

Supply Chain Resilience

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Supply chain resilience refers to the ability of a supply chain to cope with the risk of supply chain disruption and quickly return to its original performance after a disruption. For firms, supply chain resilience can be improved by adopting redundancy, flexibility, visibility, collaboration, backup suppliers, safety stocks, etc.

Keywords: supply chain diversification ; digital transformation ; supply chain resilience

1. Introduction

In recent years, the world economy has increasingly taken on the characteristics of VUCA due to global tensions, the outbreak of COVID-19, and the impact of climate change and natural disasters ^{[1][2]}. Responding to supply chain disruption crises caused by uncertain events is now an urgent priority for firms, and therefore, they need to be able to withstand and recover from supply chain disruptions, which can severely damage a firm's performance and are detrimental to long-term survival and growth. Therefore, to improve the ability of supply chains to withstand and recover from disruptions, increasing numbers of scholars and practitioners are addressing the risk of supply chain disruptions by building supply chain resilience ^{[3][4]}.

Supply chain diversification can improve the ability of firms to cope with supply chain disruptions and risks ^[5]. For example, supply base diversification ^[6] can help firms to avoid production shutdowns due to supply interruptions. Previous research has demonstrated the ability of supply chain diversification to address the risk of supply chain disruption ^[7]. A diversified supply chain base can improve the operational flexibility of firms and help firms promptly meet the needs of the market and customers. Similarly, a diverse customer base can help firms achieve higher financial performance, even if some customer needs are affected by supply chain disruptions, and can help firms sell products more effectively, thereby improving the capability to withstand supply chain disruption. On the one hand, a diversified customer base can help firms better cope with the risk of supply chain disruptions, while, on the other hand, the supply chain structure brought about by supply chain diversification is more complex, which may require firms to spend more time and energy coordinating the relationship between supply chain members.

The digital transformation of manufacturing is also an important way for firms to adapt ^[8]. The core of digital transformation is the use of digital technology to empower firms through the in-depth deployment and configuration of digital capabilities, facilitating the timely prediction of possible risks to firms, a reduction in the uncertainties faced by firms, and an improvement in their ability to cope with risks. Therefore, the implementation of digital transformation is also an important way for firms to cope with supply chain risks and improve supply chain resilience ^[9]. At present, most of the research on digital transformation regards it as one-dimensional, which explains why some firms improve their performance by implementing digital transformation, while others hurt their performance. According to the resource orchestration theory, firms not only need to possess specific resources, but, more importantly, they need to orchestrate, configure, and utilize resources correctly.

2. Supply Chain Diversification and Supply Chain Resilience

To maintain the normal operation of the firm, the firm needs to establish a certain degree of anti-risk ability and improve the supply chain resilience ^[4]. Recent research in the field of supply chain operations management proposes to increase supply chain flexibility and respond to the impact of supply chain disruptions by establishing flexibility ^{[3][10][11]}. For firms, building supply chain resilience can be accomplished by establishing some redundancy since redundancy can help firms build and improve resilience by providing some degree of buffer against the risk of supply chain disruption ^{[3][12]}. This could occur through means such as the establishment of multiple procurement strategies that will be more resistant to risks than the traditional single procurement strategy; in addition, establishing a diversified supply base can help firms reduce the single supply risk. Diversity is also considered a key determinant of resilience ^[13]. In this regard, supply diversification increases supply flow and profitability, while customer diversification increases demand flow ^{[7][14][15]}.

Similarly, firms with a diversified customer base can help protect against downstream demand disruption events, and by developing a diversified customer base, they can help improve their ability to recover from disruptions and improve their financial performance. In addition, studies have shown that the diversification of a city's food supply chain can improve a city's resistance to food disruption shocks, and policies that increase diversity in food supply chains can improve their resistance to food shocks ^[16]. Diversification can increase supply chain resistance, resilience, adaptability, convertibility, and innovation, which can help the supply chain to improve resilience, convertibility, and innovation ^[17]. Supply chain diversification can improve the responsiveness of the supply chain to risks and help firms maintain their original functions and performance in a changing and uncertain environment ^[12].

3. Digital Transformation and Supply Chain Resilience

For firms, the key to improving their ability to respond to supply chain risks is to improve supply chain resilience. Digital transformation of firms can help firms improve the visibility of their supply chains ^[18] and improve their ability to predict risks, thereby helping firms better formulate strategies to deal with risks and improve supply chain resilience. As supply chain networks particularly become increasingly complex and intertwined ^[19], traditional linear thinking is not the best way to solve problems. Supply chains are also increasingly characterized by nonlinear, unstable coupling systems, so supply chains also need to enhance their adaptability and stability to cope with changing external environments.

Digital capability contains three main dimensions—data, permission, and analytics—without which it is difficult to find value from the data; therefore, all three need to be combined to measure digital capability ^[20]. Digital transformation is a multidimensional concept ^[18] that can affect the firm's performance and organization to certain degrees. The ability of firms to embrace digital transformation is affected by many factors ^[21], such as the external competition intensity, technology maturity, etc. Digital transformation also has the potential to impact supply chain resilience in complex causal asymmetries. For example, in the study of agile supply chains and digital transformation, digital technologies seem to be a necessary but not sufficient condition for achieving flexible supply chains ^[22]. In the study of digital transformation and supply chain resilience, digital supply chains mainly include digital maturity and the adoption of digital tools. Supply chain resilience is affected by digital maturity and the adoption of digital tools ^[23].

Previous research has linked supply chain digitization to supply chain resilience, a key concept for managers who develop capabilities to enhance the ability of their supply chains to cope with unexpected turbulence. Supply chain digitization is characterized by digital maturity and the adoption of digital tools for supply chains, and supply chain resilience is positively influenced by digital maturity and digital tool adoption ^[23]. Evidence from emerging market environments (particularly the automotive industry) also demonstrates the role of digital supply chain technologies. Additionally, firms are encouraged to adopt supply chain resilience practices that support the achievement of supply chain performance goals ^[24]. The practical impact of implementing digital transformation is often more complex, as the role of technology can be better realized if digital technologies are implemented in the right environment ^[25]. Digital transformation can improve resource sharing and integration and help improve supply chain resilience ^[25]. Studies in the field of supply chain management have highlighted relationships ^[26], flexibility ^[27], agility ^{[22][28]}, and collaboration ^{[29][30][31]} as some of the main strategies to achieve supply chain resilience. Resilience is not simply about recovery after a disrupting event, but about the ability to adapt and transform. Therefore, implementing digital transformation can help firms improve their ability to predict potential risks ^[25]. According to resource orchestration theory ^[32], firms that want to have a competitive advantage require their resources and, more importantly, the ability to orchestrate resources.

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