CRISIS RESPONSE STRATEGIES FOR SUPPLY CHAIN RESILIENCE AMID GEOPOLITICAL RISKS

[1]PAPPU KUMAR THAKUR(NIU-24-24190)

Supervision By Dr. Mukul Shrivastava(Assistant Professor)

[1]Student
[1]School of Business Management
[1]Noida International University
[1]roylmithlawasi@gmail.com

I. INTRODUCTION AND BACKGROUND

The twenty-first century has ushered in an era of unprecedented global supply chain integration. While this integration delivers economic efficiencies through cost arbitrage and just-in-time delivery, it has simultaneously rendered organizations acutely vulnerable to geopolitical disruptions. Landmark events including the US–China trade war (2018–2020), Brexit, the COVID-19 pandemic (2020–2022), and the Russia–Ukraine conflict (2022–present) have exposed structural vulnerabilities in modern global supply chains.

India, as the world's fifth-largest economy and a major hub for pharmaceutical manufacturing, IT services, and electronics assembly, is deeply embedded in global value chains. India's dependence on China for approximately 65–70% of Active Pharmaceutical Ingredients (APIs) and 45% of electronic components creates strategic vulnerability. Supply Chain Resilience (SCRes) has consequently emerged as a critical organizational imperative — defined as the adaptive capacity of a supply chain to prepare for unexpected events, respond to disruptions, and recover to its original or a more desirable state (Christopher & Peck, 2004).

II. STATEMENT OF THE PROBLEM

Despite growing corporate awareness of geopolitical risks, a significant gap persists between available academic frameworks and the practical crisis response strategies deployed by organizations. Three critical gaps are identified: (i) a Theoretical Gap — dominant SCRM frameworks focus on operational disruptions rather than politically induced systemic disruptions; (ii) an Empirical Gap — quantitative evidence on the relationship between specific crisis response strategies and resilience outcomes in Indian business contexts is scarce; and (iii) a Practitioner Gap — Indian businesses largely lack structured frameworks for systematically assessing geopolitical exposure and developing coordinated resilience strategies.

III. RESEARCH OBJECTIVES

O1: To identify and assess the types of geopolitical risks that most significantly impact supply chain operations of Indian businesses.

O2: To examine the crisis response strategies currently adopted by Indian organizations in response to geopolitically induced supply chain disruptions.

O3: To evaluate the effectiveness of various crisis response strategies in enhancing supply chain resilience using empirical quantitative analysis.

O4: To assess the moderating role of organizational factors (firm size, industry sector, digital maturity) on crisis response effectiveness.

O5: To develop an integrated geopolitical resilience framework providing actionable guidance to practitioners and policy makers.

IV. RESEARCH HYPOTHESES

H1: Multi-sourcing and supplier diversification strategies are positively and significantly associated with supply chain resilience outcomes.
H2: The adoption of digital supply chain visibility tools is positively and significantly associated with supply chain resilience outcomes.
H3: Safety stock and buffer inventory practices are positively and significantly associated with supply chain resilience outcomes.
H4: Strategic long-term supplier partnerships positively and significantly moderate the relationship between geopolitical risk exposure and supply chain resilience.
H5: Organizational digital maturity positively moderates the effectiveness of crisis response strategies in enhancing supply chain resilience.

Parameter	Details
Research Design	Explanatory Mixed-Methods (Quantitative + Qualitative)
Target Population	Supply chain managers, procurement heads, logistics directors
Sampling Method	Stratified Random Sampling (by industry sector)
Sample Size	120 valid responses (out of 178 distributed; 67.4% response rate)
Industry Coverage	Manufacturing (40%), Retail/FMCG (30%), Logistics/3PL (20%), Pharma
Data Collection	Structured 52-item Likert-scale questionnaire via Google Forms
Data Period	October – November 2024
Statistical Tools	IBM SPSS v26 (Regression, Correlation) + IBM AMOS v26 (SEM, CFA)
Reliability	Cronbach's Alpha: Overall $\alpha = 0.893$ (Excellent)

V. RESEARCH METHODOLOGY

This study employs an explanatory mixed-methods research design, integrating quantitative survey-based statistical analysis with qualitative contextual interpretation. The research philosophy is post-positivist with a deductive approach — theoretical framework and hypotheses are derived from literature and tested against empirical data.

VI. KEY FINDINGS

1. Geopolitical Risk Perception

Respondents rated Trade Wars/Tariff Escalation as the highest risk (Mean = 4.32), followed by Sanctions and Export Controls (Mean = 4.18) and Regional Armed Conflicts (Mean = 3.95). These findings reflect the profound impact of US–China trade tensions and the Russia–Ukraine conflict on Indian supply chain planning.

2. Supply Chain Vulnerability

The Pharma/Healthcare sector recorded the highest vulnerability index (4.12) due to API import concentration, followed by Manufacturing (3.87). Small firms (fewer than 100 employees) show the highest vulnerability (4.21) owing to limited diversification capacity.

3. Crisis Response Strategy Adoption

Safety Stock maintenance (57.5% fully adopted) and Multi-sourcing (50% fully adopted) are the most widely deployed strategies, reflecting organizational preference for proven, traditional approaches. Advanced digital strategies such as AI/ML risk analytics (18.4%) and Scenario Planning (23.3%) remain nascent, indicating a significant digital resilience implementation gap.

4. Regression Analysis Results ($R^2 = 0.624$)

Predictor Variable	Beta (β)	p-value	Result
Multi-sourcing (H1)	0.341	0.000	Supported ***
Digital Visibility Tools (H2)	0.287	0.000	Supported ***
SC Partnerships (H4)	0.213	0.003	Supported **
Safety Stock (H3)	0.198	0.007	Supported **
Scenario Planning	0.156	0.035	Supported *
Digital Maturity (Moderator – H5)	0.178	0.009	Supported **

VII. CONCLUSIONS

C1: Geopolitical risks — especially trade wars, sanctions, and armed conflicts — constitute a primary, materially significant threat to supply chain continuity for Indian businesses.

C2: Multi-sourcing and supplier geographic diversification is the most effective crisis response strategy (β = 0.341). Organizations with diversified supplier bases across three or more geopolitical

risk zones demonstrate significantly higher resilience scores.

C3: Digital supply chain visibility is the second most powerful resilience enabler (β = 0.287). Real-time monitoring capabilities enable faster disruption detection and more agile response coordination.

C4: Safety stock, while the most widely adopted strategy (57.5%), delivers a more modest resilience contribution (β = 0.198) compared to structural and digital strategies.

C5: Strategic supplier partnerships significantly enhance resilience (β = 0.213) by enabling collaborative risk management and joint contingency planning.

C6: Advanced digital strategies (AI/ML analytics, blockchain) remain critically underutilized despite demonstrated resilience potential, representing the most significant implementation gap.

C7: Organizational digital maturity is a significant positive moderator (SEM coefficient = 0.187, $p < 0.01$) — the resilience dividend from structural strategies is amplified by digital investment.

VIII. RECOMMENDATIONS

Managerial Recommendations:

- Institutionalize a dedicated Supply Chain Intelligence function for continuous geopolitical risk monitoring.
- Execute structured sourcing diversification, eliminating single-country dependencies; prioritize Vietnam, Bangladesh, Mexico, and domestic suppliers.
- Invest in end-to-end digital supply chain visibility platforms, progressing towards AI-driven risk analytics.
- Develop and annually test geopolitically-specific Business Continuity Plans (BCPs) covering trade sanctions, border closures, and supplier country instability.
- Formalize strategic supplier partnership programs with joint risk management and collaborative contingency protocols.

Policy Recommendations:

- The Ministry of Commerce and Industry should develop a National Supply Chain Resilience Framework with standardized geopolitical risk assessment tools.
- Establish government-managed strategic reserves for critical import-dependent materials (APIs, semiconductors, rare earths).
- Introduce tax incentives and subsidized credit facilities for SME investment in supply chain digitalization.
- Accelerate India's positioning as a global alternative sourcing hub through targeted FDI incentives and PM Gati Shakti infrastructure investment.

IX. THEORETICAL CONTRIBUTION

This study develops and empirically validates a Geopolitical Supply Chain Resilience (GSCR) framework integrating three theoretical lenses: Christopher & Peck's Supply Chain Resilience Framework (2004), Dynamic Capabilities Theory (Teece et al., 1997), and Resource Dependence Theory (Pfeffer & Salancik, 1978). The framework provides the first systematic empirical evidence on the relative effectiveness of crisis response strategies in geopolitical risk contexts within India, and advances a contingency theory perspective — demonstrating that resilience strategies must be aligned with organizational capabilities and contextual factors.