organizations today is ensuring they have access to information regarding the possibility of product and process innovation, given the rapid rate of change in both markets and technologies. Access to those capable of using that information is equally important. Technology-sharing deals and "open innovation" is quickly getting traction. Once more, businesses are looking increasingly to outside skills and information sources to give them the adaptability they need.

✓ *Network Orchestration*

The need for network coordination emerges because achieving greater levels of adaptability typically necessitates inputs from various other organizations in the more extensive supply/demand network. As supply networks become more "virtual" than "vertical," coordination becomes increasingly important. It makes no difference who handles the orchestration task—the company in-house, a specialized outside logistics service provider, or a Fourth Party Logistic Model (4PL)—the capacity to organize effective networks and synchronize operations among their hubs and connections is crucial.

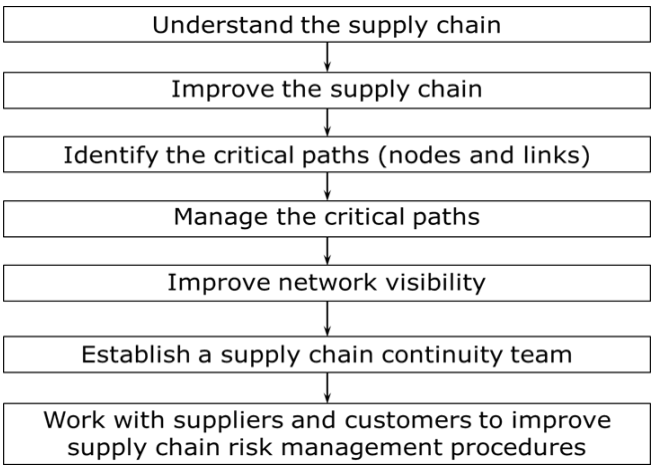

Fig 4 Managing Risks (Adopted Christopher 2012)

➢ *Mitigation of the Supply Chain*

Many firms are crippled due to a lack of awareness of the broad supply/demand factor network. Not to mention that many organizations often understand the downstream routes of the market, which is always the opposite of what lies in the upstream of suppliers since suppliers are often dependent on themselves on different levels of tier suppliers for their progression.

One company that has invested a significant amount of resources in improving its understanding of upstream risk is Amazon, a multifaceted company distributing different product lines. The business has created a tool for monitoring supplier performance that frequently evaluates potential problems with their direct suppliers and reports on potential or actual issues with second and third-grade suppliers.

This degree of supply chain knowledge is required if the risk is to be mitigated and managed. For complicated supply networks or where complete network mapping is impractical, it is sufficient to focus on the 'critical routes' - how these are recognized is dealt with later.

- *Improve the Supply Chain*

Risk in the supply chain can be increased by process uncertainty in several ways. Variation suggests a state of instability with unpredictable results. Reducing variability in supply chain operations can be accomplished by utilizing the Six Sigma approach. They enhanced process dependability, decreased process unpredictability, and simplified the process. It is accurate to state that supply networks for long-standing companies have not always been planned or constructed holistically. Instead, they have grown naturally in reaction to the opportunities and needs of the present time. Instead of selecting suppliers based on their reliable supply networks, buyers may choose them for their capacity to meet price demands.

- *Identify the Critical Paths*

Supply networks are a complicated matrix of linked points and connections. The nodes represent the buildings or organizations, such as suppliers, distributors, manufacturers, and storage. The relationships between the hubs are made possible by links, which can be either physical, informational, or financial movements. The possibility of these hubs and connections failing determines how vulnerable a supply network is.

As there will potentially be thousands of nodes and links, the challenge to supply chain risk management is identifying which are 'mission critical' paths, such as a single supply source with no short-term alternative. Also, it could depend on a specific infrastructure, e.g., ports, transport modes, or information systems, or the High levels of identifiable risk (i.e., supply, demand, process, control, and environmental risk).

- *Manage the Critical Paths*

The node and connections must be addressed for the risk to be mitigated. At its most basic, this phase should entail creating backup plans for actions to be done in the event of failure. On the other hand, it might be essential to reengineer the supply network. Statistical Process Control (SPC) should be used wherever feasible to monitor the pipeline's crucial phases.

It is essential not to neglect that bottlenecks can cause a problem in the decision that must be swiftly made with alternative options, such as holding inventory from key suppliers constrained by capacity. If quick access to

alternative sources is not possible, it will be essential to conduct strategic inventory management to keep the movement through the downstream nodes intact.

- *Improve Network Visibility*

Several delivery networks experience poor visibility. Problems in this scenario frequently take weeks or months to surface, so it may be too late to take appropriate action. Create a supply chain "control tower" to solve this issue. The concept behind the control tower is that to ensure that intended events and outcomes occur as intended, intricate global supply networks must be continuously watched methodically and formally. The supply chain management tower will also provide information on inventory amounts, transportation wait times, supplier performance, etc. The control tower's primary goals are to improve supply chain awareness and act as a foundation for better decision-making.

We previously discussed the possibility of supply chain event management (SCEM) to improve the detection of unexpected events (or the non-occurrence of planned events). These tools can significantly reduce supply chain uncertainty, reducing the need for extra inventory reserves. Radio Frequency Identification is another new technology allowing significant gains in visibility (RFID). RFID tags create a supply chain's track and trace capability. Labels can be either active or inactive. Scanners read passive tags as they travel through the network, while active tags send data to receiving locations. As the cost of these tags decreases and more organizations demand them from their vendors, the adoption of this technology will increase.

- *Establish a Supply Chain Continuity Team*

All the preceding phases of the supply chain risk management method necessitate the expenditure of resources. One approach is to form a dedicated supply chain continuity squad.

Many businesses already have business continuity teams, but their emphasis is often confined to information technology (I.T.) / information systems (I.S.). Other companies assess risk primarily from a money standpoint. All these activities are essential and required. However, the point here is that the scope of these teams should be expanded to account for the reality that the most significant risk to business continuity resides in the broader supply chain.

To guarantee that supply chain risk management is given top precedence, the team should report to a board-level executive, preferably the Supply Chain Director or Vice-President, if that individual is on the board.

- *Work with Suppliers and Customers*

Ideally, a much more robust supply chain would develop if each organization in a network took ownership of adopting the risk management practices recommended here with their immediate first-tier vendors and clients.

There are some excellent examples of collaborating with suppliers and customers to understand the potential vulnerabilities in specific industries better. This approach is akin to supplier development, widely adopted in the automotive sector, such as Tata and Mahindra in India.

The same procedure could be used in supply chain risk management by forcing suppliers to control and watch their supply chain vulnerabilities. Each supplier would collaborate with their first-rank suppliers to adopt supply chain risk management practices, potentially creating a "snowball effect."

- *Achieving Supply Chain Resilience*

The capacity of a system to return to its initial or intended condition after being disturbed is referred to as resilience. Resilient systems are adaptable and agile, and they can adapt rapidly. In this regard, it is critical to recognize that velocity alone is insufficient; acceleration, or the ability to scale up or down rapidly, is vital for resilience. Supply chain robustness necessitates 'slack' at crucial spots that serve as restricting factors for shifts in flow rate.

One approach to thinking about supply chain resilience is to divide it into two parts: resistance and recovery. Resistance alludes to the supply chain's ability to withstand the shocks that will undoubtedly occur. Consider it a function like an impact absorber in a car. We may strike a rut while traveling, but the shock absorber dampens the impact on the driver and occupants. Recovery relates to the ability of the supply chain to get back on its feet quickly after a disruptive event.

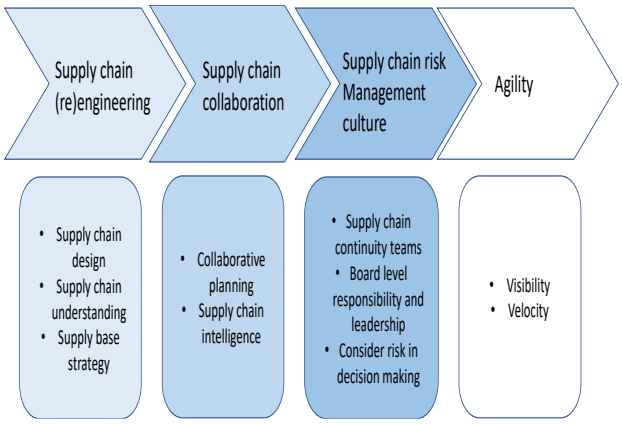

Fig 5 Creating Supply Chain Resilience

- *Supply Chain (Re-) Engineering*

Risk in the production line is mainly systemic. The present supply chain architecture may result from numerous choices made in the past. As a result, choices to centralize production or combine smaller regional delivery centers with local warehouses will probably result in lower system costs overall but may negatively impact the company's risk profile. Resilience will be improved if supply chains are built, whenever feasible, to prevent dependence on a singular facility or source of supply. Consolidation and centralization result in cost savings. The "architecture" of their existing supply/demand network must be understood

by organizations looking to build a more Supply chain collaboration.

A high degree of cooperation between supply chain partners is a crucial factor in robustness because of the interdependencies in worldwide supply networks. Because accessibility and shared information are essential to developing a robust supply chain, fostering a collaborative atmosphere is extremely important. We have already talked about how supply chain event management keeps an eye on crucial supply chain milestones to look for departures from the schedule. If supply chain partners are ready to share information, efficient event management will be feasible. Sharing information among the various supply chain participants may also decrease "bullwhips," which amplifies disruptions because perception is poor.

If the significant actors in a supply chain are willing to get together and share their knowledge and ideas about potential sources of risk in the more extensive supply/demand network, supply chain "intelligence" can also be improved. A "Supply Chain Council" of significant upstream and downstream organizations in the network should ideally be established by the company to evaluate risk profiles and routinely concur on risk reduction strategies.

- *Building a Supply Chain Risk Management Culture*

Senior management must understand the need to guide supply chain risk management due to the possibly enormous harm that can be caused to the company by supply chain failures and disruptions. The company's management should regularly examine reports on the supply/demand network and the company's risk profile. A supply chain continuity team should be established, as was already mentioned. In addition to creating contingency plans, it should also be charged with interacting with all levels of the organization and the supply/demand network to convey that supply chain risk mitigation is everyone's responsibility.

- *Investing in Agility*

While many factors support mobility, visibility, and velocity are two of the most important. Better awareness allows the organization to react to events more quickly, and momentum accelerates this process. In essence, businesses need to determine what investments they should make and what modifications they should make to the supply infrastructure and the systems that support it to create a "sense and respond" capacity. We previously discussed the concept of "structural flexibility," or the supply chain's ability to adjust to changing circumstances rapidly.

This idea is based on the understanding that many conventional supply networks are too inflexible due to prior choices that have 'locked' the business into a structure with rigid arrangements. To increase resilience, each choice must be evaluated in terms of how many options it will add or remove. The implication is that in an uncertain world, the best choices are those that leave the most alternatives available. Robust supply chain. A comprehensive network map helps to ease this supply chain comprehension.

V. CONCLUSION

Due the on-going disruptions in the supply chain and it impact on business growth, it is important for companies to strategize by instituting flexibility in dealing with the global crisis and focus more on collaboration to overcome some of the risks faced in the supply chain. Institutions dealing with supply chain disruptions must be resilience and robotic in combating supply chain risk by increasing visibility in their upstream and downstream networks of their operations.

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