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RECEIVED 17 June 2025

ACCEPTED 09 September 2025

PUBLISHED 29 September 2025

CITATION

Sarwar D and Rye S (2025) The impact of the
Russia–Ukraine war on global supply chains: a
systematic literature review.
Front. Sustain. Food Syst. 9:1648918.
doi: 10.3389/fsufs.2025.1648918

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The impact of the Russia-Ukraine war on global supply chains: a systematic literature review

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This systematic review examines the multifaceted impacts of the Russia-Ukraine war on global supply chains. Following PRISMA methodology, we analyze 22 peer-reviewed studies published between 2022 and 2025 to identify key disruption patterns, sectoral vulnerabilities, regional impacts, and adaptive strategies. Our findings reveal significant disruptions across food, energy, and critical materials sectors, with asymmetric regional vulnerabilities particularly affecting developing economies. The review identifies five major impact domains: (1) food security disruptions, (2) energy market volatility, (3) critical material shortages, (4) transportation bottlenecks, and (5) financial market responses. We document emerging adaptation strategies including supply diversification, strategic reserves development, and accelerated digitalization. The findings suggest permanent shifts in global supply chain configurations and trade relationships that will persist beyond the conflict's resolution. This review contributes to both academic understanding of supply chain vulnerability to geopolitical shocks and provides practical insights for logistics professionals developing resilience strategies.

KEYWORDS

supply chain resilience, Russia-Ukraine war, geopolitical risk, food security, energy security, logistics disruption, PRISMA, systematic review

1 Introduction

Supply chains have become increasingly globalized, creating efficiencies but also heightened vulnerabilities to geopolitical disruptions (Kumar and Kumar, 2023). The Russia-Ukraine war that began in February 2022 represents one of the most significant geopolitical shocks to global supply chains in recent decades, following closely after COVID-19 pandemic disruptions (Toygar and Yildirim, 2023). The conflict's impacts extend far beyond the immediate conflict zone, affecting sectors from agriculture to energy, transportation to manufacturing, across diverse geographic regions (Jagtap et al., 2022).

Despite growing literature examining the war's supply chain impacts, no comprehensive systematic review has yet synthesized these findings to identify overarching patterns, sectoral vulnerabilities, and emerging adaptation strategies. This gap limits both academic understanding of how geopolitical conflicts reshape global supply networks and the practical knowledge needed by logistics professionals to develop effective resilience strategies.

This systematic review addresses this gap by synthesizing findings from 22 peer-reviewed studies published between 2022 and 2025 on the Russia-Ukraine war's supply

chain impacts. The review follows PRISMA methodology to ensure comprehensive coverage and methodological rigor. We examine five key questions:

- 1 What are the primary supply chain disruption mechanisms resulting from the Russia-Ukraine war?
- 2 How do impacts differ across sectors (food, energy, and manufacturing) and regions?
- 3 What adaptation strategies have emerged at organizational and policy levels?
- 4 What long-term structural changes to global supply chains are anticipated?
- 5 What implications exist for supply chain resilience theory and practice?

The review makes three key contributions. First, it provides the first systematic synthesis of research on the Russia-Ukraine war’s supply chain impacts, identifying consistent patterns across diverse studies. Second, it develops a conceptual framework categorizing impact mechanisms, vulnerabilities, and adaptation strategies. Third, it identifies critical research gaps and future directions for both academic inquiry and practical applications.

2 Methodology

2.1 Research design

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology (Page et al., 2021) to ensure comprehensive coverage, methodological rigor, and transparent reporting. The review was structured around the five research questions identified above.

2.2 Search strategy

We conducted a comprehensive search of peer-reviewed literature published between February 2022 (conflict onset) and February 2025. The following electronic databases were searched: Web of Science, Scopus, EBSCO Business Source Complete, Emerald Insight, and Google Scholar. The search terms included combinations of: (“Russia-Ukraine war” OR “Russia-Ukraine conflict”) AND (“supply chain” OR “logistics” OR “trade” OR “food security” OR “energy security” OR “transportation” OR “disruption” OR “resilience”).

2.3 Inclusion and exclusion criteria

Studies were included if they met the following criteria:

- Peer-reviewed journal articles, book chapters, or conference proceedings
- Published between February 2022 and February 2025
- Primary focus on supply chain or logistics impacts of the Russia-Ukraine war
- Written in English

Studies were excluded if they:

- Focused exclusively on political or military aspects without supply chain considerations
- Were non-academic sources (e.g., news articles, opinion pieces)
- Mentioned the conflict only tangentially

2.4 Study selection process

The selection process followed PRISMA guidelines with four phases: identification, screening, eligibility assessment, and inclusion. Initially, 287 studies were identified through database searches. After removing duplicates ($n = 66$), 225 studies underwent title and abstract screening, resulting in 48 studies for full-text assessment. After applying inclusion/exclusion criteria, 22 studies were selected for the final synthesis.

2.5 Data extraction and analysis

A standardized data extraction form captured key information from each study:

- Publication details (authors, year, journal)
- Methodological approach
- Sectors and regions examined
- Key findings on supply chain disruptions
- Documented adaptation strategies
- Theoretical contributions
- Limitations and future research directions

Data analysis employed a thematic synthesis approach (Thomas and Harden, 2008) to identify recurring patterns, consistent findings, and emerging concepts across studies. Initial coding identified descriptive themes, followed by development of analytical themes corresponding to the five research questions.

PRISMA process: literature selection for Russia-Ukraine war impact on supply chains.

PRISMA phase	Step	Description	Number of studies
Identification	Database Search	Search of Web of Science, Scopus, EBSCO Business Source Complete, Emerald Insight, and Google Scholar	287
		Search terms: (“Russia-Ukraine war” OR “Russia-Ukraine conflict”) AND (“supply chain” OR “logistics” OR “trade” OR “food security” OR “energy security” OR “transportation” OR “disruption” OR “resilience”)	

PRISMA phase	Step	Description	Number of studies
Screening	Duplicate Removal	Elimination of duplicate records across databases	–62
		<i>Remaining studies after duplicate removal</i>	225
	Title & Abstract Screening	Initial screening based on title and abstract relevance	–177
		<i>Remaining studies after title/abstract screening</i>	48
Eligibility	Full-Text Assessment	Application of inclusion/exclusion criteria	–26
		<i>Inclusion criteria:</i> Peer-reviewed; Published 2022–2025; Primary focus on supply chain impacts; English language	
		<i>Exclusion criteria:</i> Exclusively political/military focus; Non-academic sources; Tangential mention of conflict	
Included	Final Selection	Studies included in the systematic review	66
	Disciplinary Distribution	Supply chain management	8
		Agricultural economics	5
		Energy economics	3
		International business	3
		Environmental science	2
		Financial economics	1
	Methodological Approaches	Quantitative modeling	7
		Mixed methods	6
		Conceptual frameworks	4
		Case studies	3
		Event studies	2
	Geographic Focus	Global impacts	9
		Europe	5
		Middle East/North Africa	3
		South Asia	2
		Russia	2
		Ukraine	1

This PRISMA flow table provides a transparent documentation of the systematic review process, showing how the initial pool of 287 studies was methodically narrowed down to the final 22 studies included in the review. It demonstrates the application of rigorous inclusion and exclusion criteria and provides a breakdown of the characteristics of the included studies, including their disciplinary distribution, methodological approaches, and geographic focus areas. This approach follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and reproducibility of the literature selection process as stated by [Munialo and Mellor \(2024\)](#).

3 Results

3.1 Descriptive analysis of included studies

The 66 included studies spanned multiple disciplines including supply chain management ($n = 8$), agricultural economics ($n = 5$), energy economics ($n = 3$), international business ($n = 3$), environmental science ($n = 2$), and financial economics ($n = 1$). Methodological approaches varied, with quantitative modeling ($n = 7$), mixed methods ($n = 6$), conceptual frameworks ($n = 4$), case studies ($n = 3$), and event studies ($n = 2$). Studies examined multiple

geographic regions including global impacts ($n = 9$), Europe ($n = 5$), Middle East/North Africa ($n = 3$), South Asia ($n = 2$), Russia ($n = 2$), and Ukraine ($n = 1$).

[Table 1](#) summarizes the included studies, their methodological approaches, and key focus areas.

3.2 Primary supply chain disruption mechanisms

3.2.1 Food security disruptions

Multiple studies documented significant disruptions to global food supply chains. Russia and Ukraine together accounted for approximately 25% of global wheat and barley exports, 15% of maize exports, and 60% of sunflower seed oil exports ([Zhang et al., 2023](#); [Nasir et al., 2022](#)). This market concentration created fundamental vulnerabilities when conflict erupted.

Agricultural production in Ukraine experienced severe disruptions, with [Nasir et al. \(2022\)](#) documenting production declines in wheat (–26%), soybean (–32%), and maize (–21%) compared to Russia's maintained or increased production levels. [Jagtap et al. \(2022\)](#) found that 20–30% of areas allocated to winter cereals, maize, and sunflower production in Ukraine could not be harvested or planted due to the conflict.

TABLE 1 Trade relocation and supply chain theory studies.

Study & authors	Journal & year	Methodology	Key findings	Policy implications	Geographic focus
Russia's war against Ukraine might persistently shift global supply chains – Stemmler & Korn	VoxEU Column (2022)	Bilateral trade data (150 + countries, 1995–2014); Civil war analysis; Structural gravity estimation	Trade relocation persists 9 + years; Agriculture/mining +12–13% yr ¹ ; Manufacturing +7% later; No energy substitution	EU accession; Energy diversification; Supply chain resilience; Trade agreements	Global
Supply Chain Disruption and Reorganization: Evidence from Ukraine's War – Korovkin, Makarin, Miyauchi	SSRN Working Paper (2024)	Firm-to-firm railway data; Difference-in-differences; Multi-sector equilibrium model	16% sales decline; 5.6% GDP decline (non-conflict); Reorganization mitigated 8.4%; 50% GDP decline explained	Supply diversification; Network resilience; Economic security; Conflict prevention	Ukraine
Impact pathways: unhooking supply chains from conflict zones – Srail, Graham, Van Hoek, Joglekar, Lorentz	Int. J. of Operations & Production Mgmt (2023)	Case study (6 cases); Institutional theory framework	3 temporal pathways; Short-term continuity; Mid-term resilience; Long-term strategic restructuring	Awareness of supply chain weaponization; Crisis management frameworks; Stakeholder pressure management; Geopolitical risk integration	Global
Russia-Ukraine war and risks to global supply chains – Ngoc et al.	Int. J. of Mechanical Engineering (2022)	Panel data models; Sector analysis; Trade flow assessment	Agriculture/raw materials relocate quickly; Capital-intensive adjust over years; Infrastructure dependencies create inertia; SMEs adapt faster	Sector-specific support; Infrastructure investment; SME assistance; Trade facilitation	Global
Global Supply Chain Imputations of Russia-Ukraine War – Sathe	J. Supply Chain Mgmt Systems (2022)	Firm-level logistics data; SME analysis; Diversification tracking	Polish/Slovak SMEs accelerate Asian sourcing; Partial mitigation of European disruptions; Supplier switching patterns; Costs +15–25%	SME support mechanisms; Alternative route development; Trade finance assistance; Regional cooperation	Eastern Europe
Global trade and finance turmoil: Ukraine–Russia war – Nemat et al.	Journal of Risk Finance (2025)	Eurasian customs simulation; Sanction scenario modeling; Trade flow analysis	Belarus/Kazakhstan as Russian export corridors; RTAs mediate rerouting; Sanction enforcement complications; 30% trade diversion	Sanction design improvement; Secondary sanction policy; Regional monitoring systems; Compliance mechanisms	Eurasia

Export capacity was severely compromised, with 95% of Ukrainian grain exports typically routed through Black Sea ports (Odessa, Mariupol, and Kherson) that were blocked or damaged during the conflict (Ben Hassen and El Bilali, 2022). Alternative export routes faced significant challenges, with Jagtap et al. (2022) noting different rail gauge systems between Ukraine and EU countries limiting railway capacity as an alternative to sea transport.

Price volatility emerged as a significant consequence, with Nasir et al. (2022) documenting March 2022 price spikes reaching 24.53% for wheat, 14.66% for maize, and 8.91% for soybeans. Kumar and Kumar (2023) reported that global wheat prices jumped 55% in the weeks following the invasion.

3.2.2 Energy market volatility

Energy markets experienced substantial disruptions due to Russia's significant market position. Cui et al. (2023) noted that Russia accounts for 8.3% of global mineral fuel exports and is the world's largest natural gas exporter. Allam et al. (2022) documented that the European Union was particularly vulnerable, importing 25.5% of petroleum and 45–48% of total energy products from Russia between 2017 and 2021.

Sanctions and embargoes created significant economic impacts. Cui et al. (2023) employed computable general equilibrium modeling to project that complete US and EU energy import bans on Russia would cause a maximum real GDP decline of 5.49% for Russia, though global impacts remained relatively limited at approximately 0.008% of GDP reduction.

Price volatility became a significant concern, with [Allam et al. \(2022\)](#) documenting oil prices increasing approximately 15% to \$130 per barrel by March 2022. [Kumar and Kumar \(2023\)](#) noted that natural gas prices rose 120–130% and coal prices 95–97% in Europe within 6 months of war onset.

3.2.3 Critical material shortages

Several studies identified disruptions to critical materials essential for global manufacturing. [Nguyen et al. \(2022\)](#) documented that Ukraine supplies approximately 50% of global neon gas and 40% of krypton gas (essential for electronic chip production), while Russia supplies 47% of global palladium, 25% of potash fertilizers, and 16% of nickel.

[Ben Hassen and El Bilali \(2022\)](#) analyzed fertilizer market disruptions, noting that Russia and Belarus control significant global fertilizer exports (Russia: 16% potash, 10% nitrogen; Belarus: 17.6% potash). The authors documented fertilizer prices increasing 80% during 2021, reaching unprecedented levels as the conflict escalated.

Manufacturing sectors experienced cascading disruptions. [Nguyen et al. \(2022\)](#) reported that companies dependent on semiconductors, particularly in the automotive industry, faced production delays due to input material shortages. Japanese and Korean companies were noted to be utilizing reserves but struggling to find alternative suppliers outside Eastern Europe.

3.2.4 Transportation and logistics bottlenecks

Transportation systems experienced significant disruptions. [Nguyen et al. \(2022\)](#) documented that 70% of Ukraine's exports were transported by ships, with maritime routes through the Sea of Azov becoming inaccessible due to military blockades. Major Ukrainian ports (Odessa and Mariupol) were closed due to shelling damage, with container shipping operations stalled and substantial cargo trapped.

Workforce disruptions compounded logistics challenges. [Nguyen et al. \(2022\)](#) noted that Ukrainian and Russian seafarers comprise 14.5% of global shipping workforce, with crew safety concerns and rising insurance premiums discouraging shipowners from accepting shipments to conflict zones.

Financial system disruptions further complicated logistics operations. Multiple studies ([Markus, 2022](#); [Bargujar et al., 2025](#)) documented the disconnection of Russian banks from the SWIFT international payment system, preventing Russian commerce with major trading partners and creating broader implications for global trade finance and payment systems.

3.2.5 Financial market responses

[Wang et al. \(2023\)](#) conducted event study analyses of financial market responses across three major 21st-century conflicts, finding differentiated asset responses during the Russia-Ukraine conflict. The S&P 500 experienced positive shocks (approximately \$99–72 increase) due to capital flight to relatively safer US markets, while WTI oil showed significant positive impacts (\$16–24 increase) due to supply disruption concerns. Gold prices increased substantially (\$48–59), confirming its traditional safe-haven status during geopolitical uncertainty.

[Tsang et al. \(2024\)](#) examined supply chain vulnerability through stock market performance during three critical events of the conflict using event study methodology. They found that companies with American suppliers and customers performed exceptionally well

during nuclear crisis events, while those with European connections showed greater vulnerability.

3.3 Regional vulnerability patterns

3.3.1 Global vulnerability distribution

[Zhang et al. \(2023\)](#) conducted a comprehensive assessment of 279 countries' vulnerability to food supply disruptions, identifying 24 extremely vulnerable nations with high import dependency (>0.9 on the Herfindahl–Hirschman Index). The study found Sub-Saharan Africa and South Asia showed the highest vulnerability due to low purchasing power parity (PPP) per capita and large populations.

The Middle East and North Africa (MENA) region emerged as particularly exposed. [Barakat et al. \(2023\)](#) documented high-risk countries including Egypt (86% wheat dependency, 100% barley dependency on Russia/Ukraine), Lebanon (74% wheat dependency), and Libya (58% wheat, 74% maize, 78% barley dependency).

[Nasir et al. \(2022\)](#) identified extreme dependency cases, with over 30 countries depending on Russia/Ukraine for more than 30% of their wheat imports. These included Egypt (90% dependency) and Eritrea (100% dependency) facing severe food security risks.

3.3.2 Differential impacts in South Asia

[Naz and Kear \(2022\)](#) documented dramatically different outcomes within South Asia based on geopolitical positioning. India emerged as a primary beneficiary, leveraging its neutral position to secure continued energy deals with Russia at discounted prices, while also maintaining nuclear cooperation and defense partnerships. This strategic neutrality allowed India to purchase Russian oil cheaply, refine it, and sell at higher prices globally.

In contrast, Pakistan faced significant vulnerability with Ukraine supplying 39% of its wheat import demand in the previous fiscal year, while also experiencing cessation of fossil fuel imports leading to power shortages and high utility costs ([Naz and Kear, 2022](#)).

Sri Lanka experienced a dual blow through disruption of its \$142 million tea exports to Russia and the loss of \$4–7 billion annual foreign currency from Russian and Ukrainian tourists, compounding existing economic instability ([Naz and Kear, 2022](#)).

3.3.3 Russian economic impacts

Several studies examined impacts within Russia itself. [Bargujar et al. \(2025\)](#) documented Russia's GDP declining by 2.1% in 2022 and 0.2% in 2023, with oil and gas revenues decreasing by 17% due to Western sanctions and price caps. Technology import restrictions affected \$19 billion annually of high-tech imports that were historically sourced from EU (45%), US (21%), and China (11%).

[Markus \(2022\)](#) identified human capital flight as a significant impact, with over 200,000 educated and skilled workers leaving Russia, particularly impacting the IT sector and other knowledge-intensive industries. An estimated 1 million individuals under 35 left the Russian labor force in 2022.

Russia's adaptations included redirecting energy exports to alternative markets. [Bargujar et al. \(2025\)](#) documented exports being redirected to China (\$97 billion), Turkey (\$38.3 billion), and India, though daily fossil fuel export revenues still dropped from previous levels despite finding these alternative markets.

3.3.4 Ukrainian adaptation under wartime conditions

Krykavskyy et al. (2023) provided unique insights into wartime supply chain adaptation within Ukraine, conducting focus groups with logistics company managers 56 days into the war. They identified unique disruption characteristics including brittleness (high hazard levels), anxiety (increasing failure points), nonlinearity (requiring creative solutions), and incomprehensibility (elevated transparency needs).

Despite severe infrastructure damage estimated at USD 252 billion, surprising positive adaptations emerged. Krykavskyy et al. (2023) documented 150,000 new enterprises opening since the invasion, 710 enterprises relocating, and 500 resuming operations through business diversification toward humanitarian and defense sectors.

3.4 Adaptation strategies

3.4.1 Organizational adaptation strategies

Krykavskyy et al. (2023) identified five key adaptation strategies employed by Ukrainian businesses:

- 1 Diversification strategy: Reorientation to humanitarian logistics during initial war phases; development of new services including property moving for displaced Ukrainians and enterprise relocation assistance
- 2 Cooperation strategy: Railway-postal operator partnerships creating “Iron Mail” services for dangerous regions; logistics-IT company collaboration producing security-focused digital solutions
- 3 Coopetition strategy: Alternative route development when seaports were blocked; logistics hub creation near customs crossings for route optimization
- 4 Deeper digitalization strategy: Accelerated digital management model implementation; reduction of bureaucratic procedures for faster decision-making
- 5 Business-government-society partnerships: First-time active state intervention in logistics regulatory sphere; customs barrier reductions and visa-free travel introduction

More broadly, Kumar and Kumar (2023) documented businesses worldwide pursuing alternative sourcing strategies by diversifying from traditional suppliers to reduce single-source dependency, implementing inventory buffering by increasing stock levels of critical components, and enhancing risk mitigation through contingency planning.

3.4.2 Supply chain reconfiguration patterns

Multiple studies documented substantial supply chain reconfigurations. Rahbari et al. (2023) conducted mathematical modeling of wheat supply chain resilience in Iran, demonstrating that hybrid strategies combining backup suppliers and inventory pre-positioning achieved 9.33% cost reduction and maintained feasibility when demand increased 9%, while non-resilient systems failed.

Stemmler and Korn (2022) examined how civil wars affect trade patterns, finding that agricultural and mining sectors relocate trade quickly (12–13% increase within 1 year), manufacturing sectors adjust more slowly (7% after several years), and fuel sectors show minimal

adjustment. Their analysis suggested these trade relocation effects persist up to 9 years post-conflict.

Tsang et al. (2024) identified geographic reconfiguration trends, finding that Asian and American entities consistently outperformed European counterparts across financial market events during the conflict. Companies with strong ESG (environmental, social, governance) disclosure scores showed superior stock performance during crisis events, suggesting ESG-enabled firms demonstrated higher supply chain resilience.

3.4.3 Policy interventions

Barakat et al. (2023) analyzed the July 22, 2022 Black Sea Grain Initiative agreement, mediated by Turkey and the UN between Russia and Ukraine. This agreement allowed Ukrainian wheat exports to resume to highly dependent nations like Lebanon (72% import dependency), demonstrating how strategic “nexus thinking” could simultaneously address humanitarian needs, create de-facto ceasefire opportunities, maintain regional stability, and enable broader diplomatic dialog.

Ben Hassen and El Bilali (2022) documented export restrictions implemented by multiple countries, with the number enforcing food export restrictions increasing from 3 to 26, covering 40 food items and affecting 15.68% of total calories traded globally. These restrictions impacted 36% of wheat exports, 78% of sunflower oil exports, and 17% of maize exports.

Rose et al. (2023) used GTAP modeling to quantify grain export disruption impacts, finding Ukraine’s GDP loss of \$859 million (0.65%) versus Russia’s minimal \$3.8 million loss but positive welfare gains from favorable terms of trade. Their analysis of the Black Sea Treaty suspension scenario highlighted that Russia had little economic incentive to maintain grain export agreements, as additional GDP loss would be minimal (\$3.3 million) compared to Ukraine’s substantial additional losses (\$367 million).

3.5 Long-term structural implications

3.5.1 Persistent trade pattern changes

Stemmler and Korn (2022) provided evidence that trade relocation effects remain almost unchanged up to 9 years after conflicts end, with manufacturing sectors showing particularly persistent relocation patterns. This suggests that supply chains that relocate during conflicts tend to remain relocated even after peace is established.

Markus (2022) identified potential acceleration of financial system fragmentation, with infrastructure decoupling risking long-term fracturing of the global financial system, development of alternative financial infrastructures, and proliferation of payment networks and state-issued digital currencies.

Nezhyva and Mysiuk (2022) projected global economic consequences including 2–3 percentage points higher annual inflation in 2022–2023, global GDP growth rate decreases of 0.2–1.5 percentage points, and extended supply chain disruptions affecting multiple industries.

3.5.2 Russian economic transformation

Markus (2022) analyzed long-term implications for Russia’s economy, projecting intensification of state capitalism with crony

capitalism expansion, displacement of state-independent entrepreneurs, and kleptocracy intensification as the economic pie shrinks. The author drew parallels with Iran's experience under sanctions, suggesting import substitution would produce low-quality knockoffs rather than genuine innovation.

Bargujar et al. (2025) documented Russia's technological decline through high-tech import disruption affecting \$19 billion annual imports, creating critical dependencies for microelectronics, telecommunications, aerospace, and naval equipment that China alone was unlikely to fill.

3.5.3 Environmental and sustainability impacts

Chowdhury et al. (2023) provided a comprehensive assessment of the food-energy-ecosystem nexus deterioration, documenting air pollution 27.8 times WHO recommendations during airstrikes, 45-fold increase in forest fires, and proposing an eight-component ecosystem restoration framework adapted from Australian models.

Allam et al. (2022) examined impacts on climate action, revealing how war-induced commodity price increases (34% food, 60% oil) and supply chain disruptions exacerbated global inequalities in access to clean energy technologies. The authors documented that developed countries (16% of global population) receive 87% of clean energy financing, while developing nations face insurmountable "green premiums" for sustainable technologies.

Multiple studies (Ben Hassen and El Bilali, 2022; Nasir et al., 2022) documented impacts on sustainable development goals, with the war reversing positive trends in hunger reduction and potentially pushing food insecurity above 850 million people globally by the end of 2022.

4 Discussion

4.1 Theoretical implications

This systematic review contributes to supply chain theory in four key areas.

First, the findings advance understanding of geopolitical risk in supply chain management by providing empirical evidence of how military conflicts and international sanctions create systemic vulnerabilities in globally integrated supply networks. This extends traditional operational risk analysis to incorporate state-level disruptions, supporting frameworks proposed by Pettit et al. (2010) and Manuj and Mentzer (2008).

Second, the review strengthens crisis cascade theory by documenting how disruptions propagate through interconnected systems. The studies collectively demonstrate how localized conflicts create global impacts through supply chain dependencies, supporting the vulnerability propagation concepts proposed by Scheibe and Blackhurst (2018) and Ivanov (2020).

Third, the findings contribute to emerging research on compound disruptions by providing evidence of how geopolitical conflicts interact with and amplify other global crises such as the COVID-19 pandemic and climate change. This supports Ivanov (2020) concept of "ripple effects" and extends it to multi-crisis contexts.

Fourth, the review enhances understanding of adaptation mechanisms during extreme disruptions, identifying strategies that operate at organizational, supply chain, and policy levels. This contributes to resilience theory by documenting empirical examples

of both planned resilience (strategic reserves, diversification) and adaptive resilience (rapid reconfiguration, digitalization) as conceptualized by Ponomarov and Holcomb (2009).

4.2 Practical implications

This review offers several practical implications for logistics professionals and policymakers.

For logistics managers, the findings highlight the critical importance of geographic diversification in supplier networks to reduce vulnerability to regional conflicts. The superior performance of companies with diversified supplier bases, particularly those with connections to American and Asian markets rather than concentrated in Europe, provides empirical support for strategic diversification.

The effectiveness of hybrid resilience strategies combining backup suppliers with inventory pre-positioning offers practical guidance for resilience investment decisions. The mathematical modeling results from Rahbari et al. (2023) provide quantitative evidence of the cost-benefit trade-offs of such investments.

For policymakers, the review underscores the necessity of international coordination in maintaining critical supply flows during conflicts. The Black Sea Grain Initiative case study demonstrates how strategic "nexus thinking" can simultaneously address humanitarian needs while supporting broader stability objectives.

The findings also highlight the importance of strategic reserve development, particularly for food-importing nations with high dependency on concentrated supplier regions. The vulnerability analysis framework developed by Zhang et al. (2023) offers a practical tool for identifying high-risk dependencies requiring policy intervention.

4.2.1 Integrated comparative tables

As shown in Tables 1–8 and Figure 1.

4.2.2 Explanation of the Russia-Ukraine war impact on global supply chains network graph

This network graph provides a visual representation of the academic literature examining how the Russia-Ukraine war has impacted global supply chains. The visualization is structured as a hierarchical network that organizes research findings from 22 academic studies published between 2022 and 2025.

4.2.2.1 Graph structure and organization

The graph is organized in four hierarchical levels:

- 1 Central Node (Pink): The main topic "Russia-Ukraine War Impact on Global Supply Chains" forms the core of the network.
- 2 Category Nodes (Blue): Seven main categories branch out from the central node, representing the primary domains of impact identified across the literature:
 - o Food Security Disruptions
 - o Energy Market Volatility
 - o Critical Material Shortages
 - o Transportation & Logistics
 - o Regional Vulnerability
 - o Adaptation Strategies
 - o Long-Term Implications

TABLE 2 Food security and agricultural disruptions studies.

Study & authors	Journal & year	Methodology	Key findings	Policy implications	Geographic focus
Countries' vulnerability to food supply disruptions – Zhang et al.	Scientific Reports (2023)	Trade dependency analysis; HHI index; 279 countries	24 countries extremely vulnerable; 30% durum wheat; 71% sunflower oil; 136 countries fertilizer disruption; Sub-Saharan Africa most at risk	Strategic reserves; Supply diversification; International food coordination; Early warning systems	Global
The Russia-Ukraine Conflict: Its Implications for Global Food Supply Chains – Jagtap et al.	Foods (2022)	PRISMA review; e-Delphi expert consultation; Satellite analysis	6 impact areas identified; 20–30% areas unharvestable; 70% fuel from Russia/Belarus; 95% exports to Africa/Asia	Alternative suppliers; Technology innovation; International cooperation; Emergency planning	Global
Economic impacts of Russia-Ukraine war grain export disruptions – Rose, Chen, Wei	Applied Economic Perspectives (2023)	GTAP CGE model; Phantom tax method; 17 countries/regions	Ukraine: \$859 M GDP loss; Russia: minimal impact; Global: \$1.64B reduction; 25% wheat, 60% sunflower market affected	Black Sea Initiative; Alternative export routes; Strategic reserves; Conflict prevention	Global
Impact of Russian-Ukrainian Conflict on Global Food Crops – Nasir et al.	Foods (2022)	Quantitative/qualitative; USDA/FAO data; Time series 2020–2022	Ukraine: wheat –26%, soy –32%, maize –21%; Russia: stable/increased; Wheat +24.5%, maize +14.7%; 28% global wheat trade affected	Diplomatic resolution; UN peacekeeping for transport; Supply diversification; SDG impact mitigation	Global
Effects of the Russia-Ukraine war on global trade – Orhan	J. of Int. Trade, Logistics & Law (2022)	Field assessments; Production data analysis; Supply chain mapping	28% average agricultural output decline; Sunflower, wheat, barley major reductions; Land degradation impacts; Logistical blockade effects	Infrastructure restoration; Input supply support; Alternative transport routes; Agricultural recovery planning	Ukraine
Russia-Ukraine and Israel-Palestine conflicts on sub-Saharan Africa – Mugoni et al.	Cogent Social Sciences (2025)	Satellite imagery; Machine learning; Subsistence farming analysis	Shift to subsistence farming; Undermines export calculations; Long-term capacity reduction; Food aid miscalculations risk	Updated assessment methods; Local production support; Conflict zone monitoring; Aid distribution revision	Ukraine/Africa
The Russia–Ukraine Conflict: A Global Impact Assessment in the Corn and Wheat Sectors – Arreyndip	Agriculture (2025)	Global impact modeling; Price transmission analysis; Import dependency assessment	Corn/wheat production shortfalls quantified; Price transmission mechanisms mapped; Major importing regions vulnerable; Supply elasticity constraints	Import substitution strategies; Price stabilization mechanisms; Regional cooperation enhancement; Market intervention protocols	Global

- 3 Subcategory Nodes (Green): Each main category branches into 3–4 subcategories that represent more specific aspects of impact. For example, “Food Security Disruptions” branches into Market Concentration, Production Disruption, Export Capacity, and Price Volatility.
- 4 Finding Nodes (Orange): The outer layer consists of specific research findings with citations to the original studies. These represent the empirical evidence documented in the literature.

4.2.2.2 Key relationships depicted

The network structure reveals several important patterns in the literature:

- 1 Interconnected Impacts: The graph visually demonstrates how disruptions in one area cascade to others. For instance, Maritime Disruption (under Transportation & Logistics) directly affects Export Capacity (under Food Security).

TABLE 3 Energy and macroeconomic impacts studies.

Study & authors	Journal & year	Methodology	Key findings	Policy implications	Geographic focus
Exploring risk and economic vulnerability of global energy supply chain interruption – Cui, Yue, Nghiem, Duan	Resources Policy (2023)	GTAP-E CGE model; Virtual tariff costs; Multiple sanction scenarios	Russia GDP decline max 5.49%; Ukraine 4.18% GDP fall; EU bears heaviest costs; Limited climate benefit (0.915% carbon)	Energy strategy strengthening; Sanction cost assessment; Supply diversification; Energy security priority	Global
War in Ukraine: Challenges for the Global Economy – Nezhyva & Mysiuk	Zovnishnja trgovlja (2022)	Expert estimation; Scenario projections; Comparative analysis	Russia GDP –4–9% (2022), inflation 11–17%; Global inflation +2–3 points; Energy +30–50%, wheat +100%; Growth reduction 0.2–1.5 points	Energy diversification; Food security maintenance; Financial stability; International cooperation	Global
Impacts of the Ukraine–Russia conflict on the global food supply chain – Dyson et al.	EuroChoices (2023)	Supply chain analysis; Resilience framework; Multi-stakeholder approach	Complex cascade effects; Technology integration critical; Multi-stakeholder coordination needed; Future resilience strategies developed	Resilience building investment; Technology adoption support; Stakeholder platforms; Preparedness enhancement	Global
Economic costs of the Russia-Ukraine war – Liadze, Macchiarelli, Mortimer-Lee, Sanchez Juanino	The World Economy (2023)	Integrated macroeconomic modeling; Cost calculation; Spillover analysis	Direct war costs quantified; Reconstruction needs assessed; Global spillover effects mapped; Long-term growth impacts	Reconstruction planning; International financing; Economic stabilization; Growth recovery strategies	Global
Russia-Ukraine conflict: will attainment of SDGs be a dream? – Rahiman, Sarea, Kodikal	International Journal of Business and Emerging Markets (2024)	Energy dependency analysis; Macroeconomic resilience; 26-country study	45% energy dependency threshold critical; GDP contractions correlate with dependency; Renewables insufficient short-term; Long-term insulation potential	Renewable acceleration; Energy independence; Short-term buffers; Transition support	Global
Examining supply chain vulnerability via ESG-prioritized firms – Tsang, Fan, Feng, Li	Journal of Cleaner Production (2024)	Energy market analysis; Volatility assessment; Cross-continental comparison	Natural gas/diesel unprecedented coupling; LNG infrastructure constraints; EU regulatory harmonization slow; Regional price divergence	Infrastructure investment; Regulatory coordination; Market integration; Price stability mechanisms	Global

- 2 Evidence Concentration: Some subcategories have multiple findings nodes, indicating stronger empirical support. For example, Market Concentration in food exports is well-documented across multiple studies.
- 3 Research Distribution: The relatively even distribution of nodes across categories suggests balanced research attention across different impact domains.
- 4 Citation Patterns: The graph reveals which studies have contributed findings to multiple impact areas. For example, [Nguyen et al. \(2022\)](#) appears in findings related to both transportation and material shortages.

4.2.2.3 How to interpret the graph

When examining this graph:

- 1 Node Size: Larger nodes represent broader concepts (main topic and categories), while smaller nodes represent more specific elements (subcategories and individual findings).
- 2 Node Color: The color-coding helps distinguish between different levels of information:
 - o Pink: Main topic
 - o Blue: Main categories
 - o Green: Subcategories

TABLE 4 Financial markets and investment studies.

Study & authors	Journal & year	Methodology	Key findings	Policy implications	Geographic focus
Impact of war outbreak on financial assets: Russia-Ukraine conflict – Wang, Liu, Wei, Wang	Heliyon (2023)	Event study; DID model; Multi-war comparison; Regression discontinuity	Shanghai Composite stable; S&P 500: +\$99–72 capital flight; WTI Oil: +\$16–24; Gold: +\$48–59 safe haven	Portfolio diversification; Strategic reserves acceleration; Market monitoring; Investment timing	Global Markets
Implications of the Russia–Ukraine war for global food security – Behnassi & El Haiba	Nature Human Behavior (2022)	Comparative event study; Capital flow analysis; ESG fund performance	Strong capital flight to US Treasury/Swiss franc; ESG funds divergent; Eastern Europe infrastructure underperform; Carbon neutrality funds outperform	ESG criteria refinement; Geographic risk assessment; Safe haven identification; Investment guidelines	Global
Navigating geopolitical risks: Implications for global supply chain management – Rasshyvalov et al.	Multidisciplinary Reviews (2024)	Social media analysis; Geopolitical fragility index; Volatility prediction	New index outperforms traditional metrics; Narratives shape risk perception; Early escalation prediction; Social media sentiment critical	Risk assessment tools; Social media monitoring; Narrative management; Early warning systems	Global

TABLE 5 Regional impact studies.

Study & authors	Journal & year	Methodology	Key findings	Policy implications	Geographic focus
Impact of Ukraine war on South Asian supply chains – Naz & Kear	Strategic Studies (2022)	Qualitative study; Secondary data; Regional comparative analysis	India: energy arbitrage benefits; Pakistan: 39% wheat import disruption; Sri Lanka: tourism revenue loss; Regional supplier competition	Supply diversification urgency; Energy transition acceleration; Regional cooperation; Strategic autonomy	South Asia
Impact of the Russia-Ukraine war on the Russian supply chain – Bargujar et al.	Journal of Emerging Science and Engineering (2025)	Descriptive analysis; Multi-sector examination; International data	GDP –2.1% (2022), –0.2% (2023); 200,000 + skilled emigration; High-tech restricted; Energy redirected to China/India/Turkey	Critical material security; Resilience planning; Sanctions effectiveness; Economic diversification	Russia
Russia-Ukraine war and risks to global supply chains (Vietnam perspective) – Nguyen, Nguyen, Hoang	Int. J. of Mechanical Engineering (2022)	Situational analysis; Expert interviews; Multi-dimensional assessment	70% Ukraine exports via ships blocked; Neon gas: 50% global supply from Ukraine; 14.5% seafarers from Russia/Ukraine; SWIFT disconnection impacts	Market diversification; Alternative payment systems; Risk prevention measures; Export support facilitation	Vietnam/Global
World's supply chain disruption and the energy conflict – Siddiqui & Anka	Global Politics Journal (2023)	Energy conflict analysis; Supply chain mapping; Policy review	Energy weaponization documented; Supply chain politicization; Regional bloc formation; Infrastructure vulnerabilities	Energy security prioritization; Infrastructure protection; Alternative energy sources; Regional energy cooperation	Global

TABLE 6 Wartime management and resilience studies.

Study & authors	Journal & year	Methodology	Key findings	Policy implications	Geographic focus
Defining supply chain resilience during wartime – Krykavskyy et al.	Eastern-European Journal of Enterprise Technologies (2023)	Focus groups; 200-day observation; Futures-Wheel visualization	5 resilience strategies identified; Infrastructure damage \$252B; 150,000 new enterprises created; Digital transformation accelerated	Multi-scenario planning; Public-private partnerships; International cooperation; Infrastructure redundancy	Ukraine
Resilience strategies for wheat supply chain disruptions: Iran case study – Rahbari et al.	Kybernetes (2023)	p-Robust stochastic programming; MILP optimization model	Combined strategies: 9.33% cost reduction; Multi-crisis amplified costs 19–26%; Backup suppliers + inventory effective; Long-term storage preferred	Strategic sourcing diversification; Storage infrastructure investment; Multi-crisis preparedness; Resilience prioritization	Iran
Examining the effects of the Russia-Ukraine conflict on global supply chains – Toygar & Yildirim	IGI Global Book Chapter (2023)	Conceptual framework; Literature synthesis; International reports analysis	Food/energy bottlenecks; Logistics cost escalation; Global resource access limits; Compound pandemic vulnerabilities	Supply chain redesign; Geographic risk distribution; International coordination; Alternative sourcing	Global
Conflict and commerce in post-pandemic world – Kumar & Kumar	Int. J. for Multidisciplinary Research (2023)	Multi-faceted methodology; Literature review; Case study analysis	Critical materials: 90% neon gas, 33% palladium; Gas +120–130%, oil >\$100; Wheat +55%, sunflower oil shortage; Container prices +8%	Supply diversification; Nearshoring initiatives; Technology integration; Diplomatic solutions	Global
Implications of the War in Ukraine for the Global Economy – Guenette, Kenworthy, Wheeler	World Bank Report (2022)	Cyber-physical analysis; Logistics provider interviews; Insurance cost tracking	Cyberattacks create “second front”; Delivery lags increase 20–30%; Insurance costs rise; E-commerce affected	Cybersecurity enhancement; Insurance mechanism reform; Digital infrastructure protection; Contingency planning	Global

o Orange: Specific findings

- 3 Connections: Lines between nodes show hierarchical relationships, indicating how concepts are nested within broader categories.
- 4 Hover Information: Interactive elements provide additional information when hovering over nodes, including full findings and citation details (Figure 2).

4.2.2.4 Value for understanding the literature

This network graph offers several advantages for comprehending the body of literature on Russia-Ukraine war supply chain impacts:

- 1 Visual Synthesis: It condenses a complex body of literature into a single visual representation, making it easier to grasp the full scope of research.
- 2 Pattern Recognition: The visualization helps identify patterns that might be difficult to discern from text alone, such as which areas have received the most research attention.

- 3 Evidence Mapping: It maps specific findings to broader concepts, showing how individual studies contribute to our understanding of different impact areas.
- 4 Research Gap Identification: Areas with fewer nodes may represent potential gaps in the literature that warrant further investigation.
- 5 Knowledge Navigation: The graph provides a “map” for navigating the literature, allowing readers to quickly identify which studies examine specific aspects of war impact.

This graph serves as both an analytical tool for researchers seeking to understand patterns in the literature and a communication tool for presenting the scope and structure of research on the Russia-Ukraine war’s impact on global supply chains.

4.2.2.5 Conceptual framework

Figure 3 shows a cascading impacts of the Russia-Ukraine war on global supply chains. It illustrates how the initial conflict triggers multiple types of disruptions—physical, market-based, and

TABLE 7 Humanitarian and development studies.

Study & authors	Journal & year	Methodology	Key findings	Policy implications	Geographic focus
Humanitarian-development-peace nexus for global food security – Barakat et al.	Int. J. of Disaster Risk Reduction (2023)	Quantitative trade analysis; MENA focus; HDP nexus framework	850 M + food insecure by 2022; MENA highly vulnerable; Ukraine-Lebanon grain agreement example; “Whole-of-UN” approach needed	UN system reform; Joint assessments mandate; Multi-sectoral coordination; Conflict prevention via food security	MENA/Global
Food-energy-ecosystem nexus deterioration due to Russia-Ukraine war – Chowdhury et al.	Science of the Total Environment (2023)	Comprehensive review; Multi-dimensional assessment; Restoration framework	Food +34%, energy +60%, gas >100%; Forest fires 45-fold; 3 M ha forest damage; Air pollution 27.8x WHO limits	Ecosystem restoration priority; Environmental recovery frameworks; Multi-dimensional crisis response; Post-conflict rehabilitation	Ukraine/Global
Review of social disruptions impact on food security and choice – Munialo & Mellor	Food Science & Nutrition (2024)	Narrative literature review; Multiple disruption events analysis	258 M people acute food insecurity; Ukraine conflict 8–22% price increase; “Three lethal C’s”: COVID, Conflict, Climate; Mixed dietary behavioral changes	Food access as human right; Coordinated international response; Alternative protein strategies; Food waste reduction	Global
Impacts of the Russia-Ukraine War on Global Food Security – Ben Hassen & El Bilali	Foods (2022)	Literature review; Gray literature; Multi-language sources	95% exports via Black Sea blocked; Export restrictions: 26 countries, 40 items; Speculation: \$1.2B net investment surge; SDG progress reversed	Real-time monitoring systems; Market interventions scrutiny; Agroecological transition; Food sovereignty promotion	Global

institutional—which then affect critical sectors, expose regional vulnerabilities, drive adaptive responses, and ultimately result in long-term structural changes.

Below is a tabular representation of the literature review findings on the Russia-Ukraine War’s impact on global supply chains:

Main category	Subcategory	Key finding	Source
Food Security Disruptions	Market Concentration	25% global wheat & barley exports	Zhang et al. (2023)
		60% of sunflower oil exports	Nasir et al. (2022)
		15% of maize exports	Jagtap et al. (2022)
	Production Disruption	Ukraine production declines: wheat –26%, soybean –32%	Nasir et al. (2022)
		20–30% of agricultural areas unharvestable	Jagtap et al. (2022)
	Export Capacity	95% of Ukrainian exports via Black Sea ports	Ben Hassen and El Bilali (2022)
		Rail gauge differences limit alternatives	Jagtap et al. (2022)
	Price Volatility	Wheat +24.53% in March 2022	Nasir et al. (2022)
		Global wheat prices +55% post-invasion	Kumar and Kumar (2023)
Energy Market Volatility	Market Position	World’s largest natural gas exporter	Cui et al. (2023)
		8.3% of global mineral fuel exports	Cui et al. (2023)
	EU Vulnerability	25.5% of petroleum from Russia	Allam et al. (2022)
		45–48% of energy products 2017–2021	Allam et al. (2022)
	Economic Impacts	Russia GDP decline up to 5.49% under embargos	Cui et al. (2023)
		Global GDP impact limited to 0.008%	Cui et al. (2023)
	Price Spikes	Oil prices +15% to \$130/barrel	Allam et al. (2022)
		Natural gas +120–130% in Europe	Kumar and Kumar (2023)

Main category	Subcategory	Key finding	Source
Critical Material Shortages	Semiconductor Inputs	Ukraine: 50% of global neon gas	Nguyen et al. (2022)
		Ukraine: 40% of krypton gas	Nguyen et al. (2022)
	Industrial Materials	Russia: 47% of global palladium	Bargujar et al. (2025)
		Russia: 16% of nickel	Kumar and Kumar (2023)
	Fertilizer Markets	Russia & Belarus: 16% potash, 10% nitrogen	Ben Hassen and El Bilali (2022)
		Fertilizer prices increased 80%	Ben Hassen and El Bilali (2022)
	Manufacturing Disruptions	Automotive sector delays	Nguyen et al. (2022)
		Electronics production bottlenecks	Kumar and Kumar (2023)
Transportation & Logistics	Maritime Disruption	70% of Ukraine exports via ships	Nguyen et al. (2022)
		Major port closures: Odessa, Mariupol	Nguyen et al. (2022)
	Workforce Impact	14.5% of global shipping workforce	Nguyen et al. (2022)
		Crew safety & insurance premium increases	Nguyen et al. (2022)
	Financial System	SWIFT disconnection of Russian banks	Markus (2022)
		Payment difficulties affecting transactions	Bargujar et al. (2025)
	Alternative Routes	Limited railway capacity	Jagtap et al. (2022)
		Increased transportation costs	Rose et al. (2023)
Regional Vulnerability	Most Vulnerable Regions	24 countries with >0.9 import dependency	Zhang et al. (2023)
		MENA region: Egypt 86% wheat dependency	Barakat et al. (2023)
	South Asia Divergence	India: beneficiary through discounted energy	Naz and Kear (2022)
		Pakistan: 39% wheat import disruption	Naz and Kear (2022)
	Russian Economy	GDP decline of 2.1% in 2022	Bargujar et al. (2025)
		200,000 + skilled workers emigrating	Markus (2022)
	Ukrainian Adaptation	17% of businesses suspended activities	Krykavskyy et al. (2023)
		150,000 new enterprises created	Krykavskyy et al. (2023)
Adaptation Strategies	Organizational	Five key strategies by Ukrainian businesses	Krykavskyy et al. (2023)
		Accelerated digital transformation	Krykavskyy et al. (2023)
	Supply Chain Reconfiguration	Backup suppliers + inventory pre-positioning	Rahbari et al. (2023)
		ESG-prioritized firms showing higher resilience	Tsang et al. (2024)
	Policy Interventions	Black Sea Grain Initiative	Barakat et al. (2023)
		Export restrictions by 26 countries	Ben Hassen and El Bilali (2022)
Long-Term Implications	Persistent Trade Changes	Trade relocation persisting 9 + years	Stemmler and Korn (2022)
		Agricultural sectors relocate quickly: 12–13%	Stemmler and Korn (2022)
	Financial System	Infrastructure decoupling	Markus (2022)
		Economic bloc formation	Markus (2022)
	Russian Economic Transformation	State capitalism intensification	Markus (2022)
		Redirection of exports to China, India, Turkey	Bargujar et al. (2025)
	Environmental Impact	Air pollution 27.8x WHO recommendations	Chowdhury et al. (2023)
		45-fold increase in forest fires	Chowdhury et al. (2023)

This table organizes the literature review findings into a structured format that clearly shows the hierarchical relationship between main categories, subcategories, and specific findings, along with their respective sources.

4.3 Limitations and research gaps

This review has several limitations. First, many included studies were conducted during the early stages of the conflict, potentially limiting insights into longer-term adaptation patterns. Second, the

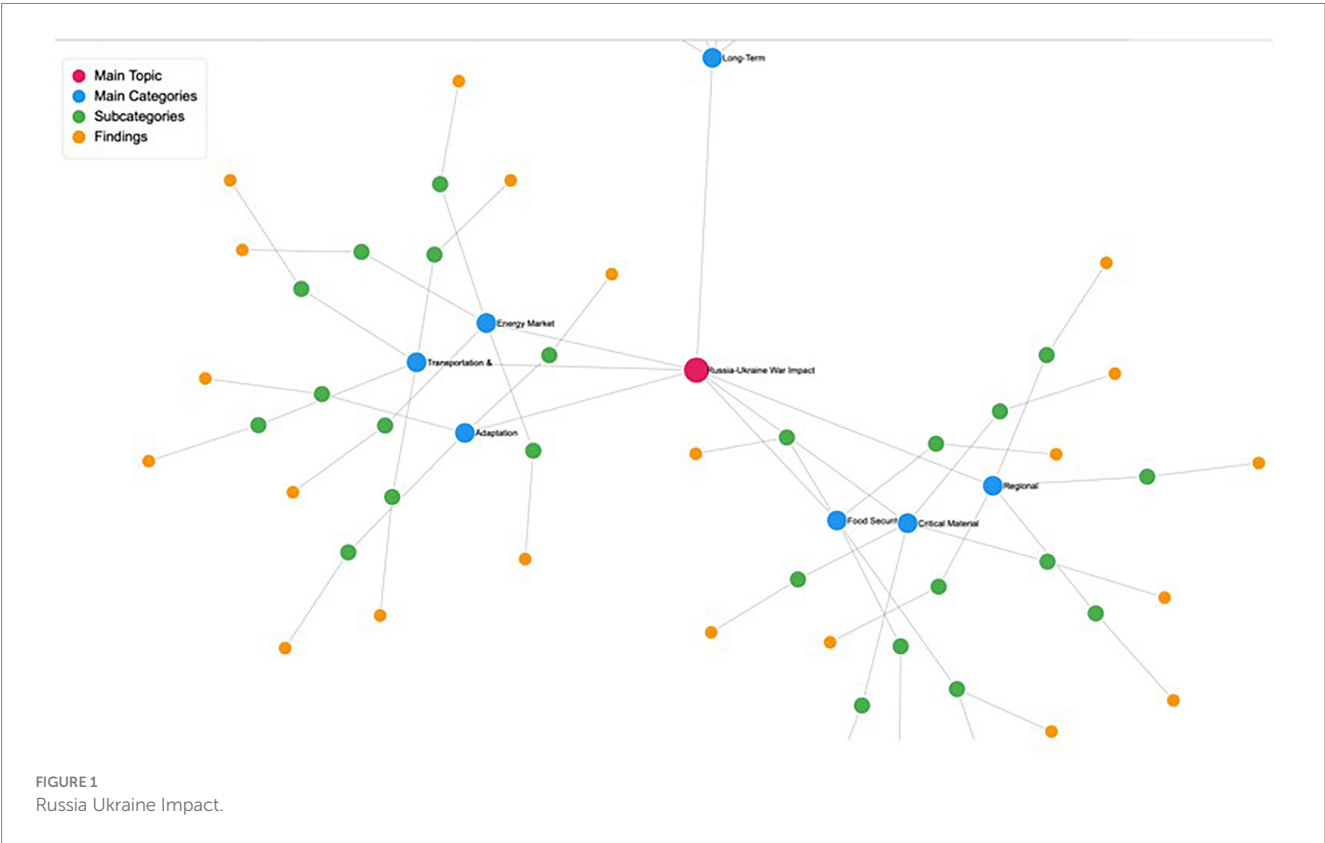
reliance on published academic literature may exclude valuable insights from industry reports and governmental analyses. Third, most studies focus on macro-level impacts with limited examination of firm-level adaptation processes.

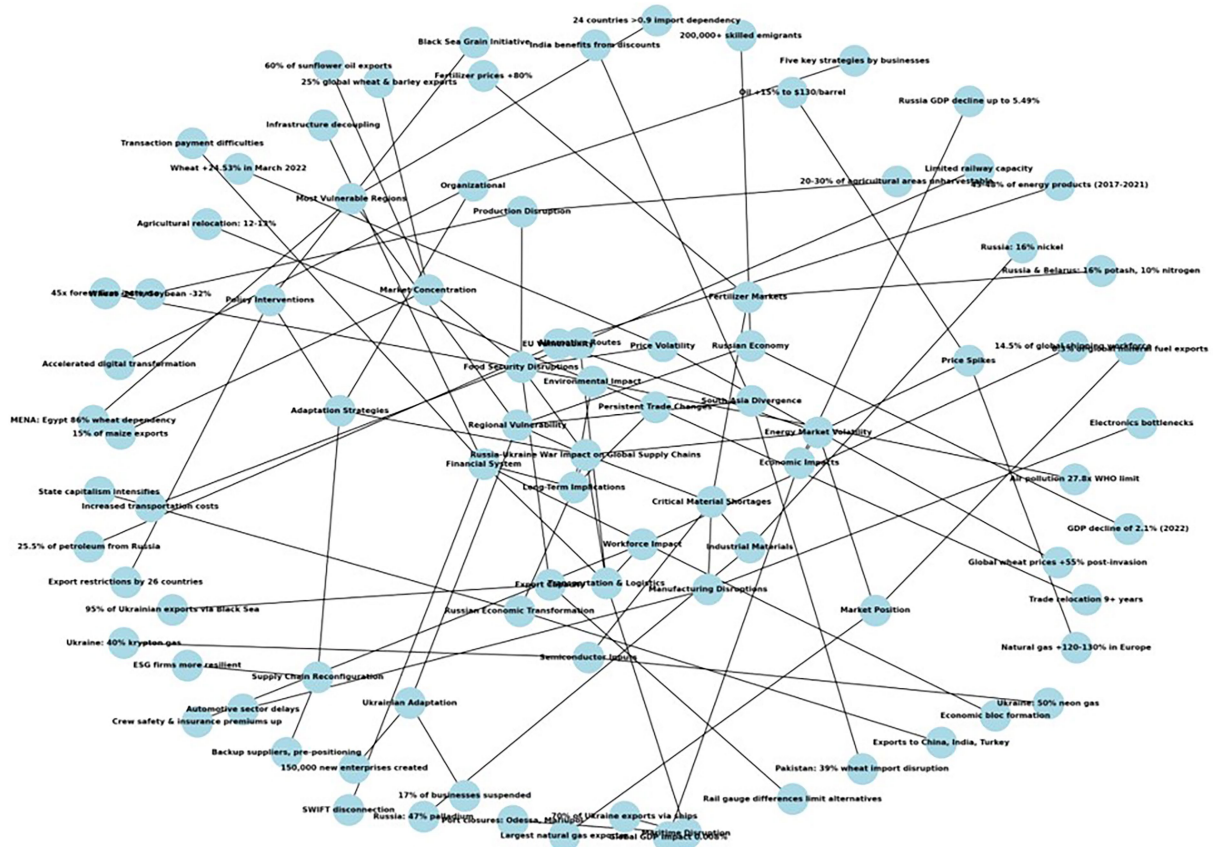
Several critical research gaps emerge from this review:

- 1 Longitudinal studies: There is an urgent need for longitudinal research tracking how supply chain adaptations evolve over the conflict duration and how permanent these changes become post-conflict.

TABLE 8 Policy and governance studies.

Study & authors	Journal & year	Methodology	Key findings	Policy implications	Geographic focus
Long-term business implications of Russia's war in Ukraine – Markus	Asian Business & Management (2022)	Expert commentary; Historical parallel analysis; Iran comparison	\$19B high-tech imports disrupted; 200,000 + worker brain drain; State capitalism intensification; Global financial fragmentation risk	Geopolitical risk assessment; Supply chain resilience; Market fragmentation prep; Alliance coordination	Russia/Global
Russian-Ukrainian War's Effects on the World Economy – Al-Saadi	Journal of Exploratory Studies in Law and Management (2023)	Legal analysis; Regulatory review; Compliance assessment	Sanctions compliance challenges; Force majeure applications increase; Trade agreement suspensions; Legal framework adaptations needed	Legal framework updates; Compliance mechanisms; Emergency provisions; International coordination	Global
Economic impact of Russia-Ukraine war – Tank & Ospanova	Int. J. of Innovative Research in Science Eng. & Tech (2022)	Economic impact modeling; Market reaction analysis; Policy effectiveness	Initial market volatility documented; Policy response variations mapped; Sector-specific impacts identified; Recovery timeline projections	Market stabilization tools; Sector-specific support; Policy coordination; Recovery planning	Global
Impact of Covid-19 Pandemic on US Supply Chain and Role of Ukraine-Russian War – Arisekola	World Atlas Int. J. of Education & Management (2023)	Compound crisis analysis; Vulnerability assessment; US focus	COVID vulnerabilities amplified; Dual crisis interaction effects; Supply chain brittleness exposed; Recovery complexity increased	Compound crisis planning; Vulnerability reduction; Resilience investment; Multi-hazard approaches	US





- As global supply chains continue to navigate this significant disruption against a backdrop of other compounding crises, both theoretical frameworks and practical strategies must evolve to address the increasingly complex risk landscape that characterizes modern logistics networks.

5 Conclusion

This systematic review synthesizes findings on the Russia-Ukraine war's impacts on global supply chains. The results reveal multifaceted

Conceptual Framework

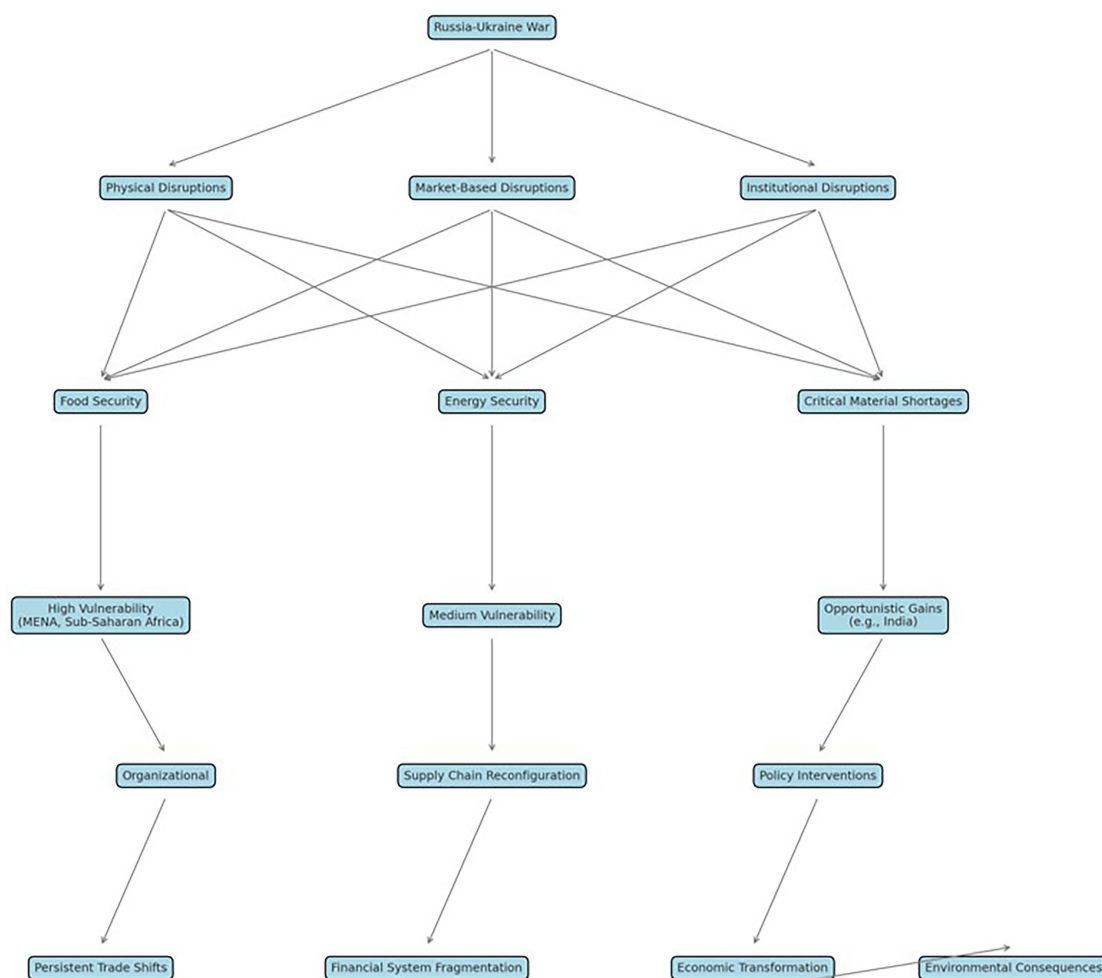


FIGURE 3
Conceptual Framework.

Author contributions

DS: Writing – review & editing, Writing – original draft. SR: Writing – review & editing, Writing – original draft.

Funding

The author(s) declare that no financial support was received for the research and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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