



Study on the Supply Chain of Multinational Enterprises under Geopolitical Risk-The Case of China's New Energy Industry

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Abstract. In the context of the intensification of global geopolitical conflicts and the acceleration of energy transformation, the vulnerability of the supply chain of new energy enterprises has become increasingly prominent. This study takes China's new energy industry as an example to explore the impact mechanism of geopolitical risks on the supply chain and the countermeasures. The study finds that geopolitical risks have direct and indirect impacts on the new energy supply chain through sanctions, trade restrictions, technology and resource blockages, leading to supply disruption, cost increase and supply chain regionalization. In the face of these challenges, enterprises can enhance resilience through diversified supply chain layout, production localization, human resources and cultural integration. Governments need to provide assurance through policy support, technological upgrading, and diplomatic coordination. This study provides a theoretical reference for the strategic adjustment of multinational enterprises in an uncertain environment and also puts forward practical suggestions for the government to formulate industrial chain security policies.

Keywords: Supply Chain, New Energy Industry, Geopolitical Risks, Coping Strategies.

1 Introduction

According to the World Trade Organization (WTO) 2023 report, the share of global intermediate goods trade involving the new energy industry has nearly tripled compared to 2010, while its supply chain disruption risk index has simultaneously surged by 42%. This paradox highlights the unique position of the new energy industry in globalization: as the core vehicle for achieving carbon neutrality goals, its supply chain not only carries the strategic value of technological revolution but has also become a focal point of great power competition due to resource dependencies, technological barriers, and policy gaming.

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The rise of China's new energy industry and its superposition with geopolitical risks present a particularly salient case. Data shows that China's global market shares in photovoltaic modules, power batteries, and rare-earth permanent magnet materials have reached 82%, 65%, and 90% respectively, forming a trinity of "technology-resource-manufacturing" supply chain advantages. However, this dominance has triggered systematic containment from Western powers. The U.S. Inflation Reduction Act (IRA), under the guise of "clean energy localization," mandates that post-2024 electric vehicle battery components must meet 50% domestic content requirements, with critical minerals exclusively sourced from FTA-partner countries. This directly blocks traditional market entry routes for companies like CATL and BYD into North America. Meanwhile, the EU's Net-Zero Industry Act (NZIA) imposes carbon footprint thresholds for photovoltaic products and initiates anti-dumping investigations against Chinese solar enterprises, compelling industry leaders such as LONGi Green Energy and Trina Solar to establish near-shore production bases in Europe (e.g., Poland) and regionalize operations in Southeast Asia.

Against this backdrop, this study examines representative cases from China's new energy sector to elucidate the transmission mechanisms of geopolitical risks and corporate counterstrategies. Theoretically, it bridges existing research gaps by integrating supply chain resilience theory with global value chain (GVC) analysis. Practically, it provides strategic references for enterprises to optimize regional layouts, enhance technological autonomy, and adjust to policy uncertainties and technological competition, while informing government policymaking on industrial chain security and international cooperation mechanisms.

2 Theoretical Foundations

2.1 Supply Chain Ripple Effects

Geopolitical conflicts trigger systemic cascades through energy price volatility, trade restrictions, and logistics disruptions [1]. For instance, international conflicts caused a 300% surge in European natural gas prices, forcing energy-intensive industries (e.g., chemicals, steel) to relocate to Southeast Asia while delaying carbon neutrality goals through coal power reactivation. This "cost-driven reconfiguration" alters regional supply chain patterns and induces technological pathway adjustments, following the transmission path: Energy shock → Production cost escalation → Industrial migration → Technological regression → Global division of labor restructuring.

2.2 Techno-Nationalism

Major powers advance supply chain "blocization" through export controls, industrial subsidies, and technical standard barriers. The U.S. CHIPS and Science Act prohibits exports of sub-14nm process equipment to China while forming a "semiconductor containment alliance" with Japan and the Netherlands. China counters through its "dual circulation" strategy accelerating domestic substitution. Techno-nationalism essentially converts supply chain control into strategic power, creating parallel systems under "technological sovereignty" competition.

2.3 Resource Politicization

Critical mineral supply chains have become arenas for great power rivalry [2]. The U.S. Defense Production Act categorizes lithium and cobalt as "strategic minerals," allocating \$3 billion to support domestic extraction and allied resource networks. Conversely, China leverages its "dual circulation" strategy to pursue resource substitution, global deployment, and counterbalancing. The core logic lies in achieving "asymmetric deterrence" through control over critical supply chain nodes.

2.4 Supply Chain Resilience Theory

Supply chain resilience theory emphasizes three-tier corporate strategies to mitigate external shocks, manifested through redundancy design via multi-source procurement and backup capacity (e.g., CATL's diversified lithium partnerships across Chile and Zimbabwe), agility enhancement employing real-time digital monitoring and flexible manufacturing (as demonstrated by BYD's smart factories reducing inventory turnover by 40%), and adaptive evolution through technological substitution like solid-state battery R&D and circular business models. This tripartite approach enables Chinese new energy leaders to counteract geopolitical resource nationalism while maintaining cost competitiveness, ultimately reconfiguring supply chains into polycentric networks that balance operational efficiency with strategic autonomy.

2.5 Institutional Complexity and Global Value Chain Theory

Under institutional complexity theory, multinational enterprises strategically navigate conflicting regulatory regimes and geopolitical pressures through three mechanisms: compliance adaptation (aligning operations with host-country policies), institutional entrepreneurship (shaping ESG standards through cross-border alliances), and strategic ambiguity (maintaining flexible interpretations of localization requirements). As evidenced by Chinese EV manufacturers establishing joint R&D centers in Germany while diversifying lithium sourcing from Africa, Gereffi's governance framework reveals how geopolitical realignments are transforming global value chains (GVCs) from market-driven efficiency models to hybrid architectures balancing geoeconomic security with technological interoperability. This paradigm shift compels firms to adopt multi-layered governance structures that reconcile competing institutional logic across jurisdictions [3].

3 Impact of Geopolitical Risks

3.1 Direct impact: Sanctions and Trade Restrictions

In recent years, the economic growth of various countries and the increase in energy demand have continuously reconstructed the global new energy geopolitical pattern, which has exacerbated the energy crisis. Some of the 'black swan' events that are happening in the world will have a superimposed impact on China's existing new energy structure, accelerate the adjustment of the interests of energy producers and consumers, and have a significant impact on global energy prices and energy trade risks [4]. It disrupts the normal operation of the supply chain, making the supply chain fragmented

and regionalized. Taking the United States' sanctions on China's photovoltaic industry as an example, the United States launched a "double reverse" investigation on Chinese photovoltaic products in 2011, that is, anti-dumping and countervailing investigations. Since then, the United States has repeatedly raised the countervailing duty on photovoltaic industry products such as solar panels, which has significantly increased the cost of Chinese photovoltaic enterprises to export to the United States market, which has had an impact on the development of China's photovoltaic industry [5].

3.2 Indirect Conduction: Technology and Resource Blockade

The technology blockade has caused China's new energy enterprises to encounter obstacles in high-end technology research and development, and the pace of innovation has slowed down; Resource blockade makes enterprises face the dilemma of raw material shortage and rising production costs, but also affects the stability of the new energy supply chain, disrupts the traditional global division of labor and cooperation system, is difficult to adjust the layout, and also disrupts the supply of key technologies and parts, and ultimately leads to the stagnation of enterprise production. In order to cope with the resource blockade, companies must find alternative materials or open up new supply channels, but this requires a large investment of time and money, seriously affecting the production schedule and short-term stability of the supply chain. For example, Japan, the United States and South Korea recently announced the official launch of joint research and development plans for hydrogen energy vehicles from February 2025 [6]. The three countries, known as the "hydrogen energy Triangle" alliance, plan to invest more than \$20 billion in research and development funds, while combining 10 national research institutes, focusing on the three core technologies of hydrogen energy preparation, storage and vehicle application. What is more striking about this incident is that the three countries have made it clear that they will establish a technology blockade mechanism to strictly prevent the leakage of core technologies.

4 Transnational Corporations and Government Collaboration

4.1 Risk Prevention from the Corporate Perspective

First, regional economies are increasingly dependent on the industrial chain of a specific country or region. If there is a problem in any link, it will have a significant impact on the overall economy of the area, it is necessary to shift focus to other markets such as Latin America, the Middle East, and Southeast Asia [7]. These markets are not dependent on the European and American markets and can effectively reduce trade barriers through regional trade agreements such as RCEP and CPTPP. For instance, establishing production bases in places such as Mexico or Southeast Asia, solving production issues at these bases to alleviate tariff burdens and rapidly enter the European and American markets.

Second, the political games and policy adjustments on a global scale are profoundly affecting the raw material acquisition, international investment actions, and global supply chain management of enterprises in China [8]. Establishing multi-regional produc-

tion bases to avoid dependence on a single supply chain, effectively and flexibly respond to geopolitical risks. By establishing factories overseas, risks are diversified, and the establishment of factories overseas reduces the distance in transit, allowing direct avoidance of tariff impacts.

Third, reducing the recruitment of overseas staff and increasing local hiring can not only lower labor costs but also reduce cultural frictions between countries. Adopting innovative solutions such as EOR (Employer of Record) to address stringent labor regulations.

4.2 Policy Support and Overall Considerations

First, with the rapid rise of China's emerging industries and the comprehensive development of the green economy, research on geopolitical risks related to the supply of such strategic minerals is imminent [9]. The State Council encourages the policy of exchanging old products for new to assist the development of the new energy industry. The Ministry of Industry and Information Technology promotes the technical specifications for the lithium battery industry, and companies need to focus on high-value-added products. Preferential use of the Renminbi for financing, by integrating multilateral development banks, local financial institutions, and Chinese-funded banks to diversify financing risks [10].

Second, the European market has strict ESG requirements, and companies must meet standards in environmental protection and labor rights, and also carefully study the laws of the target country. A team of international lawyers can help design a compliance framework. By using the above strategies, companies can effectively deal with supply chain risks arising from geopolitics.

5 Conclusion

Against the backdrop of escalating global geopolitical conflicts, the supply chain of the new energy industry has encountered numerous risks and challenges. After research, it has been discovered that geopolitical risks primarily impact the new energy supply chain through means such as sanctions, technological blockades, and resource blockades. This shock has triggered a series of issues, including sudden disruptions in supply, obstacles encountered in logistics transportation, and a significant increase in production costs. Under the influence of these factors, the new energy supply chain has shown a trend towards regionalization and localization.

In the face of these risks, companies can adopt a variety of strategies. For instance, they can promote the diversification of supply chains and markets, achieve localized development of supply chains and production, and strengthen the integration of human resources and cultural aspects. At the same time, the government should also actively play its role, strengthen diplomatic coordination efforts, continuously improve industrial security strategies, and introduce relevant policies to provide strong support.

Looking forward, related research can be deepened in the following directions: First, research on risk assessment and prediction; Second, focus on joint research on sustainable supply chains and geopolitical risks; Third, strengthen research on global strategy and supply chain coordination. Through these studies, a more comprehensive empirical

basis can be provided for supply chain theory, aiding companies in reasonably adjusting their strategic planning and offering references for the government to formulate scientific and effective policies.

6 Author Contribution

All the authors contributed equally, and their names were listed in alphabetical order.

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