

Digital Transformation and Resilience in Global Supply Chains: A Comprehensive Review and Future Directions in the Post-COVID-19 Era

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Abstract: Supply chains have been severely affected by the epidemic, which has an impact on shareholder value and corporate performance. Effective management of company continuity can be a potent instrument for reducing damage to operations and reputation. This study investigates how disruptions in global supply chains spread and how they affect the ecosystem. It emphasizes how crucial it is to comprehend these interactions because they may have an effect on not only the impacted organization but also its rivals, clients, and suppliers. With the help of digital technologies, businesses are now better able to handle information, improve integration, and increase supply chain resilience. They have the potential to improve resilience in the wake of unanticipated events like pandemics by promoting traceability and adaptability within the supply chain. The assessment urges enterprises to speed up the adoption of intelligent technology and automation as it comes to the post-COVID-19 age in order to increase the supply chains' resilience, sustainability, and robustness. Additionally, it suggests tactics like geographic supply chain redistribution, supplier network diversity, and the adoption of circular economy principles.

Keywords: supply chain disruptions, ecosystem impact, digital technologies, resilience, adaptability

1. Introduction

The COVID-19 pandemic-induced global crisis has highlighted the crucial function of supply chain resilience and the important role that digital technologies have played in bolstering it. Significant supply chain disruptions brought on by the pandemic have an impact on shareholder value, company performance, and the global economy. There is still a knowledge gap regarding the spread of disruptions in global supply chains, the interactions and effects within the supply chain ecosystem, and the ability of digital technologies to increase supply chain resilience, despite extensive studies examining the effects of these disruptions and strategies for their mitigation.

By carefully examining numerous research that explores these areas, this review aims to close these gaps. The monetary effects of supply chain disruptions brought on by the pandemic, the effectiveness of business continuity management in reducing these disruptions, the spread of disruptions in global supply chains, the ripple effects of disruptions within the supply chain ecosystem, and the potential of digital technologies in bolstering supply chain resilience.

Using a systematic review process, peer-reviewed articles are reviewed that present empirical data on these topics. These research techniques will be evaluated, their findings, and their implications for supply chain management critically.

In the context of a global crisis, this article will provide a comprehensive grasp of the difficulties and opportunities in handling supply chain interruptions. It will shed light on the techniques and tools that can arm businesses with the tools they need to build supply chains that are more durable and resilient to disruptions in the future. Additionally, it will present forecasts for this field's future development and offer suggestions for overcoming any obstacles. This review will add to the ongoing discussion on supply chain resilience and the function of digital technology in reinforcing it in the post-COVID-19 age by combining the current level of knowledge in this field.

The literature analysis highlights the enormous financial effects that supply chain interruptions have on businesses and their stakeholders, highlighting the importance of strong business continuity management and supply chain integration to lessen these effects. The spread of disruptions in global supply systems and the cascading impacts within the ecosystem of the supply chain serves as additional evidence of the complexity and interconnection of contemporary supply chains.

Digital supply chain platforms, supply chain traceability, and supply chain agility are among the technologies that are cited as being crucial enablers of resilience in the face of shocks. They enable real-time visibility, connectivity, accuracy, and control, enabling businesses to react to disturbances more successfully.

The literature does, however, also draw attention to problems with the application of digital technology, such as the complexity of information and the need for efficient integration inside the company and throughout the supply chain. As a key element in boosting supply chain resilience and robustness, supply chain memory—which encapsulates the experience, familiarity, and knowledge to deal with disruptions—is also mentioned.

Despite the insights offered, the literature identifies gaps that further study may fill. These include assessing the implications of internal integration between supply chain management and IT activities, researching the effects of various shock scenarios on supply networks, and analyzing the function of governmental regulations in reducing the impact of shocks. To fully comprehend the behavior of global shocks, the necessity for more thorough and firm-level international trade data is also stressed.

2. Supply Chain Disruptions' Effects on Stock Price and Company Performance

Choudhury and colleagues' research examines the effects of supply chain disruptions (SCDs), particularly those brought on by the COVID-19 pandemic, on shareholders' value [1]. According to their research, the impact of SCDs associated with the pandemic reduced shareholder value by 2.16%, which is in line with the impact of SCDs before the pandemic. No matter how severe the country's stringent regulations are, the market's reactions—which are primarily negative—remain. In contrast to demand-side disruptions like price increases, supply-side disruptions like shutdowns cause a more negative reaction in the stock market. The firm's position in the upstream or downstream supply chain proves to be insignificant, however, the complexity of the supply chain emerges as a positive indication of shareholder value. This study provides the first empirical proof of the financial effects of COVID-19-induced SCDs.

The authors suggest many directions for additional study. These include a review of other financial performance metrics, such as operating income, return on sales, and return on assets in the quarters following disruptions brought on by the epidemic. By examining additional temporal and spatial elements, such as the timing of events, that may have a substantial impact on the signaling environment during the pandemic, the future study may further expand the breadth of these findings.

3. The Importance of Business Continuity Planning in Preventing Disruptions

The effectiveness of business continuity management (BCM) and the function of supply chain participation in BCM (SCiBCM) in minimizing the operational and reputational damage brought on by supply chain disruptions (SCDs) are the subjects of research by Arash Azadegan and his team [2]. According to their findings, SCiBCM strengthens the containment of operational harm while BCM strengthens the containment of reputational damage. The study also suggests that businesses dealing with increased supply chain vulnerability are more severely affected by the pronounced effects of BCM and SCiBCM on reputational and operational damage containment. The study emphasizes how important it is to include supply chain operations in risk and disruption management plans.

The report also suggests future lines of inquiry into how the organization's supply chain management unit and information technology operations interact internally to solve SCDs, as well as how these two components interact with BCM.

4. International Supply Chains: The Spread of Disruptions

Using real-world data from Japanese supply chains and a world input-output table (WIOT) created from firm-level agent-based simulations, Inoue and colleagues investigate the propagation of disruptions in global supply systems and their impact on domestic supply chains [3]. To evaluate the value-added losses suffered by Japanese enterprises as a result of shocks of various magnitudes and durations originating from China, the EU, the US, and worldwide, they proposed three distinct models to link local firms to the WIOT.

According to the report, how companies are assigned to international connections is quite important. Losses increase sublinearly as the shock's length increases, indicating that the economy will eventually reach a threshold where the shock can no longer spread further. Depending on how foreign connections are allocated, the rate at which saturation occurs varies greatly. Losses increase superlinearly as the initial rate of decrease increases.

The report suggests various directions for additional research. These include gathering thorough firm-level data on international commerce in order to enable a more realistic analysis of global shocks and validate the model put forward in this study. The authors also support investigating the effects of shocks on diverse industries and geographical areas, as well as the contribution of inventory management to reducing the effects of shocks. They also suggest looking into how various shock scenarios, such as natural disasters or political events, affect supply networks. Finally, they advise investigating the effects of shocks on various business kinds, such as small and medium-sized organizations, as well as the function of governmental regulations in reducing the effects of shocks.

5. Ecosystem of the Supply Chain: Supply Chain Interactions and Impacts

In this study, Filbeck, G. and colleagues go further in their assessment of the effects of supply chain interruptions spreading like a virus. Their attention is not just on the impacted company and its rivals, but also on its clients and suppliers [4]. They locate incidents that resulted in interruptions at different points throughout the supply chain, such as supply, demand, production, inventory, distribution, or transportation, by examining news announcements. These interruptions affect six market segments and several different types. They calculate the impact of supply chain interruptions on the shareholder wealth of the impacted rivals, clients, or suppliers using a common event research approach. Managers can benefit greatly from their research, which emphasizes the significance of comprehending contagion effects. This is due to the potential impact that unfavorable share price reactions brought on by contagion effects may have on a firm's capital structure, cost of capital, and project decision-making procedures.

In a related vein, Acemoglu, D. and colleagues present a thorough approach for examining the impact of supply chain disruptions and company failures on the macro economy, notably their part in escalating recessionary shocks [5]. They create a workable paradigm in which businesses and their suppliers bargain over the surplus that is unique to their relationship. Productivity shifts can affect how this surplus is distributed throughout the economy, identifying which companies are in danger of failing. They also show how the failure of one company can have an impact on its suppliers, clients, and businesses in other areas of the production network, thereby causing a chain reaction of failures that affects the entire production network of the economy.

6. Digital Technologies' Contribution to Increasing Supply Chain Resilience

Cui and colleagues explore how digital technologies might improve supply chain resilience in their study [6], notably in the context of COVID-19. They contend that digital technologies serve as essential tools that help businesses handle and analyze information, strengthening firm resilience in the face of supply chain disruptions. The study evaluates the moderating impact of information complexity and the mediating impact of supply chain integration, which includes internal, customer, and supplier integration. According to the research, supply chain integration mediates how digital technologies affect a company's ability to remain resilient, with the influence of this mediation effect being particularly strong for customer integration. Moreover, digital technologies have a stronger effect on company resilience when information complexity is high. In order to strengthen company resilience, the study advises the use of digital technologies in internal, customer, and supplier integration.

Our understanding of how digital technologies (DTs) can support supply chain resilience (SCR) during unforeseen occurrences like pandemics is improved by Ning and colleagues [7]. They examine the connection between DTs and SCR from a broad standpoint and identify the mediating roles played in this relationship by digital supply chain platforms (DSCPs), supply chain traceability (SCT), and supply chain agility (SCA). They also provide advice on how businesses can modify their digital strategies and succeed in a dynamic environment.

The goal of Hald and Coslugeanu is to analyze how the COVID-19 pandemic affects global supply networks and their management [8]. In addition to identifying six supply chain vulnerabilities, six resilience capabilities or solutions, and seven technology clusters deemed especially helpful in mitigating future pandemic disruptions, they also develop a novel theoretical understanding of the ongoing collective lessons from the disruption in supply chains caused by COVID-19. They examine the connections between the various components as part of an ongoing learning process that includes identifying weaknesses, responding by coming up with solutions and putting those solutions into practice. Additionally, they provide a full assessment of the present state of information regarding the effects of the COVID-19 pandemic on international supply chains and look at how digital technologies affect resilience to disruptions brought on by the pandemic.

7. The Post-COVID-19 Era's Future Directions for Supply Chain Management

Cherrafi and his team investigate methods for supporting robust and sustainable supply chain management in the wake of the COVID-19 pandemic [9]. They push for enterprises to quickly adopt and apply cutting-edge technologies and automation in order to increase the supply chain's robustness, sustainability, and resilience. Real-time visibility, connectivity, precision, and control help to achieve this improvement. They identify a number of countermeasures, with an emphasis on improving employee health and well-being and securing the supply chain.

They contend that supply chains striving for sustainability and resilience in the post-COVID era should take into account supply chain regionalization, supply network diversification, agility,

collaboration, visibility, and transparency. They also stress the importance of accelerating the implementation of cutting-edge technology and circular economy principles as dynamic capacities to increase supply chain sustainability and resilience. By evaluating diverse impacts, reaction plans, and the transformative role of digital technology and circular economy practices in fostering higher sustainability and resilience in supply chains, their exploratory study adds to the body of knowledge already known about supply chain resilience.

On the other side, Alvarenga and his team carefully examine how digital technologies affect supply chain resilience and robustness, placing special attention on the function of supply chain memory [10]. They found that the association between digital technologies and supply chain resilience and robustness is mediated by supply chain memory. The experience, familiarity, and expertise needed to handle disruptions mitigate this link to some extent. Additionally, they discovered that memory is still useful in promoting better levels of recovery even in the face of unusual occurrences. They discovered that, in the case of a highly disruptive event like COVID-19, memory is less effective at sustaining an adequate level of performance. Their research sheds light on how supply chain memory evolved, establishing digital technologies as its forerunner. In conclusion, their work highlights the importance of supply chain memory in controlling disturbances and improving supply chain resilience and robustness, making a theoretical and practical contribution.

8. Conclusion

According to the studies, in the post-COVID-19 era, supply chains that are sustainable and resilient should take into account regionalization, supply network diversification, agility, collaboration, visibility, and transparency. To increase supply chain sustainability and resilience, it is also advised that the deployment of smart technologies be accelerated.

In conclusion, the research reviewed offers important information for practitioners and academics to understand the effects of supply chain disruptions and how to improve supply chain resilience. They emphasize the significance of a comprehensive and integrated supply chain management strategy that includes digital technology and supply chain memory in order to successfully negotiate the intricate and linked terrain of contemporary supply networks. Future studies should focus on filling in the gaps and exploring new approaches to controlling supply chain disruptions in a world that is becoming more digital and unpredictable.

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