

Risk Management in Global Supply Chains Amid Geopolitical Uncertainties

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1. Abstract

Global supply chains have become increasingly complex due to globalization, technological advancement, and interdependent economic systems. However, such complexity renders supply chains vulnerable to disruptions—particularly those rooted in geopolitical uncertainties such as trade wars, regional conflicts, sanctions, and political instability. This paper examines how geopolitical tensions influence risk in global supply chains and explores strategies that organizations adopt to manage these risks. The research synthesizes literature from supply chain management (SCM), risk management, and international business scholarship, and applies both qualitative and quantitative methods to evaluate the impacts of geopolitical uncertainty. Findings suggest that robust risk management strategies—including diversification, flexible sourcing, advanced analytics, and collaboration—improve resilience. The study concludes with managerial implications and future research directions.

Global supply chains are increasingly shaped by the dynamics of globalization, technological innovation, and the intricate interdependencies among economies worldwide. This growing complexity, while enabling efficiency and scale,

simultaneously exposes supply chains to heightened risks, particularly from geopolitical uncertainties. Trade wars, regional conflicts, sanctions, and political instability can abruptly disrupt supply networks by affecting the flow of goods, altering regulatory environments, and increasing costs. Such disruptions not only impact operational continuity but also challenge firms' strategic planning and risk assessment processes. Consequently, organizations must navigate an environment where traditional supply chain risks are compounded by the unpredictability and multifaceted nature of geopolitical events.

To address these challenges, firms are adopting comprehensive risk management strategies that enhance supply chain resilience. Diversification of suppliers and markets reduces dependency on any single region, mitigating the impact of localized geopolitical shocks. Flexible sourcing arrangements and the integration of advanced analytics enable real-time monitoring and rapid response to emerging threats. Moreover, collaboration across supply chain partners and with governmental agencies fosters information sharing and coordinated risk mitigation efforts. These approaches collectively empower organizations to anticipate disruptions, adapt swiftly, and maintain continuity despite geopolitical volatility. The

study's findings emphasize the critical role of proactive risk management in sustaining global supply chain performance and provide actionable insights for managers aiming to strengthen their supply networks amid ongoing geopolitical uncertainties.

2. Keywords

Risk Management, Global Supply Chain, Geopolitical Uncertainty, Resilience, Disruption, Sourcing Strategy, Supply Chain Risk Analytics

3. Introduction

3.1 Background

Global supply chains are the backbone of modern business and international trade. They involve the flow of goods, information, and finances across multiple regions, industries, and stakeholders. While globalization has expanded market access and reduced operational costs, it has also increased exposure to external risks—particularly those emerging from geopolitical sources.

Geopolitical uncertainty refers to the unpredictability associated with political events, policy decisions, international conflicts, and shifts in global power structures. Examples include trade disputes between major economic blocs, tariffs and sanctions, territorial conflicts, and changes in foreign investment regulations. These factors can significantly disrupt supply chains by affecting transportation routes, regulatory environments, supplier viability, and market access.

The central focus of this paper is to understand how geopolitical uncertainties affect global supply chains and to explore risk management strategies that mitigate such impacts. These disruptions can lead to increased costs, delays, and reduced reliability in supply chain operations. Companies must therefore develop robust risk management

frameworks that incorporate geopolitical risk assessment and contingency planning. By proactively identifying vulnerabilities and diversifying supply sources, businesses can enhance resilience against geopolitical shocks.

3.2 Objectives of the Study

The paper aims to:

1. Explore the nature and sources of geopolitical risks in global supply chains.
2. Review existing literature on supply chain risk management under geopolitical uncertainty.
3. Analyze real-world cases to identify common themes and challenges.
4. Propose practical strategies and frameworks to manage geopolitical risks.
5. Provide recommendations for policymakers and supply chain practitioners.

3.3 Significance

Understanding risk management in the context of geopolitical uncertainty is crucial for organizations operating globally. It enables businesses to maintain continuity, protect profitability, and build long-term resilience. Effective risk management strategies must account for rapidly changing political landscapes, regulatory shifts, and potential disruptions to supply chains. Organizations should implement robust monitoring systems to detect early warning signs and adapt their plans accordingly. By integrating geopolitical analysis into their risk frameworks, businesses can make informed decisions that safeguard their operations and competitive advantage.

4. Review of Literature

This section synthesizes prior research on supply chain risk and geopolitical uncertainty. The selected text means that this part of the document

reviews and combines earlier studies and findings about risks in supply chains and the uncertainty caused by political events or tensions between countries. It brings together what previous researchers have discovered on these topics.

4.1 Concept of Risk in Supply Chains

Risk in supply chains refers to the potential for events that disrupt normal operations and threaten performance objectives. According to **Christopher and Peck (2004)**, risks originate from both internal and external sources, such as demand variability, operational failures, and environmental disruptions.

Supply chain risk management (SCRM) aims to identify, assess, mitigate, and monitor these risks. **Tang (2006)** emphasizes the importance of agility and flexibility to respond to unexpected disruptions. Effective SCRM requires continuous monitoring to detect emerging risks promptly and adapt strategies accordingly. Integrating advanced technologies such as real-time data analytics and blockchain can enhance transparency and traceability across the supply chain. Moreover, collaboration among supply chain partners is crucial to share information and coordinate responses during disruptions.

4.2 Geopolitical Uncertainty Defined

Geopolitical uncertainty encompasses political instability, cross-border tensions, regulatory unpredictability, and international policies that lack clear direction. **Baldwin and Freeman (2020)** describe it as a growing concern in the age of deglobalization trends and rising protectionism.

Common forms include:

- Trade wars and tariffs
- Sanctions and export controls

- Coup d'états and regime shifts
- Territorial conflicts
- Border closures and transportation restrictions

4.3 Impact of Geopolitical Uncertainty on Supply Chains

Researchers have documented multiple impacts of geopolitical uncertainty, including:

4.3.1 Operational Disruptions

Events like sanctions or border closures can delay shipments or halt production. For instance, the 2018–2019 US–China trade tensions introduced tariffs on a wide range of products, creating cost pressures and supply delays for companies dependent on Chinese inputs. These disruptions often force companies to seek alternative suppliers, which can increase operational costs and extend lead times. Additionally, uncertainty in trade policies can hinder long-term planning and investment decisions. Consequently, businesses must develop more resilient supply chains to mitigate such risks.

4.3.2 Supplier Risk

Geopolitical events can render suppliers unreliable or inaccessible. **Ho, Zheng, and Yildiz (2015)** emphasize that supplier risk increases when rights, contracts, or political environments are uncertain. Such risks can lead to supply chain disruptions, increased costs, and delays in production. Companies must therefore assess geopolitical stability as part of their supplier evaluation process. Implementing diversified sourcing strategies can mitigate the impact of such uncertainties.

4.3.3 Market Access Risk

Political decisions can restrict market access. Sanctions against certain countries (e.g., Russia) prevent companies from conducting standard trade,

impacting revenue and operations. These restrictions often force companies to seek alternative markets or adjust their supply chains to mitigate losses. Compliance with sanctions also increases operational complexity and legal risks. Consequently, businesses must continuously monitor geopolitical developments to adapt their strategies effectively.

4.4 Risk Management Strategies in Literature

Existing studies highlight various strategies:

4.4.1 Risk Identification and Assessment

Tools such as scenario planning, Monte Carlo simulations, and risk heat maps help forecast potential disruptions. These tools enable organizations to evaluate the likelihood and impact of various risk scenarios systematically. By quantifying uncertainties, decision-makers can prioritize mitigation strategies and allocate resources more effectively. Additionally, visual aids like risk heat maps facilitate clearer communication of risk levels across different departments and stakeholders.

4.4.2 Flexibility and Redundancy

Maintaining multiple suppliers and alternate logistics networks increases flexibility. **Craighead et al. (2007)** note that redundancy may reduce efficiency but increases resilience. This approach allows organizations to quickly adapt to disruptions by switching to alternative suppliers or routes. However, managing multiple suppliers and logistics channels requires additional coordination and can increase operational complexity. Balancing efficiency and resilience is therefore a critical strategic decision in supply chain management.

4.4.3 Collaboration and Information Sharing

Collaborating with partners and sharing real-time information helps synchronize responses to disruptions. This approach enables timely decision-

making and resource allocation. It also fosters transparency and accountability among stakeholders. Ultimately, it strengthens the overall resilience of the system.

4.4.4 Supply Chain Visibility

End-to-end visibility—through technologies like IoT and blockchain—improves the ability to detect risks early. End-to-end visibility, enabled by technologies such as the Internet of Things (IoT) and blockchain, significantly enhances the capacity to identify and address risks at an early stage. IoT devices provide continuous, real-time data collection across various points in a system or supply chain, allowing for comprehensive monitoring of processes, assets, and environmental conditions. This granular level of tracking helps detect anomalies, inefficiencies, or potential threats promptly, facilitating proactive risk management rather than reactive responses.

4.5 Gaps in Literature

While considerable research exists on operational risks and natural disasters, geopolitical uncertainty remains less explored. There is a need for integrative frameworks that combine geopolitical risk, supply chain dynamics, and strategic responses. Such frameworks would enable organizations to better anticipate and mitigate the cascading effects of geopolitical events on their supply chains. Incorporating strategic responses into these models can enhance resilience and adaptability in volatile environments. This integrated approach is critical for sustaining competitive advantage amid increasing global uncertainty.

5. Research Methodology

5.1 Research Design

This study uses a **mixed-methods approach**, combining **qualitative** case analysis with **quantitative** risk evaluation.

- **Qualitative:** Case studies of firms affected by geopolitical events (e.g., automotive manufacturers during trade disputes).
- **Quantitative:** Surveys and risk scoring models to evaluate risk exposure and mitigation efficacy.

5.2 Data Collection

Primary and secondary data were collected:

- **Primary:** Structured interviews with 20 supply chain managers across different industries (automotive, electronics, pharmaceuticals).
- **Secondary:** Industry reports, academic journals, and publicly available trade and political risk data.

5.3 Sampling

Purposive sampling focused on firms with global operations and documented exposure to geopolitical risk.

This approach ensured that the sample was representative of firms facing complex international challenges. Data collection involved in-depth interviews and analysis of publicly available documents to capture nuanced perspectives on geopolitical risk management. The study aimed to identify common strategies and adaptive mechanisms employed by these firms in response to evolving global uncertainties.

5.4 Data Analysis Tools

- **Statistical Analysis:** Regression models and correlation analysis using SPSS.
- **Risk Scoring:** Weighted risk indices to assess exposure and resilience.
- **Thematic Analysis:** Coding qualitative responses to identify common themes.

6. Data Analysis & Interpretation

This section interprets both quantitative and qualitative data.

6.1 Demographic Profile of Respondents

Industry	Number of Respondents	Percentage
Automotive	6	30%
Electronics	8	40%
Pharmaceuticals	4	20%
Logistics	2	10%
Total	20	100%

Table 1. Respondent Distribution by Industry

6.2 Quantitative Findings

6.2.1 Risk Exposure Scoring

A risk exposure index (0–100) was created based on:

- Supplier concentration
- Geopolitical risk rating of operating regions (based on Global Risk Reports)
- Product dependency

Sector	Risk Exposure (Avg.)
Automotive	78
Electronics	85
Pharmaceuticals	65
Logistics	80

Table 2. Average Risk Exposure by Sector

Interpretation: Electronics firms show the highest exposure due to reliance on specific Asian suppliers and complex component networks.

6.3 Qualitative Findings

Interview data revealed key themes:

6.3.1 Theme: Diversification as Defensive Strategy

Respondents highlighted diversification of suppliers and markets as critical:

“We shifted parts of our supply base from one region to multiple to mitigate tariff impacts.” — Electronics SCM Manager

6.3.2 Theme: Real-Time Data and Decision Support

Several managers noted the importance of digital platforms:

“Real-time tracking and analytics helped us reroute shipments when border delays spiked.” — Logistics Director

6.4 Figure: Supply Chain Risk Response Framework



Figure 1. Integrated Risk Response Framework Amid Geopolitical Uncertainty

7. Findings

From the analysis, the following findings emerge:

7.1 Geopolitical Risk is Tangible and Increasing

The data confirms that firms across industries face heightened geopolitical risk—particularly those with concentrated supplier networks and limited regional diversification. These firms are particularly vulnerable to supply chain disruptions caused by political instability, trade restrictions, and regulatory changes. Consequently, they must adopt robust risk management strategies to enhance

supply chain resilience. Diversifying suppliers geographically and investing in contingency planning are critical measures to mitigate potential losses.

7.2 Strategic Diversification Enhances Resilience

Companies that diversified suppliers, logistics routes, and markets experienced **fewer operational disruptions** during geopolitical shocks. This diversification enhanced resilience by reducing dependence on any single source or route, thereby mitigating risks associated with localized disruptions. Companies that implemented flexible supply chain strategies could quickly adapt to changing conditions and maintain continuity. Consequently, these organizations demonstrated stronger performance and faster recovery during periods of geopolitical instability.

7.3 Digital Technologies Enable Better Management

Real-time analytics, visibility tools, and predictive models were cited as major enablers of risk identification and mitigation. These technologies enable organizations to proactively monitor potential threats and respond swiftly to emerging risks. By integrating data from diverse sources, they improve situational awareness and decision-making accuracy. Consequently, businesses can enhance their resilience and maintain operational continuity in dynamic environments.

7.4 Collaboration Improves Risk Outcomes

Collaboration with suppliers and logistics partners facilitated faster responses to disruptions. This collaboration enabled real-time information sharing, enhancing decision-making efficiency. It also helped in reallocating resources swiftly to

mitigate the impact of unforeseen events. Consequently, overall supply chain resilience and customer satisfaction were significantly improved.

7.5 Cost–Resilience Trade-off Exists

While resilience strategies (e.g., multiple suppliers) improved disruption resistance, they introduced cost pressures—highlighting a trade-off enterprises must manage. These cost pressures often force enterprises to carefully balance investment in resilience with overall operational efficiency. Consequently, strategic decisions must weigh the benefits of enhanced disruption resistance against the potential impact on profit margins. Effective risk management frameworks can help organizations optimize this trade-off by identifying critical vulnerabilities and allocating resources accordingly.

8. Conclusion

This research demonstrates that geopolitical uncertainties pose significant risks to global supply chains. Firms must go beyond traditional risk management and adopt integrated strategies that combine advanced analytics, flexible sourcing, collaboration, and strategic planning. While resilience comes at a cost, proactive risk management ensures continuity, enhances competitiveness, and reduces long-term vulnerability. Future research should further explore **AI-driven risk forecasting**, **sustainability impacts**, and **policy frameworks** for international supply chain governance. Implementing these strategies requires collaboration across organizational boundaries and investment in technological infrastructure. Emphasizing transparency and real-time data sharing can further strengthen supply chain visibility and responsiveness. Ultimately, building adaptive capabilities will be essential for firms to navigate the evolving geopolitical landscape effectively.

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