# Exploring the Influence Factors of Supply Chain Sustainability During Crisis

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## Abstract

Supply chain management is a crucial aspect of global business operations, focusing on environmental and societal values. Sustainable supply chain management addresses issues such as corruption, fair labor practices, deforestation, water security, climate change, and human rights. The COVID-19 pandemic has exposed the inability of traditional supply chain management methods to handle disruptions, resulting in catastrophic social, political, financial, and environmental impacts. Additionally, the COVID-19 pandemic has reignited interest in sustainable supply chain practices, with research focusing on the effects of COVID-19 on supply chain sustainability and measures to ameliorate these conditions. The aim of this study is to conduct conceptual analysis on supply chain sustainability during the crisis. The study has identified three main factors that contribute to Supply Chain Sustainability: SC Crisis Mitigation Strategies, Supply Chain Adaptive Strategies, and Supply Chain Collaborative Strategies. The study leads to an understanding of sustainable strategies, which are crucial for competitiveness in volatile environments, and efficient recovery from disruptions is essential

for preserving supply chain continuity and minimizing long-term consequences. Improved risk reduction and better cooperation with the distribution side are emphasized.

**Keywords:** COVID-19, Sustainability, Strategies, Mitigation, Adaptive, Collaborative.

## Introduction

A supply chain is a system that unifies all businesses, locations, and operations that go into producing, manufacturing, and shipping a company's goods. Sustainable supply chain management embraces the goals of environmental and societal values, whereas traditional supply chain management concentrates on operational speed, cost, and dependability. This entails addressing issues such as corruption, fair labor practices, deforestation, water security, climate change, and human rights (Luther, 2021). Despite the obstacles and problems associated with managing global supply chains, multinational company executives must devise strategies for attaining competitive advantages in their markets and for their firms' financial performance. Within Supply Chain Management (SCM), sustainability has become a major strategic field. The emphasis switched from cost-conscious and service-oriented SCs prioritizing customer happiness and operational excellence to a more balanced strategy that concurrently tackles environmental, social, and economic challenges, especially during crises or unforeseen situations such as pandemic crises.

The sustainability issue has been actively discussed globally. The General Assembly Economic and Social Council (United Nations) captured sustainability as one of the elements of Sustainable Development Goals. The importance of sustainability has been indicated in SDG 8, SDG 9, and SDG 12. SDG 8 aims to accomplish full and efficient employment, decent employment for everyone, and equitable, inclusive, and secure economic growth (Sustainable Development Goals report, 2023). The COVID-19 pandemic has exposed the inability of traditional supply chain management methods to handle disruptions, resulting in catastrophic social, political, financial, and environmental impacts. Filho, et al. (2020) researched how the COVID-19 pandemic threatened the SDG achievement. The study stated that the epidemic has raised global socioeconomic pressures, which are expanding poverty and reducing social well-being around the globe, making it tougher to attain sustainability (Sarker, et al., 2021).

The electronics sector, established in the 20th century, has enabled technological advancements through equipment, devices, and components. It serves as a foundation for modern businesses like e-commerce, consumer electronics, and manufacturing, with major markets including China, the US, Japan, South Korea, and Germany (Statista, 2022). On the

other hand, Malaysia is the world's tenth-largest electronics exporter, with electronics exports worth $ 42.9 billion in 2021, accounting for 18% of the global electronics market. Malaysia is well-known for its strengths in electronics production, particularly in the semiconductor industry (Solution S. E., 2023).

The dynamic and unstable worldwide business environment has created a significant impact on the world's now extensive supply chain. Scholars and practitioners in operations management (OM) have focused on the supply chain disruption caused by these hazards. The influence of high-profile events on supply chains has been studied in the literature. Examples of these events involve the Great East Japan Earthquake (Hendricks, et al., 2020; Todo, et al., 2015), the Northridge Earthquake (Dahlhamer & Tierney, 1998), the Rana Plaza collapse (Jacobs & Singhal, 2017), and the trade dispute between the United States and China (Fan, et al., 2022bOne of the main presumptions about interruption recovery is that it needs to happen quickly to minimize long-term effects and maintain supply chain stability. (Ivanov, et al., 2017; Fan, et al, 2023).

COVID-19 disease has wreaked chaos on the worldwide supply chain in recent years. However, the COVID-19 epidemic has reignited the Sustainable Supply Chain (SSC) stakeholders' interest in sustainability (Dwivedi, et al., 2022). The current COVID-19 pandemic has prompted scholars and practitioners to reconsider SC sustainability. Since 2020, a significant amount of research has been conducted, with the majority of the focus being on the effects of COVID-19 on Supply Chain Sustainability and measures to ameliorate these conditions (Karmaker, et al., 2021; Taqi et al., 2020). Sustainable supply chains are evaluated not just in terms of economic performance, but also in terms of environmental and social performance. The COVID-19 pandemic disrupted economic, environmental, and social sustainability pillars, affecting firms' triple bottom line. Developing economies were more severely affected, emphasizing job and economic concerns over environmental concerns. Supply chain disruptions across industries led to economic repercussions, with some non-essential industries still recovering (Sarkis, 2020; Kumar, et al., 2021; Ali, et al., 2022).

The COVID-19 pandemic impacted the electronic industry, causing both growth and setbacks due to supply chain disruptions and manufacturing site closures. Asia, with China as the largest market, showed resilience. In 2020, Europe and America experienced a 3% decline in growth, while Asia showed a 1% increase. In 2021, global performance began to improve, with Europe, America, and Asia experiencing growth rates of 9% and 10% respectively. The post-pandemic phase has begun with the relaxation of limitations, and we are living with the new normal lifestyle. However, the global economic situation starts to see the post-pandemic

effect. While the global economic situation improved, the electronics industry growth reduced by 3% to 6% in 2022 compared to 2021. According to the General Assembly Economic and Social Council, the effect of the Supply Chain disruptions of the post-Covid era started to surface when the E&E industry started to see a reduction in growth by the end of 2022 until the quarter of 2023. GDP per capita is forecasted to slow down in 2023, the result showed it slow down to 2.1% in 2022 and further to 1.0% in 2023 which has put risk in employment and income (General Assembly Economic and Social Council. (2023). In 2023, Malaysia's electrical and electronics (E&E) industry is anticipated to develop slower than it did in 2022 because of global headwinds imposed due to consumer product recalls (MSIA, 2022). The outlook for 2023 also remains soft, with 50% of the surveyed E&E companies expecting a decline in orders (MSIA Survey).

The aim of this study is to conduct a conceptual analysis of supply chain sustainability during a crisis. Given that industry managers may find it challenging to restore disrupted supply chains, this study aims to provide knowledge to achieve the Sustainable Development Goals (SDGs) by 2030 in the post-COVID environment. This includes addressing societal issues such as layoffs, health protocols, workplace safety, and socio-cultural patterns. Sustainability is increasingly emphasized in risk management, with practices like transparency, supplier relationships, and circularity reducing disruption and increasing resilience, shifting from being considered 'nice to have' to 'critical strategies.' Additionally, the UN has launched a new strategic plan to mitigate these effects. According to Sarkis, et al. (2020), their study suggests that innovative governance, capital expenditure, intellectual thinking, innovative action, and deliberate effort are required to bring the world back to a sustainable situation. To enhance an organization's resilience to potential disruptions like COVID-19, practitioners, employees, and other stakeholders need to collaborate to make the system more sustainable (Sarker, et al., 2021).

## Literature Review

### Sustainability Supply Chain

Recovery of supply chains is essential for supply chain disaster mitigation and resilience. When developing approaches to recover from the consequences of disruptions, supply networks usually encounter various obstacles (Son & Orchard, 2013; DuHadway, Carnovale, & Hazen, 2019). The severity of the event(s) determines the scope of the challenges. Firms, for instance, might face significant issues in recovering from catastrophic outbreaks such as epidemics or pandemics (Gurbuz & Ozkan, 2020; Queiroz, Ivanov, Dolgui, &

Wamba, 2020). The COVID-19 pandemic demonstrates that the three pillars of sustainability are intimately intertwined (Sarkis, 2020). 'Sustainability is a method of addressing today's demands without jeopardizing the needs of future generations' (Keeble, 1988; Sarker, et al., 2021). Knowing and understanding the capabilities and capacities of the supply chain is crucial for developing sustainability. Identifying supply chain social and ecological exposures can be addressed appropriately through integrating blockchain traceability and accessibility with predictive data analytics technologies, resulting in assistance in the development of the required skills and capacities (Sarkis, 2020). Therefore, the organization should put more effort into developing the Sustainable Supply Chain in preparation for managing unpredictable disruptions in the future.

Unexpected accidents have always threatened the future and profitability of organizations, particularly those that operate globally and have a long supply chain. As a result, researchers and industrial players have been interested in controlling supply chain risks, studying techniques for reducing these threats and their potential negative consequences (Baryannis, et al., 2019; Saglam, et al., 2020). Before COVID-19, supply chain managers primarily focused on timely delivery management of inventory, resulting in cost reductions and efficiency. However, in the wake of the COVID-19 outbreak, it became clear that this approach cannot prepare worldwide supply chains for unexpected events such as the pandemic (Govindan, et al., 2020; Raj, et al., 2022).

## Supply Chain Crisis Mitigation Strategies and Sustainability Supply Chain

The implications of the COVID-19 epidemic on worldwide supply chains have only heightened the necessity of risk management and mitigation strategies. Firms must evaluate their supply chain approaches, supply chain architecture, and supply chain dependency to dodge unexpected responses to future catastrophic events and successfully handle unanticipated disruptions (Raj, et al., 2022). Indirectly, the organizations must look into the Sustainability Supply Chain perspective to manage unforeseen crises such as pandemics crisis. Major disruptions, like the COVID-19 pandemic, drove firms to reevaluate their supply chain approach to mitigate future disruptions. Raj, et al., 2022 in his paper listed a few examples of the strategies that have been taken by the organizations such as (a) firms' sourcing mechanisms shifting from global to localized (Choi, et al., 2021; Donthu & Gustafsson, 2020), (b) the pandemic can transform the imbalance of power inside supply chains (Craighead, et al., 2020), (c) supply chains need to become more reliable (Craighead, et al., 2020; Verma & Gustafsson,

2020), and (d) companies are improving their purchasing and inventory strategy (Sodhi, et al., 2021). These strategies are examples that contribute to the Sustainability Supply Chain.

Chopra and Sodhi (2004) determined receptivity as a critical mitigation strategy, emphasizing that boosting supply chain receptivity minimizes delays and inventory risks, which endanger the firm's long-term viability. Furthermore, Roh, et al. (2014) emphasized that the objective of manufacturing strategy should be greater than merely operational efficiency; it ought to embrace the development of strategic opportunities through market trend responsiveness. If supply networks cannot recognize actual future signals, they will be unable to swiftly respond to changing conditions and predict possible threats. (Saglam, et al., 2020). Aligned with the dynamic capability theory, Raj, et al., 2022 suggested SC Crisis Mitigation Strategies should solve the observed supply chain problems due to the COVID-19 pandemic. In doing so, they also emphasized how organizations could change their supply chains to weather future disruptions which have been seen as the key factor in the Sustainability Supply Chain. Some contributors indicated that it is also essential to assess and analyze current aspects of the supply chain, as well as develop appropriate approaches that can aid managers and practitioners to be effectively preparing for future interruptions in supply (Choi et al., 2021; Craighead, et al., 2020; Donthu & Gustafsson, 2020; Raj, et al., 2022). Based on this literature, the hypothesis has been constructed as below:

*$H_1$: SC Crisis Mitigation Strategies has a positive relationship with the Sustainability Supply Chain*

**Supply Chain Adaptive Strategies and Sustainability Supply Chain**

A supply chain disruption occurs when essential elements used in manufacturing and the delivery of the final product to customers are impacted. The example of a "broken link in a chain" may have been successful in the past when businesses did not place as much emphasis on this viewpoint, but because today's complex supply networks are rarely as easy to comprehend, organizations aim to be more customer-focused. Adaptive strategy is a process of continuous development that involves a succession of planned, self-correcting experiments rather than static strategies. It expands a traditional strategy to a new level or direction of processes or methods. An adaptive strategy is a non-linear method to growth that consists of a series of planned, self-correcting experiments. It takes traditional strategy to a new level or direction of processes or methods. Supply chain adaptive techniques describe how organizations respond to shifting circumstances in the supply chain. The purpose of these

techniques is to preserve the supply chain's continuity and stability (can be considered as a Sustainable Supply Chain) in the face of obstacles such as disruptions, variations in demand, or unforeseen events (Ishak, et al., 2023).

The SC Adaptive Strategies involved internal capabilities as well as collaboration with external capabilities such as suppliers and third-party logistics (3PL). These capabilities are crucial in the Sustainability Supply Chain which also can be justified as Dynamic Capabilities where the ability of an organization to purposefully create, extend, or modify its resource base" (Helfat, 2007, p. 4; Beske, 2012). Therefore, we can hypothesize below relationship:

*$H_2$: SC Adaptive Strategies has a positive relationship with the Sustainability Supply Chain.*

**Supply Chain Collaborative Strategies and Sustainability Supply Chain**

The Supply Chain Collaborative Strategies may be enhanced in business operations if firms correctly identify and implement the internal and external collaboration required within supply chains. A higher level of collaboration with logistics providers and ultimate consumers improves risk reduction, which is a function of external collaboration alone. Processes for reducing risk are also associated with improved cooperation with the supply chain's distribution side (Duhamel, et al., 2013). According to Milliken (1987), uncertainty emerges from a lack of sufficient knowledge to anticipate correctly. As a result of having correct insight into the procurement of materials, components, and services from suppliers and other external sources as well as the movements of finished goods to the customer end, SC management may be sure regarding order cycle durations, demand projections, supplier capacity to deliver, and so on. As a result, investing in visibility is a solid agility strategy that avoids second-guessing and provides firms with capital to adapt to SC disruptions (Gunessee & Subramanian, 2020; Hassan, et al., 2022). Companies in big emerging economies are increasingly creating collaborative ties with their supply chain partners to compete strategically in the marketplace (Duong and Chong, 2020).

In this global crisis, the use of technological advances and significant analysis of data, such as artificial intelligence, the internet of things, blockchains, machine learning, control systems, automated manufacturing, 3D printing, and so on, is crucial for unforeseeable turbulence (Sharma, et al., 2020). According to research, firms with more sophisticated digital capabilities recover faster from SC interruptions during COVID-19 (Sajjad, 2021). Furthermore, Cai and Luo (2020) show that these technologies help manufacture high-demand items, accelerate the distribution system, and recalibrate and optimize SC planning throughout the

pandemic. Therefore, SC managers could gather more accurate information along the value chain, enhance SC visibility, and take proactive measures based on pre-alert signals (Hassan, et al., 2022). Firms have to eliminate their conventional linear supply chain structures in favor of a more modern and comprehensive system, such as the digital supply network (DSN) (Kilpatrick & Barter, 2020; Hassan, et al., 2022). DSN enables suppliers, manufacturers, and customers to collaborate via a dynamic data-sharing platform driven by on-time data (Sajjad, 2021; Hassan, et al., 2022). This allows organizations to effectively orchestrate and collaborate across their SC network partners, expanding a company's responsiveness and competitiveness as a whole (Hassan, et al., 2022). Based on this, the hypothesis has been constructed as below:

$H_3$: SC Collaborative Strategies has a significant relationship with the Sustainability Supply Chain

## Conclusion

The crisis potentially will open research opportunities for the supply chain management community as a whole - and sustainable supply networks - during and after this epidemic. The COVID-19 crisis's consequences on the SC demonstrate how devastating a pandemic can be to both supply and demand. This research explores how interruptions in SC influenced a semiconductor company's manufacturing efficiency, economic growth, and other operations performance during COVID-19. This unexpected situation provides room for natural experiments, empirical research, field investigations, and case studies (Sarkis,2020). The evolution of sustainability has been accompanied by a greater awareness of the SSC's extensive literature. The question of whether the COVID-19 outbreak will affect supply chain sustainability continues to gain momentum in the new literature. (e.g., Sharma, et al., 2020; Sarkis, 2020). The opposing question of whether a sustainability strategy focus will lead to organizations effectively surviving post-COVID-19 remains a significant research subject (Sarkis, 2020). Supply Chain Sustainability enables organizations to compete in a volatile environment (Sun, et al., 2022), and developing sustainable supply chain strategies is crucial (World Economic Forum, 2022) for returning to a usual or more efficient condition after recovering from a crisis (Paul, et al., 2021; Ponomarov & Holcomb, 2009). Interruptive recovery must occur efficiently to preserve supply chain continuity and minimize consequences in the longer term (Ivanov, et al., 2017). Developing an effective guideline for recovery from disruption to reduce liquidity strain is crucial (Fung, et al., 2023). Despite the crisis, companies must continue pursuing supply chain sustainability goals. This context is essential to help organizations remain relevant in the industry.

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