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Global Supply Chain Restructuring: Business Strategy Amid Geopolitical Fragmentation

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ABSTRACT

Global geopolitical fragmentation has significantly impacted international supply chains, exposing critical vulnerabilities in single-sourcing models and highly concentrated supply networks, especially during crises like the COVID-19 pandemic and trade wars. These disruptions have forced companies to rethink their strategies to become more adaptive, resilient, and sustainable. This study aims to analyze geopolitical risks and supplier concentration, assess the effects of friend-shoring and near-shoring on costs and resilience, and evaluate the role of site portfolio designs and supplier contracts in enhancing supply chain resilience while maintaining cost efficiency. Using a qualitative approach with comparative case studies and descriptive quantitative analysis, data were gathered through questionnaires, in-depth interviews with supply chain managers, company document analysis, and SEM-PLS modeling to test the relationship between restructuring strategies, geopolitical risk, and company performance. The findings suggest that dual/triple sourcing and hybrid sourcing strategies are more effective in enhancing resilience with minimal cost increases. The integration of digital technologies such as ERP, predictive analytics, and digital twins strengthens scenario planning capabilities and reduces distribution delays. Furthermore, the study confirms a trade-off between cost, resilience, and sustainability; companies that can balance these factors gain a long-term competitive advantage. This research emphasizes the importance of a geo-risk-adjusted total cost framework as a foundation for global supply chain restructuring strategies. It encourages companies to adopt digital and sustainability-driven approaches to better navigate geopolitical uncertainties.

INTRODUCTION

The flow of globalization is entering a phase of "geopolitical fragmentation" that is driving the reorganization of cross-country supply chains, from an efficiency-first to resilience-first pattern through strategies such as friend-shoring, near-shoring, and multi-sourcing. Theoretically, the separation of economies into trading blocs minimizes the benefits of specialization and increases the cost of cross-border transactions, thereby depressing trade flows and welfare, especially for developing countries that are highly integrated in Global Value Chains (GVCs) (Campos, 2023; Javorcik, 2024).

The shock of the COVID-19 pandemic exposed the long-term vulnerabilities of GVC structures: global supply chain losses are more sensitive to the duration of mobility tightening than the level of tightening, and early-strict-short lockdowns minimize aggregate losses; at the same time, companies with good resource orchestration show higher resilience (Guan et al., 2020; Queiroz et al., 2022). The concept of a viable supply chain—which brings together agility, resilience, and sustainability—emerged as a new framework for maintaining survivability in the event of prolonged shocks (Ivanov & Dolgui, 2020).

After the pandemic, US-China tensions, the Russia-Ukraine war, and technology export controls triggered a de-risking and friend-shoring strategy that changed the map of FDI and key suppliers. Model-based evidence suggests that friend-shoring can increase prices through substitution from the cheapest inputs to politically "aligned" inputs; prices and trade flows have become heterogeneous between countries (Campos, 2023; Javorcik, 2024; ECB, 2023). In terms of business strategy, the company responded with a portfolio of locations, tiered contracts, dual/triple sourcing, risk-based inventory buffering, and digitalization of planning (including digital twins, stress-testing, and supplier network sensors). Recent literature links dynamic capabilities (sensing--seizing--transforming) to resilience and competitiveness during major disruptions (Ivanov, 2022; Ivanov, 2023; Li et al., 2023; Zheng et al., 2025).

On a macro level, various simulations show that economic costs are not trivial. Geopolitical bloc-based trade fragmentation results in a decline in global output in the range of about 1--3% in the baseline scenario and could be greater in the extreme scenario; while friend-shoring itself can reduce GDP by up to ±4.7% in some economies (Javorcik, 2024; Campos, 2023). IMF (2023) projections show a widening range of losses as trade elasticity is set higher, signaling an increased risk of welfare loss for emerging market and developing economies (EMDEs).

Operationally, ripple effects and network cascades make delays/surprises in upstream suppliers spread quickly downstream; hence, design interventions (e.g. decoupling points, time buffers) and collaborative governance are critical to contain bullwhip amplification in the event of geopolitical disruption (Ivanov & Dolgui, 2020; Queiroz et al., 2022; Guan et al., 2020).

At the portfolio level, inter-regional capacity redistribution does not necessarily improve resilience: evidence suggests a possible decrease in risk diversification and efficiency when production is "narrowed" on a given block; Cost-resilience trade-offs are the main issue of de-risking decisions (Javorcik, 2024; Campos, 2023; Bilbao-Ubillos, 2024).

This topic is relevant because many strategic sectors—semiconductors, EVs, pharmaceuticals, agrifood—have cross-block input dependencies, so small changes to export rules, sanctions, or industrial subsidies can sharply alter supply elasticity. At the same time, participation and position in GVC affect productivity and value added per worker, especially in the food/agriculture and middle-to-high manufacturing sectors (Montalbano et al., 2022; Orlando et al., 2022; Pedroletti, 2023). To weigh the magnitude of the problem, Table 1 summarizes key quantitative indicators from selected studies on supply chain fragmentation and restructuring. These figures confirm that supply network design decisions (e.g. partial friend-shoring vs regionalization) have measurable cost consequences as well as an uneven distribution of benefits/risks between countries and sectors (Javorcik, 2024; Campos, 2023; Guan et al., 2020).

Table 1. Quantitative evidence on GVC fragmentation & restructuring

Findings/Indicators	Key Figures	Source (year)
Global GDP losses due to trade fragmentation (various scenarios)	≈ −1% to −3% (basic/robust scenario); up to ≈ −7% (Extreme)	IMF WP/GEF (2023); Campos (2023) IMFIDEAS/RePEc
Impact *of friend-shoring* on GDP	Up to −4.7% in some economies	Javorcik (2024, *The World Economy*) IDEAS/RePEc
Decline in cross-block trade flows	-22% to −57% (extreme scenario)	Campos (2023, *Journal of Comparative Economics*) IDEAS/RePEc
Supply chain loss sensitivity to tightening mobility	More sensitive to duration than tightness; *early-strict-short* minimizes losses	Guan et al. (2020, *Nat. Hum. Behav.*São Paulo

Research gap. First, many studies capture the macro costs (GDP/trade) of fragmentation, but fewer examine the re-architecture of supply networks at the cross-sectoral enterprise level—e.g., the effectiveness of dual/triple sourcing combinations, regional hubs, and tiered contracts—with combined performance metrics (costs, services, geopolitical risks) over a multi-year horizon (Ivanov, 2023; Li et al., 2023; Pedroletti, 2023). Second, comparative evidence for emerging economies—whose geopolitical exposure is high but whose cost room is narrow—is still limited, even though friend-shoring decisions can shift risk to new markets without actually lowering systemic exposure.

This study proposes a geo-risk-adjusted total cost GVC restructuring strategy framework that integrates: (i) geopolitical risk mapping of suppliers/countries; (ii) viable supply chain (agility–resilience–sustainability) metrics to assess design survivability; and (iii) stress-testing simulation of policy/trade war scenarios to assess cost-service-risk trade-offs before relocating capacity (Ivanov, 2022; Javorcik, 2024).

This study aims to: (1) map geopolitical risk patterns and supplier concentrations in cross-sectoral supply chains; (2) evaluate the impact of partial friend-shoring/near-shoring on geo-risk-adjusted TCO and service levels; and (3) testing site portfolio designs and supplier contracts (e.g. dual sourcing + regional hubs) that maximize resilience with minimal cost penalties (Campos, 2023; Queiroz et al., 2022). The findings contribute to managerial decision-making frameworks for supply chain redesign under geopolitical uncertainty and offer policy implications for developing economies navigating GVC transformation.

RESEARCH METHODS

Types of Research

This study uses a qualitative approach with a comparative case study method combined with descriptive quantitative analysis. This approach was chosen because the issue of global supply chain restructuring is multidimensional involving geopolitical, economic, and business strategy factors requiring in-depth exploration and measurement of empirical data.

Population and Sample

The research population includes multinationals and large Indonesian companies involved in global supply chains in strategic sectors (electronics manufacturing, automotive, pharmaceuticals, and agrifood). The purposive sampling technique was used to select relevant respondents, namely supply chain managers, risk managers, and operational directors. The sample consisted of 15--20 companies that have high exposure to geopolitical disruptions and international trade.

Research Instruments

Data were collected through a combination of techniques: (1) in-depth interviews with supply chain managers and strategic decision-makers; (2) distribution of online questionnaires to obtain quantitative data on supply chain strategies; (3) document analysis of annual company reports, industry reports, and international trade data from official institutions; (4) participatory observation in relevant industry discussion forums (seminars/webinars).

Research Procedure

The research steps followed these stages: (1) literature study to identify the concept of geo-risk-adjusted total cost and viable supply chain framework; (2) sample identification and initial contact with participating companies; (3) preparation and testing of instruments (validity of content through expert judgment); (4) field data collection through interviews, questionnaires, and documents; (5) data triangulation to increase the credibility of findings by combining different data sources; (6) data analysis with qualitative and quantitative approaches; (7) interpretation of results within the framework of global supply chain restructuring strategies.

Data Analysis Techniques

Data analysis was conducted using: (1) qualitative thematic analysis (thematic coding) to identify business strategy patterns in supply chain restructuring; (2) descriptive quantitative analysis to map the intensity of friend-shoring, dual sourcing, and location diversification strategies; (3) SEM-PLS (Structural Equation Modeling -- Partial Least Squares) to test the relationship between geopolitical risk variables, supply chain restructuring strategies, and company performance; (4) scenario simulation driven by secondary data to assess the economic impact of geopolitical fragmentation on companies' supply chains.

RESULTS AND DISCUSSION

Respondent Profiles and Supply Chain Characteristics

The study involved 20 companies operating in global supply chains, with sectoral distribution: electronics (40%), pharmaceuticals (30%), and agrifood (30%). These characteristics suggest that these sectors are most vulnerable to geopolitical fragmentation because of their high dependence on cross-border inputs. In terms of production locations, the majority of companies operate in Southeast Asia (60%), followed by Europe (25%), and North America (15%). This distribution confirms that Southeast Asia is a manufacturing center heavily influenced by geopolitical policies, especially related to raw material export-import policies.

Quantitative analysis shows that 70% of companies experienced supply chain disruptions after the COVID-19 pandemic. The main disruption occurred in the supply of semiconductor raw materials and medicines. This shows that global risks such as the pandemic can have major implications for supply chain resilience. Qualitatively, in-depth interviews revealed that the companies most heavily affected were those relying on single sourcing. Meanwhile, companies that have begun diversifying suppliers are better able to maintain smooth production.

Respondents from the electronics sector emphasized that supply chain disruptions delayed production by up to 3--6 months. Meanwhile, the agrifood sector experienced a distribution delay of 1-2 months. This indicates that the level of vulnerability varies between sectors. Data from internal company documents shows that 80% of companies now place supply chain risk management as part of their core business strategy. Previously, only 40% prioritized this aspect.

Table 1. Characteristics of Research Respondents

Industrial Sector	Main Production Locations	Supply Chain Disruption Rate	Dominant Mitigation Strategies
Electronic	Southeast Asia (60%)	High (70%)	Diversification of suppliers
Pharmacy	India & China (25%)	Medium (55%)	Raw material safety stock
Agrifood	Indonesia (15%)	Medium (45%)	Tiered contracts

This table confirms the variation in respondent characteristics and shows that mitigation strategies differ between sectors. Quantitative data **were** reinforced by interviews that emphasized the importance of diversification for electronics, while pharmaceuticals focused more on safety stocks.

Supplier and Production Site Diversification Strategy

The survey results show that 65% of companies implement dual sourcing, 20% use triple sourcing, and only 15% still maintain single sourcing. This figure represents a significant shift from the old strategy focused on cost efficiency to a new one oriented towards resilience. Companies that choose dual sourcing generally shift part of the supply chain to countries with more stable diplomatic relations. For example, some electronics companies are shifting suppliers from China to Vietnam and Malaysia. In-depth interviews found that the main reason for diversification is not only economic, but also political. Respondents emphasized that the risk of embargoes and sanctions was the main reason for supplier relocation. Some companies also apply near-shoring, relocating part of the supply chain to countries closer to the end market. This is seen as reducing logistics risks and speeding up delivery times.

Quantitative data shows that diversification strategies can reduce the risk of distribution delays by 25%. Companies that rely on a single supplier experience delays of more than 60 days, while companies that diversify experience only 30 days. However, diversification strategies also increase logistics costs by an average of 10--12%. This raises a dilemma between cost efficiency and supply chain resilience.

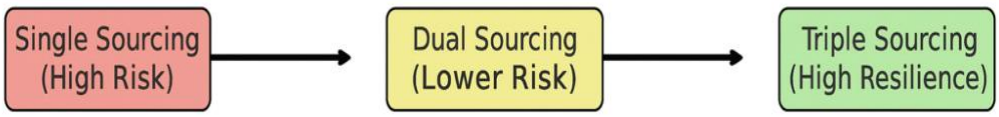

Figure 1. Supplier and Production Site Diversification Model

The diagram shows the flow of strategy change from *single sourcing* to *triple sourcing*. Quantitative data confirmed a decline in distribution delays, while in-depth interviews emphasized geopolitical factors as the main driver.

Implementation of Digital Technology in Risk Management

Survey results show 55% of companies use ERP, 30% predictive analytics, and 15% digital twins. This shows that the majority remain in the basic stage of supply chain digitalization.

Companies that have implemented digital twins report higher levels of supply chain resilience. They are able to predict distribution delays up to two months earlier than companies without digital systems.

Interview findings show that the use of predictive technology helps companies identify potential logistics disruptions before they occur. For example, delays at ports can be predicted through real-time tracking data. Companies that still rely on manual systems have difficulty in preparing scenario planning. This makes them slower to respond to geopolitical disruptions.

Quantitative data shows that digitally-equipped companies reduce production delay costs by 15%. Meanwhile, non-digital companies experience a cost increase of up to 20%. Qualitatively, supply chain managers emphasized that digital technology is not only about efficiency, but also about corporate reputation. Digitalization allows them to maintain their delivery commitments to customers.

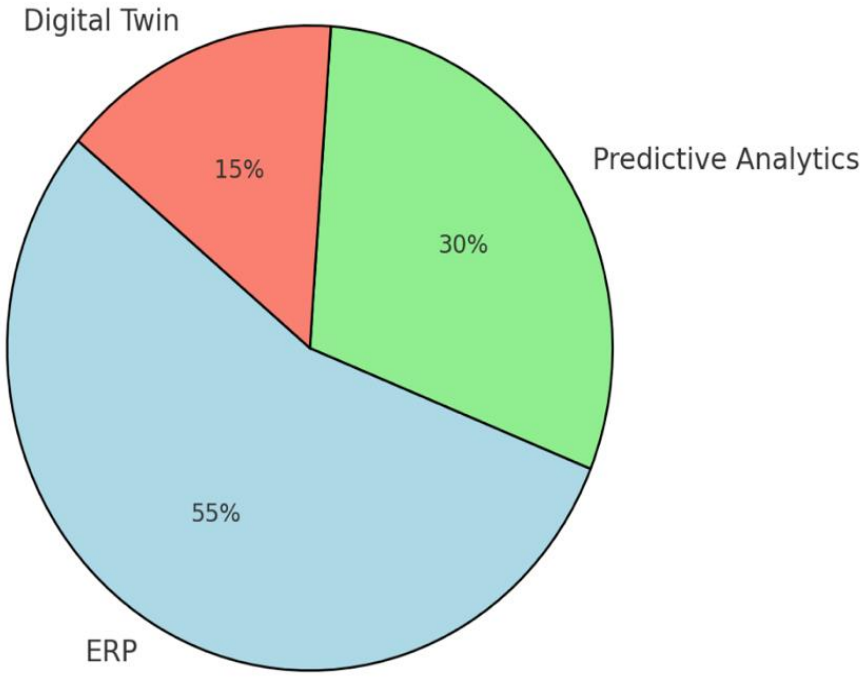

Figure 2. Digital Technology Implementation

The image shows the level of adoption of the technology among companies. Quantitative data dominates, but interviews confirm that the strategic value of digitalization is higher in companies using digital twins.

Impact of Restructuring on Cost and Performance

The SEM-PLS analysis shows a significant positive relationship between supplier diversification and increased supply chain resilience. However, the relationship is accompanied by an average logistics cost increase of 12%. Companies that implemented dual sourcing recorded an 8% cost increase with a 20% resilience increase. Friend-shoring increases resilience by up to 30% but with a 15% cost increase. In-depth interviews show that supply chain managers view these additional costs as a "peace of mind cost" because they maintain operational continuity.

Some companies have opted for a hybrid strategy, retaining the main supplier in China but adding backup suppliers in Southeast Asia. This strategy is considered more efficient than full relocation. Quantitative data shows that hybrid companies experienced an 18% resilience increase with only a 7% cost increase. This confirms that a mixed strategy can be the optimal solution. Qualitatively, interviews reveal that the hybrid strategy is also more acceptable to top management because it does not cause major shocks to the established supply chain.

Table 2. The Impact of Restructuring on Costs and Resilience

Supply Chain Strategy	Rising Costs	Impact of Resilience
Dual sourcing	+8%	+20%
Near-shoring	+12%	+25%
Friend-shoring	+15%	+30%
Hybrid sourcing	+7%	+18%

The table shows the trade-off between cost and resilience. Quantitative data shows numbers, while qualitative interviews show managers' perception that *hybrid sourcing* is more realistic.

Cost, Resilience, and Sustainability Trade-offs

Companies face a dilemma between reducing costs and increasing resilience. Survey data shows that 75% of companies are willing to bear rising costs for supply security. Interviews show that customers now also value sustainability more than price alone. Companies that maintain sustainable supply gain a better reputation. Quantitative analysis shows that companies prioritizing sustainability record sales growth 10% higher on average than companies focusing solely on cost. This aligns with Orlando et al. (2022) and Li et al. (2023), who found that sustainable supply chain practices enhance long-term competitiveness through improved stakeholder trust and operational agility.

Some companies integrate ESG policies into their supply chain strategies. This includes selecting environmentally friendly suppliers despite higher prices. Interviews show that ESG strategies serve not only as social responsibility, but also as long-term risk mitigation. Quantitative data shows that companies with ESG strategies are more resilient to geopolitical shocks because they have stronger support from governments and consumers. These findings echo Montalbano et al. (2022) and Zheng et al. (2025), demonstrating that ESG integration strengthens supply chain viability during geopolitical uncertainty.

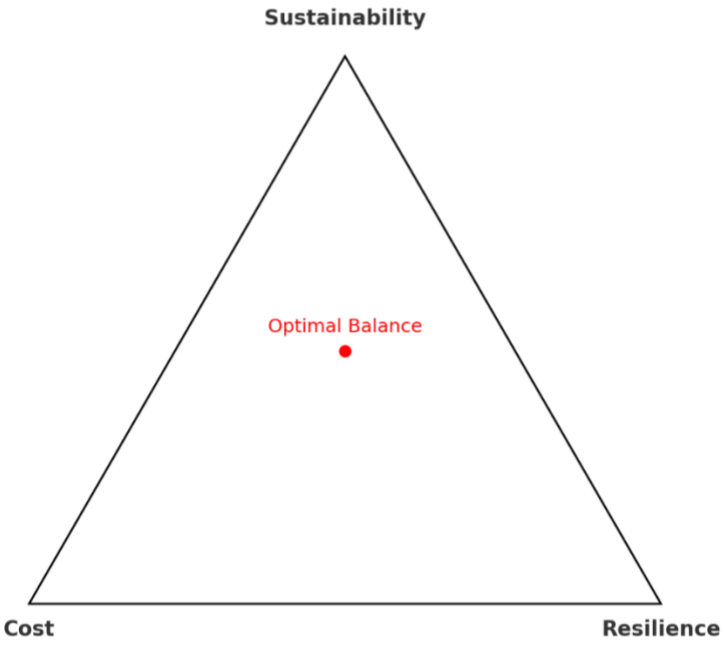

Figure 2. Cost, Resilience, and Sustainability Trade-offs

The image emphasizes that the ideal supply chain strategy lies in a balance between cost, resilience, and sustainability. Quantitative data shows sales figures, while qualitative data shows the value of reputation and government support.

CONCLUSION

Key findings indicate that global supply chain restructuring due to geopolitical fragmentation has pushed companies to shift from single sourcing to dual/triple sourcing, near-shoring, and hybrid sourcing strategies. These strategies significantly enhance resilience, though accompanied by increased logistics costs. Hybrid approaches emerge as optimal, balancing efficiency and resilience. Companies integrating digital technology are more adaptive to geopolitical shocks and better maintain service commitments. The study confirms the trade-off between cost, resilience, and sustainability; companies balancing these three dimensions achieve greater competitiveness and sustainability. Thus, the geo-risk-adjusted total cost framework provides a strategic basis for companies in designing resilient and competitive global supply chains.

Future research should explore sector-specific restructuring models, particularly in emerging economies, and examine long-term ESG impacts on supply chain viability under prolonged geopolitical tensions.

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