Quest Journals
Journal of Research in Business and Management
Volume 13 ~ Issue 9 (September 2025) pp: 50-57
ISSN(Online):2347-3002
www.questjournals.org

Research Paper

Global Supply Chain Disruptions and Firms' Strategic Choices: Analyzing Data to Elaborate Conceptual Frameworks

Hyuk Kim
(Business, Accounting & Economics Department Otterbein University USA)
Corresponding Author: Hyuk Kim

ABSTRACT: *Global supply chain disruptions have become a persistent challenge for companies globally, caused by factors such as natural disasters, geopolitical conflicts, pandemic, trade wars, semiconductor shortages, and natural resource scarcities. These disruptive events have exposed the high vulnerability of tightly interconnected contemporary global supply chain networks, resulting in increased costs, delays, and operational uncertainties. This paper develops conceptual frameworks to analyze the nature and consequences of these disruptions and explores firms' strategic responses. Drawing on interdisciplinary data from international business, economics, and supply chain management, this study identifies five key strategic directions for firms to effectively respond to global supply chain disruptions: diversification and regionalization of supply chains, integration of digital technologies and artificial intelligence, multi-layered risk management, leveraging institutional complexity, and fostering strategic partnerships. These strategies aim to enhance firms' resilience, adaptability, and sustainability in an era where disruptions are the new normal. The analysis in this paper may provide helpful insights for managers and scholars seeking to elaborate effective supply chain management strategies under today's volatile global environment.*

KEYWORDS: *Global Supply Chain, Supply Chain Disruptions, Natural Disasters, Geopolitical Conflicts, Pandemic, Trade War, Tariffs, Semiconductor Shortage, Critical Natural Resources, Strategic Choices, Risk Management, Institutional Complexity, Strategic Partnership.*

***Received** 01 Sep., 2025; **Revised** 09 Sep., 2025; **Accepted** 11 Sep., 2025 © The author(s) 2025.*
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I.INTRODUCTION

In this paper, the author tries to elaborate conceptual frameworks concerning the global supply chain disruptions that have affected firms' performance, particularly in terms of the firms' strategic choices. According to the Procurement Tactics (2025), 94% of the companies surveyed reported that they were negatively affected by the global supply chain disruptions in terms of revenue during 2024. Similarly, Alicke and Foster (2024), through their 2024 Global Supply Chain Leader Survey, reported that 90% of the survey respondents suffered from the global supply chain disruptions in 2024.Since the global supply chain disruptions are becoming a new normal in today's business, regardless of the size and the geographical location of companies, it became critical for business managers to fully understand the nature and consequences of the global supply chain disruptions to elaborate more effective strategies against the challenges they face. Thus, in this paper, the author aims to elaborate conceptual frameworks concerning the global supply chain disruptions that have affected firms' performance, particularly in terms of the firms' strategic choices.

According to Jabareen (2009), "conceptual frameworks are products of qualitative process of theorization" (p.50). To elaborate the conceptual frameworks for the global supply chain disruptions in relation to the firms' strategic choices, it is important to define the term, conceptual framework, before selecting and analyzing the elements that constitute it. Although there are different definitions of conceptual framework, for this paper, the author defines conceptual framework following Jabareen's (2009) definition: "a network, or "a plane", of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena" (p.51). As indicated above, conceptual framework can be elaborated through qualitative analysis.

Thus, it is important to note that conceptual framework helps researchers understand a phenomenon (or phenomena). It does not provide any defined theoretical conclusion for the phenomenon (or phenomena). Nevertheless, conceptual framework is important in scholarly research in exploring a phenomenon (or phenomena). In essence, conceptual framework can help researchers develop tentative theory and/or understand phenomenon (or phenomena) under investigation analyzing interrelated concepts, ideas, and events.

Tamene (2016) further defines conceptual framework as it "explains, either graphically or in narrative form, the main things to be studied and the key factors, concepts, or variables; and the presumed relationships among them" (p.51). In this respect, conceptual framework can be a guide for empirical research in qualitative study particularly for formulating firms' strategies in relation to specific phenomena, such as the events that contribute to the global supply chain disruptions.

In this paper, the author discusses the data critical to elaborate the conceptual frameworks to investigate firms' effective strategies in response to the events that contribute to the global supply chain disruptions. The author hopes that analyzing, more in detail, the data discussed in this paper could guide scholars and managers to formulate effective strategies for firms to deal with the events that contribute to the global supply chain disruptions. The data points to elaborate conceptual framework(s) of a study should be relevant sources of information that can represent the phenomenon under study. In addition, the data points should include diverse sources of information to correctly (and objectively) represent the phenomenon under study.

For this paper, the author analyzes data from diverse sources of information, such as peer-reviewed journal articles, books, newspapers, periodicals, interviews, etc. In particular, the data for this paper were collected across multiple disciplines, including international business, international politics, economics, and supply chain management, because the events related to the global supply chain disruption are in connection with multiple different disciplines and can't be explained in a single discipline. The analysis of the data should be interdisciplinary in nature.

II. EVENT ANALYSIS: RISKS ASSOCIATE WITH GLOBAL SUPPLY CHAIN DISRUPTIONS

As globalization of market as well as internationalization of firms has been intensified for the last several decades, the issues related to the global supply chain have provided companies globally not only with opportunities but also with challenges. Recently, we have witnessed several events that resulted in global supply chain disruptions across numerous countries in relation to diverse industry sectors. The global supply chain disruptions usually entail delays in sourcing raw materials, production of goods, and transportation of manufactured goods, increasing costs for businesses and, also, causing limited supply of critical products for the market. As a result, we have witnessed that consumers globally should pay more for critical products due to the global supply chain disruptions. In this section, the author examines the recent major global events that have negatively affected firms' performance for the last two decades.

First, there have been events associated with natural disasters or extreme weather that have disrupted global supply chains, including earthquake, wildfire, tsunami, hurricane, global warming, etc. These events are the external threats that are uncontrollable on the part of companies. For example, the earthquake and tsunami in Japan in 2011 heavily damaged the semiconductor production in Japan and, subsequently, disrupted, particularly, global supply chain of the automobile and consumer electronics companies (Mishra et al., 2024). Environmental issues have become major risks to the global supply chain. As the Economist Impact (2025) indicates, the past two years have seen historic floods in India and China, wildfires in California and Southern Europe, hurricanes in the US and Caribbean, and droughts constraining the Rhine and Panama Canal. All these environmental issues caused work stoppages, destruction of infrastructure, and rerouting of shipments, leading to the global supply chain disruptions (Business Climate Submit, 2025). Major storms and port closures in some countries or regions can create global effects, delaying supply of raw materials, damaging infrastructure, and causing production delays or shutdowns. We have recently witnessed that some specific industry sectors, such as automotive, electronics assembly, agriculture, and retail, are particularly vulnerable to the supply chain disruptions caused by environmental issues.

Second, there have been several geopolitical conflicts in recent years that have disrupted global supply chains. Global supply chains are interconnected with each other, making them vulnerable to geopolitical conflicts such as wars, armed conflicts, and political instability in a country or a region. These geopolitical conflicts have led to delays in manufacturing and shipping, increased costs, and shortages of critical goods, affecting various industries globally. The Global Risks Report in 2025 by the World Economic Forum reported that the geopolitical conflicts and regional instability, such as the war between Russia and Ukraine and the unrest in the Red Sea (which

escalated the tension between the US and China), are the most critical threat to the current global supply chains (Elsner et al., 2025). The Global Risks Report 2025 also reported that, currently, more than 110 geopolitical tensions (including the armed conflicts) are active worldwide, leading to the global supply chain disruptions. These geopolitical tensions also have resulted in economic sanctions against some countries (for example, Russia) that negatively affected global trade and investment, leading to inflation, and energy price volatility in many countries in the world.

Geopolitical conflicts have negatively affected global supply chains in the following manners:

1. Disruption of Trade Routes: Armed conflicts often block or reroute major shipping lanes. For example, attacks on merchant vessels in the Bab-el-Mandeb Strait forced ships to divert around Africa, adding 10–14 days to transit times and increasing fuel costs by up to $1 million per voyage (Edwards & Wilkin, 2025).

2. Damage and Operational Risks in Infrastructure: Wars damage transportation infrastructure such as ports, railways, and highways, leading to severe logistical bottlenecks. The war in Ukraine has disrupted grain exports and energy supplies, causing the ripple effects across global food and energy markets (Unicargo, 2024).

3. Sanctions and Export Controls: Economic sanctions imposed during the geopolitical conflicts restrict access to critical materials and technologies. For instance, sanctions against Russia after its invasion of Ukraine disrupted energy markets and raw material supplies, negatively affecting industries globally (Unicargo, 2024).

4. Increased Costs and Insurance Premiums: Geopolitical instability raises the war-risk insurance premiums and shipping costs. Companies often adopt the 'just-in-case' inventory strategies, increasing operational expenses (Maersk, 2025).

5. Resource Scarcity: Conflicts can lead to resource nationalism, where countries prioritize domestic use of critical resources, creating shortages in global markets (Cin7, 2025).

Third, as we have witnessed, the COVID-19 pandemic presented unprecedented disruptions in the global supply chains, showing how much contemporary businesses, globally, are interconnected with each other through the global supply chains and, also, prompting major strategic shifts across diverse industry sectors. The major disruptions caused by the pandemic include: (1) lockdowns and travel restrictions limiting the flow of raw materials and finished goods and leading to manufacturing delays and inventory shortages; (2) some businesses encountered demand collapse (e.g., luxury goods), but, in contrast, other businesses (e.g., medical supplies and sanitizing products) experienced demand surge; and (3) reduced workforce availability due to illness, quarantines, and safety protocols, particularly in the areas of logistics and manufacturing. The global supply chain disruptions caused by the pandemic negatively affected global trade volume because of the lockdowns, export restrictions, and the shocks on the supply side (UNCTAD, 2020).

Fourth, the trade war (trade conflict) between the US and China has been emerged as a major cause of the global supply chain disruptions. As Subhash (2022) noted, the trade tension between the two countries "threaten the entire global economy, not just the relationship between the two" (p.12). The trade tension, specifically tariff issue, have recently changed the global trade environment, not only between the US and China, but also between the US and the rest of the world. For instance, in 2025, the US increased tariffs to as high as 145% against Chinese imports, with China responding with up to 125% tariffs against US goods. The high tariff policy of the current US government has negatively affected the member countries of the USMCA, as the high tariffs against Mexico and Canada led to huge controversies between the US and the other two member countries of the USMCA (Reid, 2025). Similarly, the trade deal, in terms of the tariff, between the US and the EU, has also presented the changing trade environment to businesses (particularly to manufacturers outside the US) to deal with the high tariffs levied by the US government. The trade war (trade tension) has provided businesses worldwide an increasingly unpredictable global business environment including the global supply chain disruptions. Trade war, characterized by levying high tariffs and other retaliatory measures, has negatively affected global supply chains. The escalation of the U.S. tariffs by the current Present Trump administration against the imports from major trading partners, including Mexico, Canada, Japan, South Korea, and the EU member countries, has disrupted global supply chains reshaping global trade flows.

In specific, the impacts of the US' high tariffs against its trading partners include not only global supply chain disruptions but also other issues:

1. Supply Chain Disruptions: Established supply chains have been disrupted as companies seek alternative suppliers or adjust production processes. This has resulted in delays, shortages, and increased complexity in logistics management (SupplyChains Magazine, 2025).

2. Increased Costs and Inflationary Pressures: Tariffs directly increase the cost of imported goods, which raises production costs for manufacturers and retail prices for consumers. For example, SupplyChain Magazine (2025) reported that the U.S.'s tariffs against the imports from China and Mexico have led to higher costs for automotive components, electronics, and consumer goods, with some vehicles projected to cost $3,000 more due to tariffs (SupplyChains Magazine, 2025).

3. Changes in Sourcing Strategies: Companies are diversifying supply chains through nearshoring and reshoring to reduce reliance on the regions affected by the high tariffs. However, this transition is costly and time consuming, leading to inefficiencies, at least in the short-term period (SupplyChains Magazine, 2025).

4. Retaliatory Tariffs: Retaliatory tariffs from Canada, Mexico, and China have further disrupted global supply chains as well as have negatively affected the US industries in terms of export, such as agriculture, automotive, and manufacturing (SupplyChains Magazine, 2025).

5. Macroeconomic Effects: Analysts warn that steep tariff increases could create a stagflationary shock, combining slower economic growth with higher inflation, while also triggering financial market volatility (Erb, 2025).

Fifth, the global semiconductor shortage has emerged as a critical challenge for the contemporary global supply chain networks, disrupting automotive, consumer electronics and other industry sectors in the long-term perspective. Scholars have conducted research about how the semiconductor shortage has generated a ripple effect across global supply chain networks, lengthening lead times and amplifying variance in downstream operations (the ripple effect), with particularly acute impacts where just-in-time practices met capacity-constrained chip nodes (Kravchenko et al., 2024; Xiong et al., 2024). Beyond the immediate production shortages, the structural features of the global semiconductor supply chain, such as its multi-stage process (design–fab–assembly–test–packaging), extreme capital intensity, and long cycle times, limit the short-term elasticity of supply and make recovery protracted once capacity is fully utilized. Recent literature emphasizes that only few firms can control the issues related to the global semiconductor shortage, reinforcing concentration risk and exposing companies globally to failures (Fu et al., 2023; Xiong et al., 2024). Automobile manufacturers like Toyota and Ford have faced production halts, and technology giants like Apple have reported delays in product launches. These disruptions have created ripple effects across the global supply chain networks, affecting suppliers' revenues and causing volatility in equity and credit markets (Bloomberg, 2022).

One of the primary reasons for the prolonged shortage of the semiconductor supply is the complexity and cost of manufacturing it. Producing semiconductors requires highly specialized facilities, known as fabs, which cost billions of dollars and take years to build. Furthermore, the process of manufacturing semiconductors involves extreme precision, cleanroom environments, and advanced lithography techniques using extreme ultraviolet light (Bloomberg, 2021). Due to these technological and financial barriers, only few companies, such as TSMC, Samsung, and Intel, dominate the market, creating a concentrated supply base that is vulnerable to the global supply chain disruptions. The shortage of semiconductor supply has also exposed the fragility of globalized supply chains. Many semiconductor producers rely heavily on Southeast Asia for production, making them susceptible to regional disruptions such as natural disasters, political instability, or trade restrictions (Bloomberg, 2022). Recent geopolitical developments, including tariffs on semiconductor imports and export restrictions on advanced chips, have further strained supply chains and increased costs for technology firms (Bloomberg, 2025). These measures not only affect chip availability but also influence strategic decisions by companies to diversify suppliers and invest in domestic manufacturing capabilities.

Lastly, critical natural resources (e.g., rare earth elements, minerals, energy resources, etc.) are fundamental to global economic development and industrial production. However, their scarcity has emerged as a major source of the global supply chain disruptions. The increasing demand for these natural resources, driven mainly by technological innovation, has intensified competition among companies and national governments and exposed the structural weaknesses in the global supply networks (Zheng et al., 2024). The shortages in these natural resources have been compounded by geopolitical tensions, trade restrictions, and environmental regulations, leading to further constraint in the resource availability and supply chain disruptions across multiple industry sectors globally. Technological innovation and subsequent digitalization under today's globalization have

also amplified the complexity of the supply chains of these natural resources. While innovative digital technologies enhance operational efficiency, they also increase dependence on the resource-intensive components, such as semiconductors and rare earth minerals, creating additional pressure on natural resource reserves (Pilatin et al., 2025). In addition, as Katsaliaki et al. (2022) pointed out, disruptions in resource extraction or processing in one region can spread across multiple different industry sectors globally, leading to production delays, cost escalations, and reduced resilience, because global supply chains are interconnected with each other. Zheng et al. (2024) maintain that the mineral resource supply chains show systemic fragility because of the network structure. A recent study found that the resilience of global mineral resource supply chains declined by nearly 40% over a decade, with critical nodes concentrated in manufacturing sectors.

III. FIRMS' STRATEGIC CHOICE TO GLOBAL SUPPLY CHAIN DISRUPTIONS

As discussed above, global supply chains have faced significant disruptions over the past decade due to natural disasters (including extreme weather), geopolitical conflicts, the COVID-19 pandemic, trade wars and high tariffs, semiconductor shortages, and natural resource scarcities. These events have prompted many firms to reanalyze and reevaluate their supply chain strategies, shifting their focus from cost-efficiency to resilience, adaptability, and sustainability. In this section, the author discusses recommended new strategic directions for companies to deal with a new normal in today's global business environment, the global supply chain disruptions.

Recommendation 1: Diversification and Regionalization of Supply Chains

In a recent study, Ahn and Tan (2025) introduced the resilience-efficiency trade off in a multi-country, multi-sector general equilibrium model with network rigidities. This study shows that diversifying sources for upstream, rigid, shock-prone inputs (e.g., chips, chemicals, et.) raises expected welfare when the probability of large shocks is high. This study also shows that diversification is especially valuable where short-run factors and relationship stickiness impede rapid reconfiguration. The recent industry data show that companies are operationalizing this through nearshoring and friendshoring. For example, Deloitte (2024) reported that 97% of companies reconfigured supply chains by late 2023, with the U.S. goods trade shares shifting from China toward Mexico and Canada, and manufacturers exploring Mexico, Canada, India, Vietnam, and Eastern European countries to reduce lead times, minimize tariff exposure, and add redundancy. In addition, Bain & Company's (2024) recent operations survey found that 81% of the chief executive officers (CEOs) surveyed planned to bring supply chains closer to home markets (i.e., reshoring, near-shoring, or split-shoring), although only 2% of the respondents had fully completed their plans, confirming the long-term (multi-year) nature of the diversification and regionalization of the global supply chains. In specific, the survey results showed that automotive nearshoring to Mexico and Central/Eastern Europe has been notable under transition to electric vehicles and volatile logistical environment.

Recommendation 2: Integration of Digital Transformation and Artificial Intelligence (AI)

A number of studies have recently connected AI, machine learning (ML), IoT, digital twins, and analytics with firms' resilience capabilities, such as visibility, anticipation, adaptation. Iftikhar et al. (2024) conducted a systematic review to identify the core clusters around predictive analytics, cyber-physical systems, and digital twins as enablers of supply chain resilience under the global supply chain disruptions. In terms of the performance effects, the recent literature showed that both AI and ML fundamentally improve demand forecasting and logistics optimization. But, the recent literature also provided some adoption hurdles, including data quality, benchmarking, and explainability (Singh, 2023). Maersk (2024)'s report posited the unified data models and predictive analytics as the foundation of AI-ready, proactive supply chains that can fill the gaps between forecast–plan integration and responsiveness.

Recommendation 3: Risk Management

To effectively deal with the current global supply chain disruptions, companies should develop and implement a multi-layered risk management strategy that combines technological innovation, supplier diversification, and proactive planning. In other words, elaborating the risk management strategy to effectively manage disruptions in global supply chains requires multiple analysis considering different areas of consideration listed below:

1. Risk Identification and Assessment: Mapping the entire supply chains and evaluating dependencies among these supply chains help identify vulnerabilities. Both quantitative and qualitative risk assessment frameworks are essential to fully identify potential threats (Antonio, 2024).
2. Supplier Diversification and Redundancy: Reducing dependency on a single supplier or a region enhances flexibility and mitigates risks from geopolitical conflicts or natural disasters (Agrawal, 2024; Kumar et al., 2024).
3. Technology Integration: Using innovative technologies, such as blockchain, AI, and IoT, can improve visibility, traceability, and predictability, enabling real-time monitoring and proactive responses to supply chain disruptions (Agrawal, 2024; Antonio, 2024).
4. Scenario Planning and Contingency Frameworks: Developing adaptive strategies and conducting scenario analyses help managers prepare for various supply chain disruption scenarios (Kumar et al., 2024).
5. Collaborative Relationships: Strong partnerships with suppliers and critical stakeholders can facilitate coordinated risk responses and shared contingency planning (Antonio, 2024).
6. Organizational Culture and Governance: Commitment by leadership and an organizational culture of resilience are vital for embedding risk management into the strategic decision-making process of the company (Kumar et al., 2024)

Recommendation 4: Institutional Complexity and Supply Chain Disruptions caused by Geopolitical Conflicts

Institutional complexity helps companies manage global supply chain disruptions caused by geopolitical conflicts by enabling adaptive responses to conflicting institutional logics and enhancing multi-level governance. Herold and Marzantowicz (2023) discussed that organizations embedded in complex institutional environments, in which multiple, often conflicting logics coexist, are better equipped to respond to geopolitical conflicts that negatively affect global supply chains. In addition, Moradlou et al. (2025) further discussed that institutional complexity also promotes structural ambidexterity, allowing companies to partition internal subunits, reconfigure supplier networks, and create parallel supply chains. This also enables companies to explore new opportunities and exploit existing capabilities during geopolitical disruptions (Moradlou et al., 2025). In essence, institutional complexity supports multi-level governance, helping companies navigate regulatory fragmentation and political instability. By engaging with diverse institutional actors and aligning supply chain strategies with evolving norms, companies can maintain operational continuity and resilience (Bednarski et al., 2025).

Recommendation 5: Strategic Partnership

Strategic partnership can be an effective measure for companies to deal with global supply chain disruptions, particularly in volatile geopolitical environments. Partnerships foster resilience through collaboration, resource sharing, and coordinated responses across supply chain networks. In other words, strategic partnerships can help companies mitigate global supply chain disruptions in multiple ways as described below:

1. Enhanced Agility and Responsiveness: Strategic partnerships improve a firm's supply chain agility, facilitating faster decision-making and coordinated action during supply chain disruptions. It is noted that digital transformation can further amplify this effect, enabling real-time data sharing and predictive analytics (Mutambik, 2024).
2. Shared Risk and Resource Optimization: Cooperative partnership with suppliers, logistics providers, and technology partners allows a firm to distribute risk with its partners and optimize resources. This can be especially important during geopolitical tensions, where access to materials or transport routes may be compromised (Fröhlich et al., 2021).
3. Sustainable and Ethical Procurement: A long-term partnership with suppliers supports sustainable procurement practices, helping firms comply with evolving regulations and social expectations. This is becoming more important as supply chains face scrutiny over human rights and environmental impact (Fröhlich et al., 2021).
4. Improved Visibility and Coordination: Strategic partnership enables firms to have better visibility across supply chain networks, improving coordination with partners. This leads to more accurate forecasting and inventory management for firms during uncertain times (Corbett et al., 1999).
5. Strategic Reconfiguration and Innovation: Firms can leverage partnerships to redesign existing supply chains through, for example, regionalization or modular manufacturing, to reduce dependency on geopolitically sensitive regions (Bednarski et al., 2025).

IV. CONCLUSION

Global supply chain disruptions have evolved into systemic challenges in the contemporary global business environment, redefining the competitive landscape for companies globally. This paper emphasizes that resilience, adaptability, and sustainability must be considered, in addition to the cost-efficiency, as the critical criteria in elaborating supply chain management strategies. By analyzing diverse disruptions that negatively affect global supply chain networks, ranging from natural disasters and geopolitical conflicts to pandemic, trade wars, and resource scarcities, this study highlights the interconnected nature of the contemporary global supply chain networks in terms of vulnerability. The author believes that the proposed conceptual frameworks and strategic recommendations, including diversification, digital transformation, risk management, institutional complexity, and strategic partnerships, can provide helpful pathways for firms to navigate uncertainty. In essence, building resilient supply chains should not be a short-term assignment but a long-term strategic imperative that requires cross-disciplinary insights, technological integration, and collaborative governance. Future research needs to empirically validate these frameworks, with sector-specific applications, to strengthen global supply chain resilience under today's persistent volatility in the global business environment.

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