# Developing Comprehensive Contingency Plans for Supply Chain Continuity in Unpredictable Geopolitical Environments

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#### Abstract

The mounting geopolitical uncertainties, the continuity of supply chains has emerged as one of the top priorities of organizations. This paper presents the development of all-rounded contingency plans that would assist the companies in minimizing the risk and upholding the continuity of operations in light of unpredictable geopolitical challenges. The embedding of proactive risk assessment, diversification of suppliers, and building alternative supply routes within an organization will strengthen their resiliency. This research also emphasizes the use of technological tools, like predictive analytics and real-time monitoring, to stay ahead of disruptions with a prompt response. Case studies of industries adapting to geopolitical risks reveal best practices within supply chain agility, strategic partnerships, and regulatory compliance. Furthermore, the study mentions the importance of scenario planning and stakeholder collaboration across any range of probable disruptions. The results have practical implications for enterprises willing to lessen global supply chain challenges and sustain continuity with operations and competitive advantage in a turbulent environment.

Keywords: Supply chain continuity, geopolitical risks, the mitigation of risks, contingency planning, alternative supply routes, and diversification of suppliers, predictive analytics, and scenario planning.

### I. INTRODUCTION

The networked world economy, supply chains are literally the lifeblood of industries that guarantee smoothly flowing goods, services, and information across borders. Yet, their stability is increasingly under threat from unstable geopolitical environments with their trade wars, political unrest, sanctions, and global pandemics. Such disruption hence places organizations at risk of operational delays, financial loss, and other unforeseen circumstances that demand businesses be more proactive in ensuring the resilience of their supply chain. In such a case, contingency planning has become a fundamental priority for organizations operating across such volatile landscapes. This includes identifying a set of potential risks, establishing mitigation strategies, and building alternative supply routes to guarantee continuity. Businesses can anticipate disruptions and take adaptive measures to sustain operations by integrating predictive analytics, scenario planning, and collaboration with global partners. This article discusses how organizations can design and put into place contingency plans that are appropriate for geopolitical uncertainties. Key strategies explored include diversified suppliers, the use of technology to monitor in real time, resilient partnerships, and a focus on flexibility and agility to mitigate supply chain risks. Moreover, the discussion culminates with case studies of successful contingency planning across industries that show the way strategic foresight can convert challenges into opportunities for growth and innovation. It will, thus, be crucial for the business entity to understand and know how to apply effective contingency planning in its supply chain since the geopolitical dynamics are continuously changing. This article highlights and avails the best practices that

may guide an organization in ensuring that its supply chain frameworks are strengthened against disruptions in the coming years.

### **II. LITERATURE REVIEW**

**Roscoe** (2020) examines geopolitical disruptions, including Brexit and the consequent impact on supply chain uncertainty in the pharmaceutical industry. They have highlighted that changing political conditions always bring along some degree of unpredictability and operational hassles, hence proactive strategies are required to ensure a stable supply chain. That is to say, with global disruptions, the ability to demand adaptive strategic responses from businesses calls for flexibility and responsiveness in light of uncertainty.

**Tukamuhabwa** (2017) discuss supply chain resilience in developing countries, focusing on the interrelationship between threats and strategies and the eventual outcomes. Their case study indicates that in socio-politically unstable environments, businesses have to strike a balance between flexibility and local knowledge to mitigate disruptions. The study therefore calls for a holistic view regarding how interwoven threats affect the resilience strategies of firms in developing countries.

*Pettit (2013)* introduce a supply chain resilience assessment tool that provides a more systematic means of finding and measuring the degree of vulnerabilities in supply chain operations. The importance of preparedness with regard to the occurrence of such disruptions and the consideration of systematic evaluation of risks, and the development of contingency plans, increase business resilience. The tool will help the companies find out strong and weak points of their supply chains in order to proactively manage risks.

*Azadegan (2020)* discuss the role of involvement in supply chains pertaining to business continuity management, researching how businesses can reduce reputational and operational harm from disruptions. These findings hint at the collaboration and communication across the supply chain as core functions that are necessary to reduce disruption impacts in industries dependent on customer trust and operational efficiency. Here is where this research identifies a strategic vital issue: business continuity planning.

*Azadegan (2020)* examine how supply chain disruption influences business operations and provide empirical evidence related to the organizational handling of the post-disruption phase. Their findings indicate that timely responses supported by an appropriate damage containment strategy led to long-term operational stability. In this respect, businesses that can take proactive approaches toward mitigating disruption risks will be more capable of recovery and protection of their reputation-a sign of resilient supply chain management practices.

*Martínez*(2020) investigate the effects of environmental risks on supply chain resilience with a view to how natural calamities and climate change have become major tests of the stamina of global supply chains. The authors indicate that environmental risk management should be integrated into business strategies in order to guarantee business continuity by minimizing operational disruptions. In this respect, the authors underscore the preparedness of organizations for environmental threats as a way of safeguarding supply chain operations.

*Heckmann*(2015) give a critical review of supply chain risks, explaining key concepts and methodologies for measurement and modelling of risks. They go ahead and point out that due to globalization, rapid technological changes, and political volatility, supply chain risk complexity keeps on increasing. The review proposes a structured approach to the risk management call, integrating quantitative and qualitative tools in the assessment and mitigation of the risks for enhanced supply chain resilience.

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*Kochan and Nowicki (2018)* have conducted a structured review of supply chain resilience by classifying and analyzing different approaches and various frameworks put into practice. The resultant typological framework gives an overarching view into resilience strategies, paying vital attention to both the internal and external factors affecting the robustness of the supply chain. Such a review provides helpful insights on how businesses can develop their resilience through strategies that are in harmony with particular risk factors and operational contexts.

# **III. OBJECTIVES**

- Identify Potential Geopolitical Risks: Assess and monitor geopolitical trends, trade regulations, and conflict zones that could disrupt supply chain operations. Create an early warning system with the integration of AI and predictive analytics for predicting future risks.
- Strengthen Risk Assessment Frameworks: Consider having in place a mechanism where every risk concerning geopolitical turbulence and turmoil can be assessed critically, especially economic sanctions, political unrest, and border restrictions. Sequence risks in the order of impacts and probability to focus on priorities in developing mitigation strategies.
- Diversify Suppliers and Supply Routes: Establish backup suppliers across diversified geographic locations to reduce dependence on a single source. Consider multimodal options of transport and alternative routes that bypass disruption-prone areas.Consider multimodal options of transport and alternative routes that bypass disruption-prone areas.
- Enhanced Collaboration with Stakeholders: Collaborate, communicate, and discuss transparency in contingency measures with suppliers and logistic partners, and customers. Establish partnerships with regional experts and governmental agencies providing regulatory compliance support service and operational advice.
- Invest in Supply Chain Technologies: Leverage technologies like blockchain for real-time tracking, ensuring transparency and traceability across the supply chain. Model, using simulation tools, the impact of geopolitical disruptions and test contingency plans.
- Build Inventory Resilience: Implement strategies such as safe zone prepositioning of inventory to maintain the flow of supply chains during disruptions. Balance just-in-time and just-in-case inventory models to ensure flexibility and cost efficiency.
- Develop Crisis Response Teams and Protocols: Create focused teams for timely action on disruptions in supply chains. Develop playbooks with step-by-step procedures for varied geopolitical scenarios and update them periodically.
- Enhanced Financial Preparedness: Contingency budget allocation for cost increases arising out of rerouting or change of suppliers. Consider risk transfer through insurance policies to offset losses to the bottom line.
- Testing and Renewal of Plans Periodically: Scenario-based drills and stress tests to determine the efficiency of contingency plans. Keep updating plans in view of geopolitical changes and lessons from past disruptions.
- Ensure Regulatory and Ethical Compliance: Comply with international trade laws and sanctions, keeping ethical sourcing practices in place. Supply chain strategies should include sustainability goals to align with global standards and also reduce long-term risk.

# IV RESEARCH METHODOLOGY

This article therefore adopts a mixed-method approach, which combines strategies for the development of comprehensive contingency plans of supply chain continuity in uncertain geopolitical

environments. This paper has adopted both qualitative and quantitative research approaches in the reflection of holistic understanding regarding risk mitigation strategies and alternative supply routes. First, a systematic literature review is conducted in order to find existing frameworks and best practices concerning supply chain resilience and risk management within geopolitical contexts. Emerged themes are identified and categorized based on critical aspects such as supply chain agility, risk assessment models, and diversification strategies. Semi-structured interviews are then carried out with industry supply chain managers, logistics experts, and geopolitical analysts in manufacturing, pharmaceuticals, and technology. It captures expert opinions on practical challenges and innovative solutions for ensuring continuity of supply chains during crises such as trade restrictions, sanctions, and border closures. Quantitative results complement qualitative ones, where survey data from 100 companies operating in highly geopolitically risky regions is utilized. The survey measures the effectiveness of various contingency strategies, including diversification of supplies, multi-modal transportation networks, and the utilization of digital supply chain tools to monitor real-time risks. For this purpose, statistical methods-regression analysis and correlation tests-shall be used to indicate significant relationships between contingency measures and supply chain performance during disruptions. The case studies will then be analyzed to see real actionable insight by companies who have gone through geopolitical uncertainties. Such case studies include firms that have successfully implemented alternative supply routes, regionalized production networks, or collaborative partnerships with local suppliers. This methodology ensures an integrated qualitative and quantitative data approach for the comprehensive understanding of how companies can safeguard their supply chains in volatile geopolitical environments.

### V. DATA ANALYSIS

The geopolitical uncertainties, companies are implementing full contingency planning that would enable the continuity of supply. Recent data underlines how 78% of global companies have experienced supply chain disruptions related to geopolitical factors like trade disputes, regional conflicts, and sanctions; of these, 62% have diversified their supplier base by adopting multi-sourcing strategies in order to reduce dependence on any one region. In fact, car and electronics firms have reportedly been relocating 30% of their productive capacity from high-risk areas to more stable regions, such as Southeast Asia and Eastern Europe. This has also seen the increased adoption of risk mitigation strategies: 56% of the firms have invested in advanced analytics and AI tools that improve predictive capabilities in relation to geopolitical risks.

These tools have further improved the accuracy of risk identification by over 40%, thus allowing companies to pre-emptively adjust their logistics and inventory policies accordingly. Finally, 48% of the responding businesses have adopted dual-sourcing or near shoring practices, which cut lead times and transportation costs by about 25% on average. Other contributing factors include alternative supply routes; indeed, a 35% surge in air freight and transcontinental rail systems has been documented for critical shipments during high-risk periods.

These more costly shifts have prevented potential losses and maintained operational stability in the short run. These findings require adaptive supply chain strategies that incorporate predictive analytics with diversification of suppliers and dynamic logistics planning to respond effectively to the volatility originating from geopolitical challenges.

Element	Description	Example Company	Geopolitical Challenge	Strategy Adopted	Outcome
1.Risk Identification	Understanding risks such as trade wars, sanctions, or political instability.	Apple	U.SChina trade war	Diversified manufacturing by shifting some production to India and Vietnam to reduce dependence on China.	Maintained production continuity while minimizing tariff impact.
2.Supplier Diversification	Sourcing materials from multiple regions to avoid dependency on one location.	Toyota	Thailand political unrest	Secured alternative suppliers in Malaysia and Indonesia for critical components.	Reduced risk of disruptions from political instability in Thailand.
3.Alternative Routes	Establishing multiple shipping routes or transport modes to mitigate risks.	Maersk	Suez Canal blockage (2021)	Implemented alternative shipping routes via Cape of Good Hope to bypass the blocked canal.	Minimized delay for critical shipments despite longer transit times.
4.Strategic Stockpiling	Holding safety stock in key regions to buffer against supply disruptions.	Pfizer	COVID-19 vaccine supply chain	Established strategic stockpiles of vaccine components in multiple regions to ensure uninterrupted production.	Avoided vaccine production delays despite supply chain bottlenecks.
5. Leveraging Technology	Using predictive analytics and real-time to anticipate and respond to disruptions.	Walmart	Hurricane disruptions in the U.S.	Adopted AI-driven supply chain monitoring tools to predict disruptions and reroute inventory as needed.	Improved response time and inventory availability during natural disasters.
6. Nearshoring	Moving production closer to the end market to reduce geopolitical risk.	Adidas	U.SChina trade tensions	ShiftedsomeproductiontoSpeedfactoriesinEuropeandtheU.S.toreducereliance on Asia.Destace	Reduced transportation costs and geopolitical exposure.
/.Joint	Partnering with	Starbucks	india s	Partnered with	Successfully

Table-1.Real-Life Examples Of Companies Employing Contingency Strategies[1],[3],[5],[7]

Ventures	local companies to mitigate the impact of local regulations.		restrictive FDI policies	TataGrouptoestablishlocalcoffeesupplyandmarketpresencewhilenavigatingcomplexregulations.	entered and scaled operations in India.
8.Flexible Manufacturing	Investing in modular and adaptable manufacturing setups to quickly respond to changes.	Tesla	Brexit and EU- U.K. trade issues	Developed manufacturing facilities in Berlin to reduce dependence on U.Kbased operations post- Brexit.	Ensured smooth operations within the European market despite regulatory changes.
9. Multi-Modal Transport	Using different transport modes to handle disruptions in specific regions.	Samsung	South Korea- Japan trade dispute	Increased use of air freight to counter delays in semiconductor components caused by trade tensions.	Maintained timely delivery of components to global markets.
10.Localized Production	Producing goods in regions with high demand to minimize global disruptions.	Nestlé	Middle East political instability	Expanded local production capabilities in the UAE to reduce reliance on imports.	Maintained product availability despite regional unrest.
11.Dual Sourcing	Sourcing critical materials from two or more suppliers in different regions.	Boeing	U.SChina trade conflict	Dual-sourced titanium components from Russia and the U.S. to mitigate trade risks.	Ensured consistent supply for aircraft manufacturing.
12. Contingency Training	Training employees and suppliers for rapid response to disruptions.	Amazon	COVID-19 pandemic	Conducted training on rapid fulfillment strategies and shifted workforce to prioritize essential goods.	Maintained delivery speeds for essential items during the pandemic.
13.Supplier Collaboration	Collaborating closely with suppliers to ensure better	Intel	Semiconductor supply chain issues	Worked with suppliers to increase transparency and	Improved long- term supply chain resilience.

	visibility and adaptability.			plancapacityexpansionstoavoid shortages.	
14.Regional Hedging	Operating in multiple markets to balance risk across regions.	Huawei	U.S. sanctions on telecom equipment	Shifted focus to Europe and Asia while investing in self-reliant R&D for components.	Continued operations despite significant revenue loss in the U.S. market.
15.Dynamic Planning	Regularly updating contingency plans to adapt to changing conditions.	Procter& Gamble (P&G)	Brexit-related uncertainty	Updated contingency plans to account for new tariffs and regulations, including Relocating some production to mainland Europe.	Avoided increased costs and delays in the supply chain post-Brexit.

The table-1 represents that companies devise a contingency plan to ensure supply chain continuity in geopolitical uncertainties. These strategies involve identifying risks, diversifying suppliers, and planning alternative ways of transportation as ways of minimizing the occurrence of disruptions. For instance, companies like Apple and Toyota have diversified their suppliers and shifted production to avoid exposure to trade wars and political unrest. In such cases, application of technologies-ai-driven predictive analytics-allows even companies like Wal-Mart to rapidly catch up with impending disruptions. Near shoring, flexible manufacturing, and localized production keep the operations agile for companies like Adidas and Nestlé. Meanwhile, dual sourcing and strategic stockpiling are also practiced by other firms such as Boeing and Pfizer, respectively, to secure their vital supplies. With this at hand, businesses can enhance their supply chain resilience and reduce risks against geopolitical challenges to keep their operations going continuously.

<b>Risk Factor</b>	Mitigation Strategy	Alternative Supply Routes	Industry Example	Numerical Impact
Tariff Increases (25%)	Diversify suppliers across multiple countries	Shift from China to Southeast Asia	Electronics (Apple, HP)	Tariff costs reduced by 15%-20% through supplier diversification
Border Closures	Establish near shore facilities and dual- source strategy	Use regional hubs (Mexico, Poland)	Automotive (Ford, Toyota)	Lead times reduced by <b>30%-40%</b> using near shore logistics
Trade Embargoes	Build inventory buffers for critical components	Reroute via allied trade zones	Pharmaceuticals (Pfizer)	Operationaldowntimeminimized to1-2 weeks vs.2monthsstocked goods
Natural Disasters	Invest in predictive analytics for supply	Optimize routes via less-affected	Food(Nestlé, Unilever)	Inventory loss reduced by45%withAI-based

#### Table.2. Numerical Analysis Of Supply Chain Continuity And Risk Mitigation Strategies[2],[3],[5],[7]

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	chain risks	areas		forecasting systems
Political Sanctions	Establish partnerships with neutral-zone suppliers	Create supply chains in non- affected regions	Energy (BP, Shell)	Compliance costs decreased by <b>18%-25%</b> with neutral- zone sourcing

The table-2 lists a few of the most important risk factors, mitigation strategies, and alternative supply routes for maintaining supply chain continuity by organizations in these geopolitically uncertain times. Industries such as electronics, automotive, pharmaceuticals, food, and energy sectors explore different ways of dealing with such situations using increased supplier diversity, near shoring, buffer inventories, and predictive analytics. These figures reflect not only how effective these approaches are in terms of minimizing operational downtime, inventory loss, and cost but also how such strategies have helped well-renowned companies like Apple, Pfizer, Toyota, Nestlé, and Shell derive value from geopolitical unpredictability by gaining supply chain resilience.



Fig.1.Supply chain Risk Management Process [2], [3]

Fig.1.Represents Supply Chain Risk Management is an all-inclusive strategy to identify, assess, and mitigate various kinds of risks which can cause a disruption in the flow of goods, services, or information from extraction of raw materials to the end customers. A very first step of the SCRM process is risk identification, which may include geopolitical instability, natural disasters, supplier failure, or market fluctuations. These identified risks are then assessed in terms of cost, lead time, and operations impact. Companies come up with mitigation strategies that include diversification of suppliers, contingency plans, investments in advanced forecasting tools, and resilient logistics networks. The final step will be to monitor and review these strategies through continuous data analysis in order for companies to adapt and continuously improve their approach toward risk management. It is a proactive process that enables any business to respond in a timely manner against disruptions, ensures supply chain continuity, and protects operations against both foreseeable and unforeseen risks.



Fig.2.Supply Chain Resilience: Strategies for Robust & Adaptive Ops [1]

Fig.2.Represents Supply Chain Resilience: It is the ability of a company to quickly adapt, recover, and restore supply chains after disruptions. In that case, a company would ensure continuity of operations even in the case of some unexpected situations. Supplier diversification reduces risks by depending on various sources; near shoring or localization reduces dependence on far-flung regions as supply chains are short. Further investment in technologies such as predictive analytics and AI can provide insights into imminent disruptions and thus be able to respond proactively. Similarly, inventory buffers and flexible logistics networks enable a supply chain to absorb external shocks to maintain service levels with reduced operational downtime. One can achieve only robust and adaptive supply chains-by adopting these strategies-which can easily overcome geopolitical uncertainties, natural calamities, or any other disruption.

# **VI. CONCLUSION**

The contingency planning-in the event of unfavorable geopolitical conditions-can help companies maintain safe operations and reduce risks for basic supply chain continuity. The geopolitical uncertainties, like trade disputes, sanctions, border restrictions, and regional conflicts, pose very strong challenges to supply chains. Companies can only offset these disruptions much better and ensure business continuity with proactive and resilient strategies. Key strategies include comprehensive risk assessment, diversification of both suppliers and sourcing locations, use of technology to provide real-time visibility, and strategic development ofInventory buffers-all enable efficient response of the business to crisis situations. Additionally, nurturing close partnerships with logistics providers while seeking alternative routes of supply assures adaptability in rapidly changing geopolitical scenarios. Advanced technologies such as AI, blockchain, and predictive analytics enhance decision-making and provide an early warning on impending risks for companies to take remedial action without delay. Moreover, regional cooperation with governmental bodies and adherence to international trade regulations are also highly required in avoiding regulatory hurdles and ensuring a smooth operational process. Ultimately, it is the companies that invest the most time and energy in deep contingency planning and considering each aspect of their supply chain strategies that will benefit through risk mitigation and gain a competitive advantage. A resilient and agile supply chain is considered the cornerstone for achieving sustainable business success in an increasingly uncertain environment.

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