International Affairs and Global Strategy
ISSN 2224-574X (Paper) ISSN 2224-8951 (Online)
Vol.103, 2026

Logistics under Fire: Russia's Supply Chain Response to Western Sanctions

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Abstract

Russia's response to sweeping Western sanctions since the invasion of Ukraine illustrates how logistical constraints can be transformed into instruments of geopolitical power. Sanctions have reshaped the corridors, hubs, and alternative networks mobilized by Moscow to maintain the continuity of strategic flows despite increasing isolation. Routes through Central Asia, expanding hubs in Turkey and the United Arab Emirates, as well as the Arctic Northern Sea Route, operate as vectors of State resilience, enabling the circumvention of external pressure while reinforcing territorial and political ambitions. In parallel, gray markets, informal intermediaries, and an expanding "shadow fleet" sustain energy exports and industrial activity, yet generate structural vulnerabilities linked to opacity, safety risks, and dependence on opportunistic actors. This dynamic raises a core research question: how do Western sanctions reconfigure Russia's logistics architecture, and to what extent do adaptive mechanisms—across formal, informal, and illicit channels—produce both resilience and systemic fragility within global supply chains? The article contends that Russia's adjustments do not merely mitigate the effects of sanctions but actively reshape global trade patterns. By combining established corridors with shadow networks, Moscow secures short-term autonomy while accumulating long-term risks, demonstrating that logistics has become a central arena of contemporary geopolitical competition.

Keywords: Geopolitics, gray markets, logistics, resilience, Russia, sanctions, shadow fleet, supply chains

DOI: 10.7176/IAGS/103-01
Publication date: January 31st 2026

1. Introduction

Since the outbreak of the war in Ukraine in February 2022, Western sanctions have disrupted global trade networks and exposed vulnerabilities in long-established supply routes, while simultaneously elevating the strategic importance of alternative land and maritime corridors for Russia. Confronted with an unprecedented form of economic encirclement, Moscow has sought to reconfigure circulation channels to bypass constraints, preserve industrial continuity, and secure essential flows directly linked to national security, energy, and critical industrial production. Such reorientation generates a paradox in which operational inventiveness coexists with structural fragility, as extended hybrid networks—combining official infrastructures with clandestine arrangements—multiply dependencies, delays, bottlenecks, and risks. Logistics has evolved from a technical matter into a critical dimension of statecraft that reshapes commercial flows, reinforces asymmetric interdependencies, and strategically influences power relations. At the same time, the pursuit of logistical sovereignty creates transnational pressure points, from regional competition over ports and corridors to constraints placed on third-party States serving as vital transit hubs. Sanctions therefore act as catalysts that reveal a delicate equilibrium between resilience and vulnerability, showing how supply chain agility has become a central yet contested component of contemporary geopolitical strategy.

Beyond visible infrastructure, Russian resilience relies heavily on informal strategies and parallel supply networks that sustain critical sectors such as energy, defense, and high-technology manufacturing. Adaptive and often opaque channels support a model of sovereignty that rests on improvisation, flexibility, and constant problem-solving, enabling operational continuity under severe external pressure. The deployment of alternative corridors across Eurasian land routes, Middle Eastern logistics hubs, and Arctic maritime passages contributes to a broad reorganization of global flows and demonstrates Moscow's capacity to maintain industrial momentum despite extensive sanctions. Such reconfiguration also highlights structural weaknesses in the global trade architecture shaped by neoliberal norms, revealing how operational ingenuity can coexist with systemic exposure. Russia's logistical adjustments intertwine economic, political, and security considerations, linking infrastructure management to broader strategic objectives. The fusion of formal infrastructures with clandestine supply networks illustrates a form of resilience that contains both opportunity and inherent risk, confirming that

logistics has become a deliberate instrument for asserting sovereignty, shaping regional influence, and sustaining strategic continuity in a multipolar environment. This evolution provides the analytical foundation for examining how sanctions reshape the architecture of contemporary global supply chains.

Recurrent Western sanctions against Russia have followed a trajectory that requires careful distinction to interpret the current pattern of logistical adaptation. Measures adopted after the annexation of Crimea in March 2014 mainly targeted individuals, banks, and specific strategic firms through financial and travel restrictions, limiting access to Western capital markets while leaving core segments of energy and industrial trade largely untouched. Moscow responded with modest adjustments, including partial agricultural import substitution and closer cooperation within the Eurasian Economic Union, without major restructuring of supply chains. The full-scale invasion of Ukraine marked a turning point: sanctions became comprehensive and explicitly aimed at restricting long-term technological and industrial capabilities. According to Caprile & Cirlig (2025), the post-2022 measures represent the broadest sanctions in Russia's post-Cold War history, encompassing embargoes on advanced technologies, extensive asset freezes, and export controls on high-tech inputs, forcing firms to reconfigure trade routes and establish alternative suppliers and supply chains. These developments highlight the following research question: *How do Western sanctions reshape Russia's logistics architecture, and to what extent do adaptations across formal, informal, and illicit channels generate both resilience and systemic vulnerability in global supply chains?*

2. Impact of Economic and Political Sanctions

Economic and political sanctions have become increasingly recognized as major sources of disruption for global supply chains (Davarzani *et al.*, 2015). They represent deliberate interventions by States or supranational organizations aimed at influencing the behavior of targeted countries, companies, or sectors by constraining the flow of goods, services, and technology (Mykyta, 2025). Evidence from multiple case studies, particularly in the automotive and energy sectors, indicates that sanctions result in delayed deliveries, shortages of critical components, rising logistics costs, and, in some cases, the risk of bankruptcy (Imbs & Pauwels, 2024; Caruso & Cipollina, 2025; Zheng & Deng, 2025). These effects extend well beyond the primary targets, affecting suppliers, intermediaries, and logistics service providers across the entire supply chain (Davarzani *et al.*, 2015; Sun *et al.*, 2022). As Özdamar and Shahin (2021) observe, the full extent of these impacts is often underestimated due to fragmented research, which tends to examine economic, political, humanitarian, and systemic effects separately. Sanctions operate within a tightly interconnected network of interdependence, where consequences reverberate across third-party States and global trade actors. Imposed trade, financial, or technological restrictions increase strategic uncertainty, reduce operational flexibility, and compel firms to adapt sourcing strategies through multi-sourcing, nearshoring, or renegotiated contracts to maintain continuity in increasingly volatile geoeconomic environments. These dynamics highlight how sanctions not only target immediate actors but also trigger cascading effects that influence global operational resilience.

Building on observed disruptions, several studies in operations management emphasize that geopolitical shocks such as sanctions must be analyzed through the broader lens of supply chain resilience, a central concept for understanding companies' ability to anticipate, absorb, and recover from shocks. Sheffi & Rice (2005) define resilience as the capacity of a system to withstand and rebound after a major disruption, highlighting not only structural robustness but also the adaptability of procurement networks when conditions evolve unexpectedly. Building on this foundational view, the systematic literature review conducted by Rahman *et al.* (2022) adds that resilience emerges from a dynamic interplay between proactive measures—such as risk mapping, supplier diversification, or early-warning mechanisms—and reactive approaches aimed at restoring operational continuity once a disruption materializes. From a more political perspective, the effectiveness of sanctions depends heavily on their multilateral, rather than unilateral, formulation, as well as on the strategic behavior of both State and private actors, which in turn shapes the functioning of global supply chains (Bapat & Morgan, 2009). Finally, recent research suggests that sanctions may accelerate geoeconomic fragmentation by encouraging firms to redesign sourcing models, relocate production capacities, and strengthen internal control over critical activities (Bolhuis *et al.*, 2023), a dynamic that also reshapes how neutral and sanctioning States experience and respond to cascading effects.

Beyond their direct impacts, sanctions generate contagion effects affecting neutral States, including those responsible for imposing restrictions (Sun *et al.*, 2022; Li *et al.*, 2025). Economic actors in these countries often face a choice between compliance, which entails absorbing potential losses, and circumvention strategies, which may involve legal or illicit workarounds (Dumanska, 2024; Li *et al.*, 2025). Multinational corporations

headquartered in sanctioning countries typically comply with extraterritorial measures, whereas local firms in neutral countries, less exposed to reputational or legal risks, exploit regulatory loopholes to maintain trade flows. This behavior diminishes the overall effectiveness of sanctions while generating additional disruptions, including rising supplier costs, bottlenecks for critical materials, and the expansion of clandestine networks (Dumanska, 2024). Consequently, global supply chains become increasingly vulnerable to geopolitical fragmentation, with sanctions amplifying systemic weaknesses (Rasshyvalov *et al.*, 2024). In response, companies increasingly rely on geographic diversification, modular production approaches, and advanced technologies to enhance visibility, transparency, and operational resilience against political and economic pressures (Bednarski *et al.*, 2026). Such measures are now considered essential for navigating an unstable geopolitical and commercial environment.

Ultimately, economic and political sanctions act not only as sources of disruption but also as catalysts for strategic transformation within supply chains (Mykyta, 2025). Firms adjust networks by diversifying suppliers geographically, relocating production, and strengthening trusted partnerships to mitigate risks associated with sanctions-induced disruptions (Bei *et al.*, 2024). Targeted restrictions on critical technologies, such as semiconductors, underscore the increasing intersection of supply chain resilience and national security imperatives (Allen, 2021; Bednarski *et al.*, 2026). Ekwall & Kovacs (2021) underline the necessity of scenario planning, stress testing, and risk modeling to anticipate revenue losses, reputational damage, and operational bottlenecks. Across sectors, sanctions function both as disruptive forces and drivers of innovation, reshaping supply chain architectures while revealing the delicate balance between efficiency and geopolitical resilience (Bruno *et al.*, 2023). In the Russian context since 2022, the unprecedented scale and combination of Western sanctions have prompted extraordinary logistical restructuring, triggering adaptive and circumvention strategies that exemplify the evolving role of supply chains as instruments of both economic survival and strategic statecraft.

Methodology

The article is grounded in interpretive research, which seeks to understand complex phenomena through the synthesis of existing studies (Yin, 2018). Its primary objective is to uncover the mechanisms by which Russian logistics adapt to disruptive economic and political sanctions and to examine the role of parallel and clandestine networks deployed to mitigate resulting constraints. The methodology employs a comparative analytical framework using available data, following the guidance of Ragin (2014), enabling identification of different categories of infrastructure and intermediaries involved in sustaining strategic operations. Drawing on documented sources from reputable scholars, the approach highlights practices that are otherwise difficult to observe directly in wartime, such as gray markets and the "*shadow fleet*," while filtering out misinformation prevalent on conspiracy-oriented websites. By applying a qualitative methodology focused on the systemic analysis of relevant papers, the study reveals how Russia converts externally imposed constraints into levers of resilience, while simultaneously exposing the systemic vulnerabilities embedded in its logistical adaptations. This framework provides a nuanced understanding of the interplay between State strategy, operational ingenuity, and the broader risks posed to global supply chains.

3. Power, Sanctions, and the Reconfiguration of Russian Logistics

Since the start of Russia's invasion of Ukraine, Western sanctions have served as a hybrid instrument of coercion and political signaling, combining punitive measures with an intent to reshape the rules of international trade. The eighteen sanction packages adopted by the EU through July 2025 target not only access to financial markets but also critical logistics infrastructure, highlighting the strategic importance of supply chains. The suspension of routes by major shipping lines such as Maersk and MSC to Russian ports has created widespread uncertainty, causing significant delays in the import of electronic components and the export of agricultural products. Refusals by Western insurers to cover certain routes further amplify operational costs. Paradoxically, sanctions both constrain flows and foster Russian logistical ingenuity, yet their actual effectiveness remains debated. Ogbonna (2017) notes that EU sanctions against Russia following the annexation of Crimea did not clearly achieve their primary objectives in terms of cohesion, punishment, or signaling. They imposed economic costs on both sides and failed to alter Russian behavior, suggesting that coercive measures alone may be insufficient to achieve lasting strategic outcomes.

Studies on complex interdependence (Keohane & Nye, 2011), on one hand, and sanctions circumvention (Early, 2015), on the other hand, demonstrate that formal prohibitions often fail to isolate a State when intermediary actors and alternative land corridors and sea routes are available. Smith (2017) highlights this point in her

analysis of Crimea: rather than yielding to pressure, Moscow interprets sanctions through a framework of risk and loss, responding according to principles of resilience rather than compliance. The resulting disruption of flows drives both a geographical realignment of exchanges and the emergence of a new hierarchy of stakeholders across Eurasia. By redirecting energy exports toward Asian markets and leveraging secondary hubs in Turkey, Kazakhstan, and the United Arab Emirates (UAE), Russia illustrates how sanctions can inadvertently incentivize new logistical solutions. Ogbonna's (2017) observations complement this perspective, emphasizing that punitive measures may exacerbate tensions and economic costs without achieving their intended political objectives. In such context, sanctions function less as effective instruments of control and more as triggers for adaptive strategies, compelling the targeted State to diversify supply chains, develop clandestine logistics, and restructure trade networks. These dynamics underscore the complexity of sanction regimes and highlight the need for complementary diplomatic and strategic engagement alongside coercive measures to ensure meaningful impact.

The impact of sanctions on energy exports provides a clear illustration of Russia's adaptive logistics. European reliance on Russian hydrocarbons has prompted large-scale redirection of flows toward Asian markets, necessitating the development of new supply chains and the utilization of logistical hubs that were previously underexploited. Congestion at Baltic ports, deployment of alternative pipeline routes, and increasingly complex insurance arrangements demonstrate the tangible influence of infrastructure on economic sovereignty. This approach aligns with the concept of "*governance by denial*" described by Biersteker *et al.* (2016): while sanctions disrupt essential services and block conventional trade channels, they simultaneously create openings for strategies of circumvention. Land corridor and sea route selection, dictated by immediacy and operational efficiency, reflects Moscow's capacity to convert constraints into instruments of resilience. Bottlenecks in tanker traffic, escalating transport costs, and the opacity of logistical networks are no longer incidental malfunctions but deliberate factors shaping strategic adaptation. These dynamics underscore the intersection of infrastructure and State policy, showing how logistical agility has become a core element of Russia's economic resilience and a mechanism for sustaining strategic flows under conditions of external pressure, highlighting the evolving role of supply chains in contemporary geopolitics.

The transnational dimension of Russia's logistics circumvention becomes particularly apparent through the active involvement of third-party actors. Turkey, Kazakhstan, the UAE, and other regional intermediaries operate as "gray" platforms, enabling the continuation of critical trade despite sanctions. Istanbul has emerged as a central hub for the re-export of Western technological products restricted in Russia, while the Mediterranean port of Mersin functions as a principal entry point for redirected shipments. Kazakhstan, utilizing the Trans-Caspian Corridor and the port of Aktau, facilitates the movement of goods toward the Black Sea and China, reshaping Eurasian trade flows. In Dubai, Jebel Ali free zones host shell companies engaged in triangular trade, effectively obscuring the true origins of cargoes. This network of secondary actors highlights the permeability between legal and illicit channels and demonstrates the resilience of commerce under pressure. Newly developed supply chains safeguard Moscow's economic continuity while simultaneously restructuring interdependencies, reinforcing the emergence of a multipolar order in which the capacity for logistical resistance represents a tangible "marker" of power, strategic adaptability, and influence over global trade networks. Such developments also illustrate how hubs and corridors, considered vulnerable yet critical in global supply chains, sustain the flow of goods under geopolitical pressure (Paché, 2025). These dynamics underscore then how non-transparent, adaptive logistics serve as a decisive instrument for maintaining strategic continuity amid external constraints.

To enhance the understanding of Russia's logistical adaptations, two summary maps are provided in the Appendix, illustrating major flow reconfigurations since the start of the war in Ukraine. The first map depicts the Trans-Caspian Corridor, or *Middle Corridor*, highlighting its multimodal segments that combine rail and maritime transport. It identifies key entry and exit points, secondary hubs, and alternative routes employed to bypass sanctions, while also showing the coordination between Russian and regional actors. The second map focuses on Arctic shipping routes, with particular emphasis on the *Northern Sea Route*, demonstrating Russia's use of polar infrastructure, modernized ports, and icebreaking capabilities to maintain and redirect trade flows toward Asian markets. Together, these visualizations clarify the corridors' multimodal structure, the spatial redistribution of goods, and the operational ingenuity underpinning Russia's adaptive logistics. By contrasting traditional routes with new configurations, the maps provide a tangible illustration of how sanctions have reshaped Eurasian supply chains and reveal the interplay between logistical innovation and geopolitical strategy.

Beyond land-based corridors, Russia has invested heavily in the Northern Sea Route, leveraging the summer retreat of Arctic ice to establish a viable alternative to conventional maritime paths. Nuclear-powered icebreakers, upgraded Arctic port facilities, and enhanced redistribution capabilities enable uninterrupted trade

and reinforce national sovereignty. The Northern Sea Route has become a strategic instrument, allowing Moscow to assert control over key maritime spaces, project geopolitical influence, and reshape global energy flows (Cooley & Nexon, 2020). This transformation affects regional geopolitics by strengthening Russia's position within Eurasian corridors and challenging Western oversight of critical infrastructure. The emergence of these new logistical geographies highlights that, while sanctions exert economic and operational pressure, they simultaneously catalyze strategic adaptations and reveal the complex interplay between state power, interdependence, and resilience. Table 1 complements this analysis by summarizing Russia's principal logistical strategies, linking each to the sanctions that triggered them, detailing operational mechanisms, and illustrating the broader implications for national policy and global trade networks.

4. Geopolitics of Russian Resilience

The resilience of Russia's logistics apparatus is strongly underpinned by parallel, or gray, markets—networks where legally produced goods circulate outside formal channels. These arrangements emerge when price differences or product shortages incentivize intermediaries to purchase items at lower cost and resell them in more profitable markets (Berman & Dong, 2016). In Russia, these markets cover critical sectors including microprocessors, civil aviation spare parts, and industrial turbines for defense and energy production. Since 2022, semiconductor re-exports from Armenia surged by 500%, the UAE became a hub for electronic goods prohibited in Russia, and Turkey operates as a critical conduit for Western mechanical equipment. Gray markets grant Moscow operational flexibility, allowing continuity of essential supplies under sanctions. These mechanisms illustrate that resilience extends beyond technical engineering, embedding strategic continuity within broader economic and political frameworks. By facilitating constrained adaptation, parallel networks protect industrial capacities while reinforcing the State's ability to navigate a restricted and volatile trading environment. Such adaptive structures are key to understanding how Russia converts external constraints into instruments of resilience, revealing the intertwining of technical logistics, economic strategy, and statecraft.

Table 1. Russian Logistical Adaptations to Western Sanctions

Adaptation strategy	*Triggering sanctions*	*Concrete modalities*	*Strategic implications*
Land corridors, sea routes and alternative hubs	Withdrawal of major Western shipping lines	Redirection through rail networks and secondary ports	Geographical reconfiguration of flows; reduced dependence on Western maritime routes
Energy redirection toward Asia	European embargo on hydrocarbons	Development of new energy supply chains	Strengthened Eurasian interdependencies; diversification of export markets
Turkey as a re-export platform	Ban on high-tech exports to Russia	Triangular trade and re-export via Istanbul	Turkey consolidated as a "gray" hub; reinforced role in a multipolar economy
Northern Sea Route (Arctic)	Rising costs and vulnerabilities of traditional routes	Investment in Arctic ports and nuclear icebreakers	Power projection; sovereignty assertion; reshaping of Eurasian connectivity

Source: The Author.

The growing activation of Russia's shadow fleet highlights another key dimension of its geopolitical resilience: the deliberate use of gray-economy instruments to support strategies of coercion, circumvention, and controlled confrontation. As Rolander (2025) observes, Moscow systematically exploits the ambiguity between legitimate maritime commerce and organized criminal activity to conduct operations that obstruct oversight, evade sanctions, or sabotage critical infrastructure—all while remaining difficult to attribute. Operating under flags of convenience and layered ownership structures, this aging fleet does far more than transport hydrocarbons; it provides a flexible platform for hybrid actions, from disabling transponders and conducting covert ship-to-ship transfers to engaging in suspicious maneuvers near sensitive undersea infrastructure. The Eagle S episode in the Baltic Sea between December 2024 and October 2025 demonstrates how such tactics leverage gaps in international maritime law and complicate diplomatic, military, and legal responses. By relying on opaque logistical ecosystems, Russia strengthens its ability to disrupt critical infrastructure, bypass external constraints, and shape the regional security environment with limited escalation

risk. This systematic use of legal and operational ambiguity functions as a form of offensive resilience: sustaining vital flows while constraining Western governments' options to respond.

Maritime logistics play a central role in Russian resilience through the shadow fleet, composed mainly of aging tankers, often over twenty years old, operated under opaque ownership structures and flags of convenience. This fleet carries nearly 70 % of Russia's seaborne oil exports, over three million barrels per day, and has prompted the United Kingdom to sanction 135 vessels in July 2025, alongside the EU blacklisting nearly 200, as part of efforts to curb evasion of energy export restrictions. The UK sanctions package specifically targeted those tankers and associated entities implicated in moving Russian crude, reflecting an active policy to disrupt shadow fleet operations. To maintain routes, vessels engage in high-risk practices such as clandestine transshipments, observed off Ceuta and Malaysian waters. While these operations sustain Moscow's energy revenues, they heighten dependence on opportunistic brokers and increase exposure to accidents or interdiction. The shadow fleet embodies hidden resilience, leveraging non-transparent mechanisms to maintain export continuity, yet structural vulnerabilities accumulate within the supply chain, illustrating the trade-off between flexibility and systemic stability. Environmental and infrastructural risks are externalized, as seen in submarine cable damage in the Baltic and oil spills in the Black Sea, with a 35% rise in incidents reported by the European Maritime Safety Agency in 2025. These adaptive maritime strategies underpin Russian resilience but simultaneously magnify fragility in constrained networks, confirming the dual nature of operational inventiveness: maintaining flows while generating strategic risks.

Beyond gray markets and maritime adaptations, Russia pursues a broader geopolitical objective: constructing a sovereign flow architecture. Massive investments in the Northern Sea Route, whose traffic reached 36 million tons in 2024—triple the 2018 volume—illustrate this strategy. Ports such as Murmansk and Sabetta have been modernized for nuclear icebreakers and liquefied gas redistribution to Asia. On land, corridors through Central Asia and the Middle East have been diversified: the Trans-Caspian corridor via Aktau saw traffic rise 40% in two years, and Moscow–Xi'an rail links doubled container volumes between 2022 and 2025. The port of Novorossiysk was reinforced for grain exports. These hybrid networks reduce dependence on Western-dominated routes, confirming Sergunin & Gjørv's (2020) analyses, though sovereignty remains partial and costly, with detours adding 20–30% to expenses and lengthening delivery times. Environmental and infrastructural vulnerabilities also persist: in June 2025, a vessel ran aground near Murmansk, causing a fuel leak into the Barents Sea, with water samples showing petroleum concentrations above permissible limits (https://etc.bellona.org/2025/09/04/monthly-highlights-from-the-russian-arctic-june-july-2025/, Accessed July 6, 2025). Russian logistics thus illustrates the ongoing tension between resilience and vulnerability, as operational gains come with strategic, financial, and ecological trade-offs. These adaptive structures, summarized in Table 2, highlight how the integration of official corridors, parallel networks, and clandestine channels sustains critical flows under external pressure while exposing systemic fragilities inherent to heavily constrained supply chains.

Russian resilience extends beyond internal mechanisms, relying on multilateral strategies and a profound reorganization of trade flows to cope with Western sanctions. Toymentseva *et al.* (2024) show that declines in air, sea, and road transport, coupled with rising costs for imported parts, forced Russian firms to rethink supply chain management. These constraints prompted new infrastructure and corridors, particularly through Central Asia and the Middle East, while energy flows were redirected toward China and India (Aponte-Garcia, 2024). For their part, Golubchik & Pak (2024) describe a "*new Russian logistics*" model combining official infrastructure with transit-State hubs to circumvent restrictions and secure strategic supplies. Rail transport, which remained operational despite wartime disruptions, preserved Eurasian connectivity when maritime and air routes were partially suspended (Pomfret, 2023). However, as Tsouloufas & Rochat (2023) emphasize, these adaptations do not eliminate vulnerabilities: dependence on intermediaries, complex topography, and reliance on gray markets continue to expose strategic risks. Overall, Western sanctions, while designed to isolate Russia, inadvertently stimulated logistical innovation, geographic diversification, and hybridization of supply chains, reinforcing operational continuity while creating systemic fragilities. The evidence underscores that resilience under pressure is multidimensional, integrating technical, economic, and political strategies to maintain strategic autonomy in a constrained global environment.

Table 2: Russian Resilience: Mechanisms and Vulnerabilities

Resilience dimensions	*Mechanisms*	*Illustrations*	*Associated vulnerabilities/costs*
Strategic supply	Gray markets and parallel flows	Semiconductor re-exports from Armenia and UAE	Dependence on intermediaries; opaque circuits; risk of shortages if disrupted
Energy exports	Shadow fleet (aging tankers)	70% of Russian maritime oil carried by old vessels; United Kindom and EU sanctions	High accident risk; seizure risk; ecological externalities
Infrastructure continuity	Land corridors and sea routes	Growth of Trans-Caspian corridor, and modernization of ports	Logistical overcosts; longer transit times; reliance on alternative hubs
Sovereignty and power projection	Northern Sea Route (Arctic)	Investment in nuclear icebreakers and Arctic hubs	Structural fragility; dependence on extreme infrastructures; high investment costs
Operational security	Management of externalities and risks	Clandestine transshipments; incidents in the Black Sea and Baltic Sea	Network disruption; vulnerability to accidents and targeted sanctions

Source: The Author.

5. Constrained Logistics and Strategic Risks

The exploitation of the Northern Sea Route embodies the tension between economic imperatives and environmental protection (Clapp & Dauvergne, 2011). Global warming opens new commercial opportunities by reducing ice cover, yet this advantage depends on a global catastrophe accelerating the destabilization of polar ecosystems (Dalby, 2020). Convoys of nuclear icebreakers, necessary for safe navigation, produce radioactive effluents and further strain already fragile marine habitats. **The reliance on aging and poorly maintained vessels is also a significant source of risk. Russia's shadow fleet, estimated at hundreds of tankers operating outside conventional insurance and regulatory regimes, consists predominantly of old ships—over 72% are more than 15 years old, far above the global average tanker age—which increases the probability of mechanical failure, collisions, and spills at sea (Caprile & Gabija, 2024).** Such characteristics have already manifested in documented incidents, including the accident in the Kerch Strait in December 2024 involving two tankers that broke up and spilled thousands of tons of oil, contaminating coastal waters for weeks while authorities scrambled to respond. Russia portrays Arctic corridors as strategic alternatives to saturated southern routes, but the logistical sovereignty they offer relies on amplified ecological and operational risks. Operational resilience is therefore intertwined with negative externalities that are difficult to control internationally. As Rusinek (2015) notes regarding the sanctions regime against Iraq, apparent rationality in State decision-making frequently masks perverse effects and unforeseen consequences. In the Arctic, Moscow risks overestimating logistical gains while underestimating long-term environmental and security vulnerabilities, highlighting the paradox of pursuing strategic advantage at the cost of planetary fragility.

Bypass logistics exposes a critical security dimension, particularly in the Arctic. The Northern Sea Route has evolved into a strategic theater, where Russian commercial convoys are increasingly escorted by naval and coastal defense units. The Nagurskoye base on the Franz Josef Archipelago exemplifies this transformation, now hosting permanent military capabilities (Sergunin & Gjørv, 2020). Logistics in this context is no longer neutral infrastructure: each Arctic port, strait, and shipping lane constitutes a potential point of rivalry. The militarization of the region has prompted countermeasures from Western actors: the United States is expanding its icebreaker fleet, Canada has intensified Arctic maritime patrols, and Norway has strengthened radar and surveillance operations since the early 2010s (Khare & Khare, 2021). Energy and trade flows increasingly function as instruments of deterrence, transforming logistics from a technical channel into a lever of state power (Acemoglu & Robinson, 2012). Moscow's efforts to secure supply routes paradoxically amplify adversaries' mistrust, generating a self-reinforcing cycle of escalation. Far from stabilizing the Arctic, the continuity of flows contributes to heightened regional tension, demonstrating that operational resilience is inseparable from security imperatives and that asserting control over critical supply routes carries substantial strategic consequences for both regional stability and global power dynamics.

Building directly on these Arctic dynamics, Russia's shadow fleet finally illustrates how logistical resilience intersects with hybrid maritime competition on a global scale. Initially spurred by the 2022 Oil Price Cap regime, the rapid expansion of poorly regulated vessels enables Moscow to maintain critical hydrocarbon exports while operating in a legal gray zone. As Parlov & Sverdrup (2024) emphasize, this growth raises substantial concerns for maritime safety, environmental protection, and the integrity of global ocean governance, exposing the limits of flag, coastal, and port State oversight. Many vessels rely on opaque ownership structures, permissive flags, and unmonitored ship-to-ship transfers, allowing Russia to sustain operational continuity while minimizing attribution risk. Such arrangements circumvent sanctions and create systemic vulnerabilities along major maritime routes, complicating monitoring, enforcement, and risk mitigation for other States. The shadow fleet thus exemplifies a paradox of resilience: it secures Russian energy flows and strategic flexibility while amplifying uncertainty, environmental hazards, and potential disruptions for the wider maritime order, demonstrating how operational ingenuity can simultaneously enhance state power and generate global systemic fragility.

Beyond the Arctic, Russia's land corridors connecting the country to Central Asia and the Middle East reveal complementary structural vulnerabilities. The Trans-Caspian Corridor, linking Aktau and Baku before reaching Turkey, requires coordination among multiple States with diverse political regimes (including authoritarian ones) and private intermediaries often pursuing conflicting interests (Pop-Eleches, 2007). Border bureaucracy, local corruption, and cargo theft regularly undermine reliability, as in 2024 when a Moscow–Tehran rail convoy was halted in Turkmenistan, leaving hundreds of containers stalled and causing hundreds of thousands of dollars in demurrage costs. Traversing politically unstable regions, these corridors are exposed to ethnic tensions, terrorist threats, and opportunistic actors. Dependence on clandestine logistics further undermines regulatory frameworks and normalizes opaque channels. By multiplying dependencies, externalizing operational costs, and expanding gray-market networks, Russia sustains a parallel economy that challenges conventional governance of trade flows. These dynamics show that logistical adaptability provides strategic advantages while simultaneously generating systemic fragility and global uncertainty, highlighting the delicate balance between operational continuity and exposure to geopolitical, security, and economic risks (Clapp & Dauvergne, 2011).

Furthermore, Popoola & Popoola (2023) highlight that the war between Ukraine and Russia has had significant negative effects on international trade, particularly on the bilateral relations between the European Union and the United States. It has caused a reduction in net exports, disruptions in investment flows, and an increase in tariffs, indicating that Russian logistical adaptations, while ensuring operational continuity domestically, generate substantial economic externalities for international partners and ripple effects across related regional and global markets. These findings demonstrate that Russian resilience is not limited to internal management but also affects the economic and commercial stability of third-party States, exacerbating systemic vulnerabilities within global supply chains and creating unpredictable pressures on interconnected industries. By redirecting energy exports toward Asian markets and leveraging secondary hubs in Turkey, Kazakhstan, and the UAE, Russia shows how sanctions and conflict-driven disruptions can inadvertently incentivize logistical innovation and alternative procurement arrangements. This paradox of resilience under pressure illustrates that operational adaptability provides domestic strategic advantage while simultaneously producing unintended consequences and risks for global trade networks (Pop-Eleches, 2007; Berman & Dong, 2016).

6. Discussion and Conclusion

Russia's logistical adaptation to Western sanctions captures a defining paradox of contemporary international relations: the capacity of a sanctioned State to innovate rapidly while simultaneously exposing the structural fragility of global supply chain architectures. The development of alternative corridors—overland routes through the Caucasus, expanded rail connections via Central Asia, and maritime pathways across the Arctic—demonstrates how a highly centralized political system can deliberately convert logistics into an instrument of power projection. Route diversification has enabled Moscow to circumvent external constraints and actively reorient international trade flows in its favor, rather than merely mitigating losses. Such adaptation rests on a hybrid configuration that integrates formal infrastructures with parallel and clandestine networks, ensuring the circulation of strategically critical goods under intense political and economic pressure. Operational continuity, however, has been achieved at a significant cost. Intensified geopolitical competition, the redistribution of risk toward neighboring regions, and the emergence of new systemic vulnerabilities underscore the limits of logistical resilience as a purely technical achievement. Logistics has therefore evolved from an auxiliary economic function into a strategic lever that reinforces asymmetric dependencies and extends state influence beyond territorial borders. In that respect, the Russian experience aligns with broader theoretical work on

economic resilience to shocks, insofar as adaptive capacity is rooted in the reconfiguration of trade flows, the enduring centrality of energy exports, and the strategic reorientation toward Asia, particularly through strengthened partnerships with China and other non-Western economies (Drăgoi, 2024).

The adaptive strategies deployed by Russia also generate significant political, environmental, and security externalities that extend well beyond national borders. The multiplication of alternative corridors has heightened regional tensions, ranging from port competition in the Black Sea to growing pressure on Central Asian States that have become indispensable transit hubs, as well as disputes associated with the progressive activation of the Arctic Sea Route. Regulatory circumvention further contributes to the normalization of gray markets, gradually transforming sanctions evasion into a routine commercial practice and eroding the authority of international institutions responsible for overseeing trade and financial governance. The increasing hybridization of supply chains—where informal and illicit networks intersect with official infrastructures—amplifies dependencies and systematically shifts operational risks toward peripheral actors. Transit States and commercial intermediaries, often lacking sufficient regulatory capacity, are consequently exposed to legal uncertainty, reputational damage, and security vulnerabilities. Such dynamics illustrate the structural limits inherent in sanctions regimes, whose effects cannot be assessed solely through short-term macroeconomic indicators. Any rigorous evaluation must instead account for strategic adaptation, the reconfiguration of procurement networks, and the long-term transformation of business practices that sanctions actively induce (Giumelli, 2024).

Returning to the research question posed in the introduction—namely how Western sanctions reshape Russia's logistics architecture and the extent to which adaptive mechanisms rooted in formal, informal, and illicit channels generate both resilience and systemic vulnerability—the academic literature points to a consistent pattern. Economic and political sanctions have compelled Moscow to construct a hybrid logistical system that combines official infrastructures, parallel arrangements, and illicit flows to preserve the continuity of critical operations. Such a configuration enables the Russian economy to absorb external shocks while redistributing adjustment costs across space and institutions, permanently reconfiguring relationships of dependence between state actors and international markets. The Russian case therefore exposes the relative weakness of sanctions as instruments of coercion when targeted States possess both strong political resolve and the structural capacity to reorganize strategic flows. Rather than producing straightforward economic collapse or policy reversal, sanctions have incentivized institutional innovation and geopolitical realignment. Scholarly work further suggests that adaptive capacity depends not only on domestic policy instruments, but also on external geopolitical conditions, including the rise of alternative growth poles, sustained energy price increases, and the ongoing "*recomposition*" of international monetary hierarchies (Aslan & Aslan, 2025).

Over the longer term, Russia's logistical adaptation highlights the growing difficulty of governing global flows in an increasingly multipolar international system. Contemporary supply chains operate simultaneously as economic infrastructures and as diplomatic and military instruments, generating systemic risks that encompass macroeconomic volatility, environmental degradation, and the potential escalation of regional conflicts. By converting external constraints into strategic opportunities, Moscow illustrates how modern logistics functions at the intersection of resilience and exposure: transport infrastructures and corridors operate as tools of influence while also constituting potential sources of future disruption. The energy sector offers a particularly revealing illustration of this dynamic. The redirection of oil and gas exports has stabilized domestic fiscal revenues yet has also contributed to global price volatility and heightened uncertainty across international markets. Focusing on energy logistics therefore allows observed infrastructural transformations to be directly linked to broader macroeconomic outcomes. The continued centrality of energy and mineral resources to Russia's resilience since 2022 confirms that sectoral sanctions generate far-reaching global repercussions, notably in the domains of inflationary pressure, energy security, and macroeconomic instability (Ata *et al.*, 2023). Such effects diffuse across producers, transit States, and consumers alike, complicating collective governance.

Taken together, these findings underscore a persistent tension within the geopolitics of supply chains that existing scholarships have yet to fully resolve. Since 2022, Russian logistics has simultaneously functioned as a mechanism of sovereignty preservation and as a source of systemic fragility affecting multiple regions. The strategic control of critical flows produces substantial externalities for global supply chains and for the stability of a region of considerable geopolitical importance. Looking ahead, Russia's logistical resilience is likely to evolve further along hybrid lines, combining official infrastructures, parallel networks, and illicit practices while deepening interdependencies with regional and global partners. Analytical uncertainty is further compounded by methodological constraints, as the classification and politicization of key economic indicators limit the possibility of definitive assessments regarding sanctions effectiveness and foster competing interpretations of observed outcomes (Studzińska *et al.*, 2024). Ultimately, the analysis advances a central insight: modern

logistics constitutes a core arena where power, resilience, and fragility converge. Any comprehensive geopolitical evaluation of sanctions must therefore integrate logistical dynamics to assess their actual, rather than presumed, consequences within an increasingly fragmented global order.

Acknowledgements

The author thanks the two anonymous reviewers of *International Affairs & Global Strategy* for their constructive feedback, which greatly improved the quality of this article. Special thanks are also due to Anya Kuteleva and Christophe Bys for their insightful comments and suggestions on earlier drafts, which helped refine the arguments and clarity of the manuscript.

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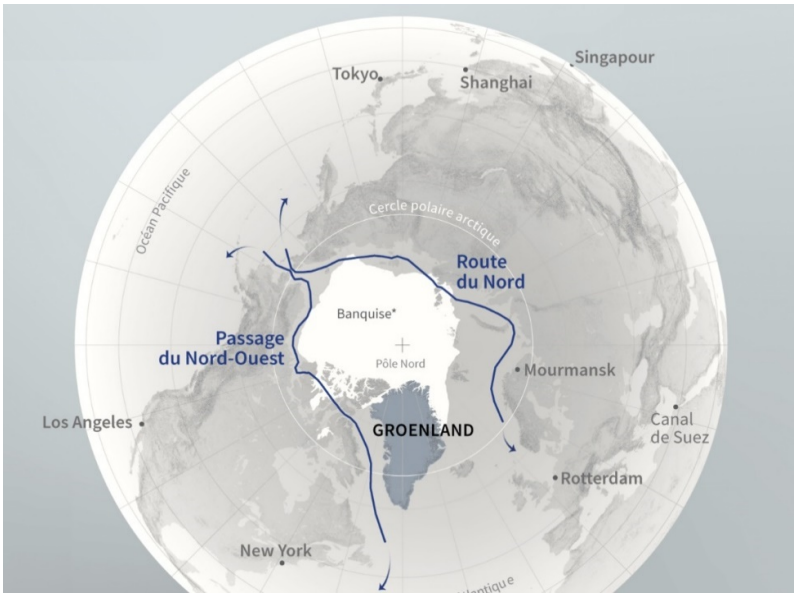
APPENDIX

Map 1: Trans-Caspian International Transport Route (*Middle Corridor*)
and Key Multimodal Segments (Rail + Sea)

Source: https://www.caspianpolicy.org/research/maps/middle-corridor-live-map
(Accessed December 29, 2025)

Map 2: Arctic Shipping Routes with Emphasis on the *Northern Sea Route*



Source: https://www.revueconflits.com/carte-les-routes-maritimes-de-larctique/, March 3, 2025