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Resiliency in supply chain

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Abstract

Resiliency in supply chain refers to the ability of a company or organization to withstand and adapt to disruptions or risks that may arise in the supply chain. It involves the capacity to bounce back, recover, and continue operations, minimizing the impact of disruptions on the overall supply chain performance. This paper explores various innovative methods that are make resiliency in supply chain. By implementing these strategies, organizations can enhance their resiliency and minimize the impact of disruptions on their supply chain, helping them to maintain the flow of goods and services to customers even in challenging circumstances.

1. Introduction

Supply chain resilience is the ability of a supply chain to withstand and recover from disruptions. A resilient supply chain is one that can anticipate and forecast disruptions, and in many cases, avoid them altogether. To achieve resiliency, businesses must optimize production with supply chain planning. This synchronizes all components of the supply chain and drives greater visibility and agility. Through supply chain planning, supply and demand requirements are better understood, and production is harmonized. This connected, forward-looking approach helps businesses better anticipate issues, limit the impact of supply chain disruptions, and improve overall operations.

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In addition to strategic planning, resilient supply chains work by understanding and leveraging data. When a business has the digital systems in place to analyze and make sense of Big Data, it leads to significant improvements in supply chain resiliency. Systems empowered with artificial intelligence can curate disparate data sets from across the business and around the world. News, competitor activity, sales reports, and even customer feedback can all be analyzed together to spot trends and opportunities. Connected devices within the system are continually being listened to, leading to real-time insights as to where and how workflows can be automated and optimized.

In today's globalized and interconnected world, supply chains are more complex and vulnerable than ever before. Natural disasters, political instability, and cyberattacks are just a few of the threats that can disrupt supply chains and cause significant financial losses [1].

In order to protect themselves from these risks, businesses need to build resilient supply chains. A resilient supply chain is one that is able to withstand disruptions and continue to operate effectively. This requires a proactive approach to risk management, as well as the implementation of specific strategies and practices that can help to mitigate the impact of disruptions [2].

According to Geraint John, VP Analyst at Gartner, most supply chain leaders understand the importance of enhancing resilience in the current business environment. However, this may contradict the traditional lean supply chain philosophy that has been dominant in recent decades, as measures such as alternative factories, dual sourcing, and larger safety stock levels are not consistent with lean principles [3].

The process of rebalancing efficiency and resilience is challenging and often comes with additional costs. Nevertheless, the consequences of not taking action can also be significant. To build greater resilience into their networks, supply chain leaders can pursue six major strategies.

The first strategy is to implement inventory and capacity buffers. This involves having excess production capacity or inventory beyond safety stock requirements. However, the cost of maintaining buffers can be high, and supply chain leaders may struggle to justify these costs to top management. Leading companies utilize buffers for surge capacity during new product launches or expansions, and they can also partner with contract manufacturers strategically to create buffer capacity [4].

The second strategy is manufacturing network diversification. Many companies have started diversifying their sourcing or manufacturing bases in response to the U.S.-China trade war. This may involve switching to suppliers outside of China or requesting existing partners to supply from different regions, such as Mexico or other parts of Asia. Supply chain disruptions in recent years have increased the importance of having multiple supply locations, which is now seen as a necessary cost of doing business rather than an inefficiency.

The third strategy is multisourcing, which mitigates the risk of disruptions caused by relying on single sources of supply. Supply chain leaders need to thoroughly understand their supplier networks and categorize suppliers based on revenue impact if a disruptive event occurs. This can be achieved by awarding business to additional suppliers or working closely with a single-source supplier capable of producing from multiple locations.

The fourth strategy is nearshoring, where companies aim to reduce geographic dependence and shorten cycle times by establishing regional or local supply chains. Although this can be more expensive due to the added complexity, it provides greater control over inventory and brings products closer to the end consumer [5].

The fifth strategy involves platform, product, or plant harmonization. This means aligning plant technology and standardizing components across multiple products. Harmonization simplifies sourcing policies and increases resiliency by allowing higher volumes to be distributed among multiple suppliers.

Lastly, strategy six focuses on ecosystem partnerships. The COVID-19 crisis has emphasized the importance of diversifying sourcing, but collaborating with key raw material suppliers and external service partners is essential for better preparedness and resilience in the future. For companies without the capacity to support multiple locations independently, strong relationships with contract manufacturers and global third-party logistics providers (3PLs) are crucial for diversifying production and distribution across different countries (Figure 1) [6].

Figure 1: Resiliency in supply chain.

According to Gartner survey data, about half of supply chain organizations are either already using external manufacturers or considering how they can support product movements, and a similar proportion are engaging logistics partners to enhance resilience.

2. Survey on related works

Supply chain resilience is the ability of a supply chain to withstand disruptions and continue to operate effectively. This includes the ability to recover quickly from disruptions and minimize the impact on customers.

There are three main dimensions of supply chain resilience: Vulnerability: The likelihood that a disruption will occur, Capability: The ability to withstand a disruption, Recovery: The ability to recover from a disruption.

Factors Affecting Supply Chain Resilience

There are a number of factors that can affect the resilience of a supply chain. These include:

The nature of the products or services being supplied: Some products or services are more vulnerable to disruptions than others. For example, perishable goods are more likely to be affected by disruptions to transportation or storage.

The structure of the supply chain: The more complex the supply chain, the more vulnerable it is to disruptions. This is because there are more points at which a disruption can occur [7].

The level of collaboration between supply chain partners: A high level of collaboration between supply chain partners can help to mitigate the impact of disruptions. This is because partners can share information and resources, and work together to develop contingency plans.

The use of technology: Technology can be used to improve the resilience of a supply chain. For example, real-time tracking systems can help to identify and respond to disruptions more quickly.

Strategies for Improving Supply Chain Resilience

There are a number of strategies that businesses can use to improve the resilience of their supply chains. These include:

Risk assessment: The first step is to conduct a risk assessment to identify the potential threats to the supply chain. This will help to identify the areas where improvements are needed.

Contingency planning: Once the risks have been identified, contingency plans should be developed to mitigate the impact of disruptions. These plans should include steps to be taken before, during, and after a disruption.

Collaboration: Building strong relationships with supply chain partners can help to improve resilience. Partners can share information and resources, and work together to develop contingency plans [6].

Technology: The use of technology can help to improve the resilience of a supply chain. For example, real-time tracking systems can help to identify and respond to disruptions more quickly.

Flexibility: A flexible supply chain is better able to adapt to disruptions. This can be achieved by using a variety of suppliers, having multiple distribution centers, and using transportation options that are not as vulnerable to disruptions [9].

Transparency: Having visibility into the supply chain can help to identify and respond to disruptions more quickly. This can be achieved by using technology to track shipments and share information with supply chain partners.

Holling (1973) was the first to use the term "resilience" to describe the persistence of systems and their ability to withstand change and disturbance while maintaining the same relationships between populations or state variables. Svensson (2002) defines resilience in supply chains as the ability to handle unexpected deviations from the norm and their negative consequences. In other words, supply chain resilience refers to the capacity of complex supply chains to survive, adapt, and grow in the face of turbulent changes, including catastrophic events. Mathematically, vulnerability can be measured as "risk," which is a combination of the likelihood of an event and its potential severity. These definitions are built upon traditional risk management techniques and have been expanded upon by other authors [10].

3. Results and discussion

There are a number of benefits to improving the resilience of a supply chain (Figure 2). These include: Reduced risk of disruptions: By identifying and mitigating the risks to the supply chain, businesses can reduce the likelihood of disruptions.

Improved customer service: A resilient supply chain can help to improve customer service by ensuring that products are delivered on time and in good condition. Increased profitability: A resilient supply chain can help to increase profitability by reducing the costs associated with disruptions. Enhanced reputation: A company that is known for its resilient supply chain is likely to have a positive reputation with customers and suppliers.

Today, the supply chain is becoming more interconnected, complicated, and susceptible to both temporary and long-term disruptions. The issue lies in the fact that the intricacy and global nature of modern supply chain management expose companies to a wider range of unexpected disruptions, despite their low inventory levels and lack of redundancies necessary for efficient operations. The challenge is to create supply chains that are not only robust enough to continue operating in this risky business environment but also to transform this resilience into a competitive advantage.

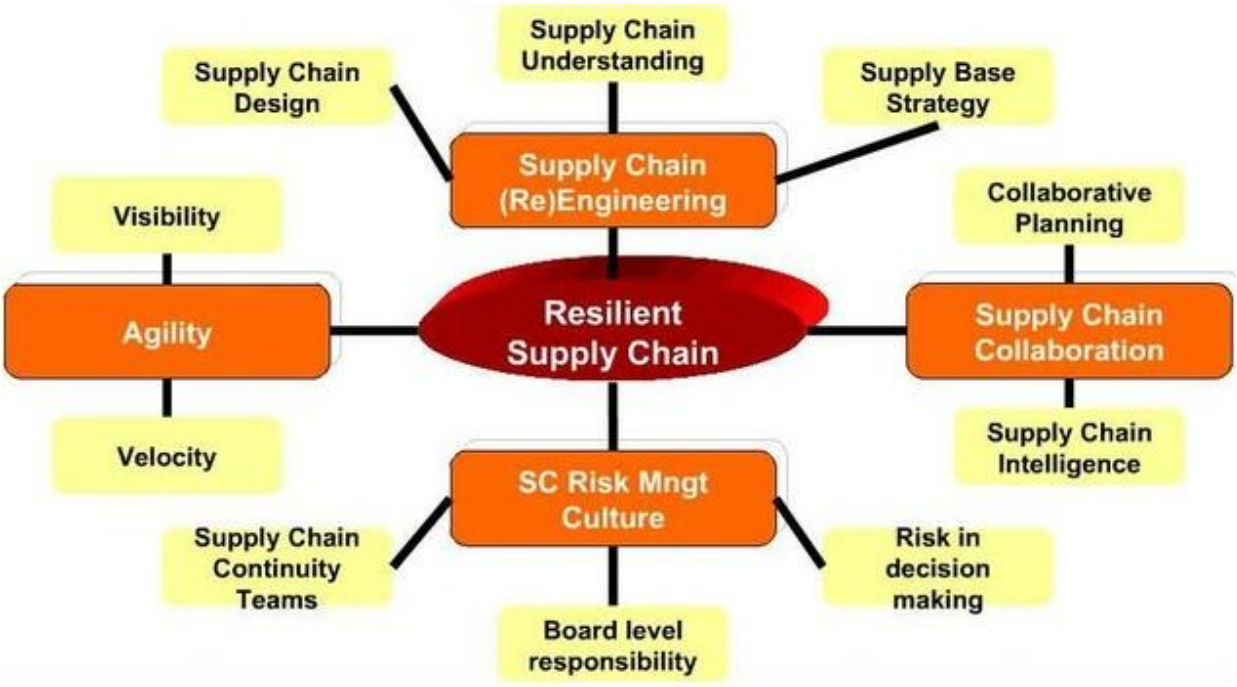

Figure 2: Resilient Supply Chain Structure.

These principles not only enable the creation of resilient supply chains that can recover from disruptions but also flexible supply chains that can respond to daily changes in demand. Companies like Nokia, Toyota, Nissan, UPS, Schneider National, FedEx, Dell, and the U.S. Navy serve as examples of organizations that have leveraged flexibility and resilience to gain a competitive

advantage. These industries understand that by designing supply chains with a profound impact on inherent risk, managers should collaborate to design resilient chains [11].

How does a resilient supply chain function?

Having a resilient supply chain involves responding quickly to operational disruptions and having a flexible contingency plan. However, true resilience means being able to forecast and anticipate disruptions, and even avoid them altogether. It is about shaping a supply chain resilience strategy focused on disruption avoidance to gain a competitive advantage.

A resilient supply chain works by optimizing production through supply chain planning. Strategic supply chain planning synchronizes all components of the supply chain, driving greater visibility and agility. It helps businesses anticipate issues, limit the impact of disruptions, and improve overall operations by better understanding supply and demand requirements and harmonizing production.

Resilient supply chains also leverage data. Analyzing and making sense of Big Data through digital systems empowers businesses to spot trends and opportunities. Artificial intelligence can curate various data sets, providing real-time insights for automating and optimizing workflows. AI, machine learning, and modern databases analyze and learn from Big Data, allowing quick responses to disruptions and unexpected events.

Diversifying suppliers and manufacturing partners is another characteristic of a resilient supply chain. While traditional supply chain strategies focused on minimizing partners and suppliers for operational efficiency, having multiple supply locations is now seen as a necessary cost for doing business. Technologies like blockchain, sensors, and advanced analytics enable overseeing complex partnerships and supplier contracts across distant regions.

Implementing capacity and inventory buffers is crucial for supply chain resilience. While minimizing surplus and lean inventories have been common strategies to reduce costs, the pandemic revealed the risks of that approach. Shifting from a "just in time" to a "just in case" mindset, supply chain operations can include on-demand manufacturing, virtual inventories, and predictive demand forecasting to remain resilient.

The top three benefits of a resilient supply chain include more efficient operations, improved productivity, and risk reduction. Resilience minimizes risks and allows businesses to invest in innovation and growth, leading to shorter product development cycles and increased output capacity. Resilient supply chain technologies contribute to overall productivity improvements, and they reduce risk by providing visibility and empowering businesses to optimize processes in real-time.

To achieve resilience, supply chains can leverage Supply Chain 4.0 technologies. These include artificial intelligence, machine learning, the Industrial Internet of Things (IIoT), additive (3D) printing, robots, drones, and modern databases. These technologies provide deep insights, predictive analytics, real-time decision-making, intelligent automation, and the ability to rapidly adapt to changing needs, ensuring a resilient and competitive supply chain.

4. Conclusion

In today's increasingly volatile world, supply chain resilience is more important than ever before. By implementing the strategies outlined in this paper, businesses can improve the resilience of their supply chains and protect themselves from the financial losses that can be caused by disruptions.

Key aspects of resiliency in supply chain include:

Redundancy: Building redundancy in the supply chain ensures that alternative sources, channels, or suppliers are available to cope with disruptions. This can involve maintaining multiple suppliers, manufacturing facilities, or transportation routes.

Flexibility: Establishing flexibility in the supply chain allows for quick adjustments to changes in demand, supplier availability, or other external factors. This can involve reconfiguring production processes, using modular components, or adopting agile manufacturing approaches.

Visibility: Enhancing visibility across the supply chain enables organizations to better monitor and anticipate potential disruptions. This can involve using advanced data analytics, real-time tracking systems, or collaborative platforms to gain insights into the flow of goods and information.

Collaboration: Promoting collaboration and building strong relationships with suppliers, customers, and other stakeholders helps in sharing information, coordinating responses, and jointly managing disruptions. Collaboration can involve joint planning, sharing inventory levels, or aligning business continuity strategies.

Risk assessment and mitigation: Conducting regular risk assessments to identify vulnerabilities and implementing mitigation measures helps in proactively managing potential disruptions. This can involve conducting supply chain risk assessments, scenario planning, or developing contingency plans.

Continuity planning: Developing robust business continuity plans ensures that there are strategies in place to handle unexpected disruptions. This can involve documenting critical processes, establishing alternative suppliers or facilities, and testing the effectiveness of the plans through drills or simulations

Technology adoption: Leveraging technology solutions such as artificial intelligence, blockchain, or Internet of Things (IoT) can enhance supply chain resiliency. These technologies can provide real-time data, improve visibility, automate processes, and enable faster decision-making.

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