

Supply Chain Risk Identification and Resilience Building for Lithium-Ion Battery Firms: A Resource Dependence Perspective

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Abstract:

Against the backdrop of the global energy transition, lithium has become a critical raw material for lithium-ion batteries. With soaring demand, the supply landscape is facing significant adjustment. This paper applies the EVE Energy lithium supply chain as the study object. The dependence-risk-strategy framework is constructed based on Resource Dependence Theory and Supply Chain Risk Management Theory to systematically identify the core risks in the EVE energy lithium supply chain. The findings indicate that EVE Energy needs to address the triple threat of geopolitical tensions, price volatility, and supplier concentration. It is highly dependent on external sources; the raw material costs make up 81.99% of total costs. Procurement amount from the top five suppliers accounts for 35.00% of annual procurement. The global lithium trade network structure presents a duality of robustness and vulnerability; the disruptions at a few core nodes will spread rapidly across the entire value chain. The midstream of the Chinese lithium supply chain is the main net exporter of risk. To address this, the paper proposes a risk response strategy that combines diversification of procurement channels, strategic reserves, and hedging.

Keywords: Lithium Supply Chain; Supply Chain Resilience; Risk Identification; Resource Dependence; EVE Energy

1. Introduction

1.1 Research Background

Driven by global carbon neutrality strategies, the new energy vehicle and energy storage industries have experienced explosive growth; the stable supply of

lithium-ion batteries has become a defining issue for national energy security and industrial upgrading, as they are the core power source [1]. Based on the data from Benchmark Mineral Intelligence, global lithium needs will exceed 2.4 million tons of lithium carbonate equivalent in 2030, nearly four times the 2022 level [2]. However, the geographical distribution of

lithium sources is extremely imbalanced. According to the data from the USGS, the four countries of Chile, Argentina, Bolivia, and Australia together account for more than 85% of global proved lithium resources, creating an obvious resource lock-in effect [3]. Although China has more than 60% of global lithium salt processing capacity, its external dependence on upstream mineral resources is still more than 65%. This kind of structural conflict between strong processing capacity and weak resource endowments makes midstream battery manufacturing companies face significant supply chain vulnerability [4]. The price of lithium carbonate experienced a sharp fluctuation, soaring from RMB 50,000 per ton to 600,000 per ton and rapidly declining to 100,000 per ton between 2022 and 2023. This leads to squeezed profit margins for many battery corporations, even pushing them into a cost-price inversion [1]. Against this background, constructing a resilient supply chain is not only a business problem for survival and development, but also a strategic demand for safeguarding national strategic emerging industries [5]. This paper selects EVE Energy, a globally leading lithium-ion battery company, as the research subject. It is precisely based on its representative position in the industrial chain and the typical resource constraints it faces that this study aims to analyze the whole chain structure and provide a replicable risk management paradigm for industry [6]. According to EVE Energy's 2025 annual report, the company recorded total operating revenue of RMB 61.47 billion, a year-on-year increase of 26.44%, and ranked sixth globally in power battery shipments and consistently among the top two globally in energy storage battery shipments.

1.2 Literature Review

Shao & Jin proposed that corporate resource reserves can only respond to short-term fluctuation, and the effect of alternative resources is very limited. To improve the resilience of the lithium supply chain, driving the recyclability design of related resources is crucial [5]. Yang et al. found that the midstream segment is the most important net transmitter of price shocks. The risks are transmitted from the midstream to the upstream and then to the downstream, or transmitted from midstream to downstream directly [7]. Hao et al. stated that the lithium trade network has two main traits, which are robustness and vulnerability. When core countries in the lithium supply chain face shocks, the whole supply system is affected by risks [8]. These findings indicate the risk transmission role of midstream firms and the requirement of building a proactive risk mitigation strategy. Consequently, they provide support for the EVE Energy study.

Most studies are focused on the research of national trade networks or the model of supply chains, but ignore how specific firms, such as EVE Energy, achieve structural

adjustment to alleviate resource dependence. On top of that, limited research combines the operating data from corporate annual reports with the theoretical framework of supply chain resilience. It is hard to evaluate the effect of hedging and inventory management. This study will fill the gap and analyze the relevant case of EVE Energy, and will provide practical suggestions for specific firms to improve the resilience of the supply chain and for other lithium-ion battery firms by combining widespread environmental risks with specific corporate risk response strategies.

1.3 Research Framework

This study will construct a research framework from risk identification to mechanism analysis and strategy evaluation, and finally propose optimization suggestions. This study will systematically identify three core risks that are currently faced by EVE Energy, namely geopolitical risks, price volatility, transmission risks, and supplier concentration risks. Secondly, this study will analyze how supply disruptions, cost transmission, and weakened bargaining power affect supply chain security. Thirdly, it assesses the effectiveness of EVE Energy's current response strategies: hedging, overseas capacity deployment, and procurement diversification. Finally, it offers relevant optimization suggestions regarding procurement diversification, safety stock, hedging optimization, and recycling system development, which can also be applied to other lithium-ion battery companies.

1.4 Innovation points

This paper has two main innovations. Firstly, it constructs an analytical framework based on dependence, risk and strategy which enhances the practicality of Resource Dependence Theory and can be directly used in the evaluation of specific corporate supply chain resilience. Moreover, this paper is different from general research which focuses on the analysis of inter-country trade flows or industry-level risk transmission. This paper takes the challenges which firms face as the entry point, uses the real data from EVE Energy to build a connection between macro risk environment and corporate decision-making so that it fills the research gap between macro trade analysis and specific firms.

2. Case Profile: EVE Energy

Founded in 2001 and listed on the Shenzhen Stock Exchange (stock code: 300014), EVE Energy serves as a representative case in the global lithium-ion battery industry. Headquartered in Huizhou, Guangdong, the company provides comprehensive battery solutions spanning consumer, power, and energy storage applications. Ac-

According to the 2025 annual report from EVE Energy, the company's total revenue amounted to RMB 61.47 billion which increased by 26.44% compared with last year. EVE Energy ranked sixth globally in power battery shipments and consistently ranked among the top two globally in energy storage battery shipments. These significant results make EVE Energy a reliable case in research on lithium supply chain risks. As a core hub in the midstream of the lithium supply chain, EVE Energy transforms upstream lithium resources into high-performance cells and systems for downstream sectors such as electric vehicles and smart grids.

In recent years, EVE Energy has implemented international strategies in order to meet the rapidly growing global demand, constructed the Debrecen factory to serve the European market, and built the Kulim facility to expand its influence in Asia. According to the annual report, EVE Energy has eleven production bases in Huizhou, Jingmen, Chengdu and Qujing in China. The Malaysian plant is operating, the Hungarian plant is under construction and the American project is in the planning stage. The company's large-format cylindrical battery has been mass produced and installed in over 90,000 vehicles with the longest single-vehicle range exceeding 280,000 km and has become the first benchmark product in the industry. However,

EVE Energy's 2025 annual report demonstrates that it is highly vulnerable to raw material costs, which account for as much as 81.99% of total operating costs, meaning the price of lithium plays a decisive role in its profit and loss. Meanwhile, the risk of supplier concentration is significant. The top five suppliers account for 35% of the procurement amount. EVE Energy has applied several measures to address the supply chain risks. Firstly, the company constructed the commodity hedging program, made lithium carbonate one of the core hedging commodities. The period-end position value amounted to RMB 2.788 billion. Secondly, the company promotes the CLS Global Cooperation Business Model through technology licensing and service provision to achieve asset expansion. Thirdly, the company signed a long-term agreement with upstream suppliers and improved its control of upstream lithium resources through equity participation. Although EVE Energy has implemented a commodity hedging program, with a period-end market value of approximately RMB 2.788 billion, to mitigate the impact of lithium carbonate price fluctuation, against the background of ongoing geopolitical tensions and market volatility, an in-depth analysis of the structural vulnerability of its supply chain architecture cannot be ignored (Table 1).

Table 1. Key supply chain risk indicators of EVE Energy (2025)

Indicator	Value	Implication
Raw material cost	81.99%	EVE Energy's profitability is highly sensitive to lithium price fluctuations.
Percentage of the top 5 suppliers	35.00%	High supplier concentration, limited bargaining power,
Commodity hedging period-end market value	RMB 2.788 billion	The measure to address the fluctuation of lithium carbonate
Overseas production factories	Malaysia, Hungary, America (planned)	Establishing overseas factories to alleviate the supply resource instability

These data indicate the high vulnerability of EVE Energy to upstream supply disruptions, which means it is necessary to have an in-depth study of its underlying risk mechanisms.

3. Risk Analysis Based on Resource Dependence

3.1 High External Dependence on Upstream Lithium Resources

The global supply situation of lithium resources has a significant structural imbalance. Based on USGS data, global lithium resources are concentrated in Chile, Argentina,

Bolivia, and Australia. These four countries account for the vast majority of global reserves [3]. In the processing stage, China accounts for approximately 60% of lithium salt processing capacity and possesses unique advantages in processing, from mineral resources to battery materials. However, this exposes the Chinese lithium battery industry to objective constraints arising from upstream resource dependence [4].

EVE Energy, as a major lithium-ion battery manufacturer, is located in the midstream and downstream segments of the lithium supply chain, which means it has to endure pressure from the upstream raw material structure. According to EVE Energy's 2025 annual report, a high percentage of raw material costs in total costs and a high concentration of suppliers make the company highly sensitive

to upstream lithium price fluctuations and supply changes. Research indicates that the lithium trade has a high degree of concentration. The lithium supply chain trade network has a dual nature of robustness and vulnerability. However, once any node suffers external shocks, it will lead to risks expanding rapidly across the industrial chain [5,6].

3.2 Supply Chain Risks Arising from Lithium Resource Dependence

3.2.1 Geopolitical risks

Against the backdrop of pursuing carbon neutrality, the global energy transition leads to a reduction in national dependence on fossil fuels, while the shift from fuel dependence to material dependence will generate a new dependence on critical minerals such as lithium. This makes 82% of countries in areas such as electricity and transportation systems face higher trade risks [1]. Lithium reserves are highly concentrated in a few countries. Chile and Australia together make up 74% of global lithium reserves [1]. The global footprint of EVE Energy continues

to expand, with its Hungarian factory serving the European market and its Malaysian factory serving the Asian market. Against the backdrop of supply chain de-risking, its overseas plants' raw material sourcing and market access face the risk of a contraction in trade networks [8].

3.2.2 Price volatility and risk transmission

The price of lithium soared from 2021 to 2022, then declined sharply from 2023 to 2024, affecting the whole industrial chain (Figure 1). The research indicates that the midstream of the Chinese lithium supply chain is a net exporter of risk. The price shocks are transmitted from the midstream to the upstream and then to the downstream, or directly from the midstream to the downstream [7]. As a midstream battery manufacturer, EVE Energy inevitably suffers from upstream price fluctuations transmitted across the industrial chain. According to the annual report, EVE Energy has established the commodity hedging program, listing lithium carbonate as one of the core commodities, with the period-end value amounting to RMB 2.788 billion.

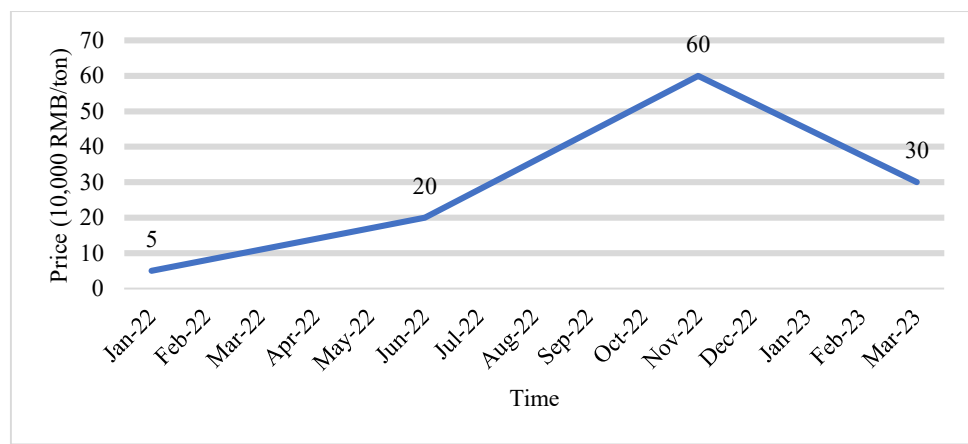


Fig. 1 Lithium carbonate price trend (10,000 RMB / ton) (2022–2023)

3.2.3 Supplier concentration risk

According to the 2025 annual report from EVE Energy, the procurement of the top five suppliers accounts for 35% of total procurement. This concentration of global lithium resources leads to the restriction of firms' bargaining power and exposes the firms to the risk of supply disruptions [3]. The research indicates that the resilience of the lithium supply chain cannot return to balance in a short time when faced with long-term disruptions [5]. This means that if supply disruptions are caused by environmental inspections, labor strikes, or political factors, it will make it difficult for EVE Energy to find alternative lithium resources, and then it will cause production line stoppages due to material shortages. The over-concentration of suppliers and the corporate dependence on imported resources contribute to a dual concentration, which weakens

the firms' bargaining power [4,7]. When market demand exceeds supply, firms have to accept premium prices and unreasonable conditions, and even need to face the risk of supply disruptions. Further studies indicate that the lithium supply chain has poor resilience to long-term supply disruptions, and the entire system takes an extremely long time to return to balance [9]. As a result, this phenomenon causes incalculable economic losses.

4. Risk Mitigation Strategies

4.1 Procurement Channel Diversification to Break Resource Lock-in

Constructing a diversified procurement network is a key to addressing the risk of supplier concentration.

Firms can explore the new lithium suppliers from other countries, such as the DRC, Mali, and Brazil. These high-potential countries can help firms reduce their traditional dependence on Australian spodumene and South American salt lakes. As a result, firms can reduce the impact of geopolitical risk [10]. When firms decide to explore a new country as a lithium source country, they should primarily consider those that have well-developed infrastructure, efficient transportation networks, and political and social stability.

Deepening Long-Term Collaboration and Equity Investment: Building on existing long-term purchase agreements, the company should increase its equity investment in high-quality upstream mineral firms, including through equity participation or offtake agreements [9]. Increasing capital involvement can create a mutual lock-in effect, boosting mutual interdependence and deep collaboration, thereby reducing the risk of unilateral supply disruptions from resource suppliers and ultimately enhancing supply chain stability.

Expanding the supplier channels actively: When the main suppliers are facing the risk of supply disruption, firms can rapidly use alternative suppliers, which reduces the risk of over-dependence on a single supplier [8].

4.2 Coordinated Optimization of Inventory Management and Financial Hedging

Establish strategic safety stock: Studies indicate that reserve adjustment mainly addresses short-term fluctuations, but cannot eliminate long-term price risks [5]. For this purpose, applying big data forecasting models can accurately analyze the fluctuation range and cycle of lithium prices. EVE Energy can increase raw material procurement as corporate strategic reserves when lithium prices are at historically low levels. Moreover, applying reserves to buffer against upward price pressure and supply-disruption risks helps mitigate the negative impact of cyclical fluctuations in procurement costs on the company.

Enhancing the strategy of hedging: the Chinese midstream lithium supply chain is the main net exporter of risk. The price shocks are transmitted from the midstream to the upstream and downstream. This fact has been proved by research [7]. Consequently, it is a viable method for EVE Energy to expand the range of raw materials covered by its existing commodity hedging program, such as lithium hydroxide. Establish a hedging decision-making and risk control system suited to the market, and enhance the control of futures trading volume to ensure the trading volume is not more than the actual production demand of the firm, and avoid speculative action. At the same time, track the market signals to lock in the raw material cost.

Promote technology substitution and recycling: In the long term, reducing complete dependence on primary lith-

ium resources is a fundamental method to address price risks. Greim et al. indicated that developing substitute technologies such as sodium-ion batteries and establishing an efficient recycling system are key strategies to alleviate lithium resource constraints [2]. Almellem et al. compared circular strategies across the upstream and downstream segments of the supply chain and found that upstream strategies, such as sustainable procurement and circular design, have greater potential than downstream strategies for long-term sustainability [9]. Therefore, EVE Energy should boost R&D investment in low-resource-dependency technologies, such as sodium-ion batteries, and simultaneously accelerate the construction of a lithium battery recycling network. Reduce dependence on primary lithium resources by recycling lithium-rich spent lithium batteries, electronic waste, and industrial by-products [8].

4.3 Enhancing Global Operational Compliance and Local Integration

Considering that the lithium supply chain often needs to undertake the two risks of geopolitical and market access risk, it is necessary to enhance resilience in international operations. **Improving supply chain localization:** Under the global production network landscape, international firms face dual risks from policy changes in host countries and trade network contraction [10]. Therefore, factories in Hungary and Malaysia should build localized secondary supplier systems and increase the percentage of local procurement of raw materials and components to meet the rules of origin and carbon footprint requirements in Europe and the United States, and to avoid trade barriers [6]. **Construct an ESG compliance system:** The sustainable development of the lithium supply chain not only depends on resource availability, but is also profoundly influenced by ESG (Environment, Social, and Governance) standards [10]. Firms should proactively meet the highest international ESG standards to ensure compliance with overseas mining development and production processes, reduce non-market risks arising from environmental or labor standards issues, and enhance reputation and market access in the global market [9].

Digital supply chain early warning: Deploy a supply chain risk monitoring system based on artificial intelligence to monitor in real time policy and regulatory changes, logistics bottlenecks, and public sentiment dynamics in major resource-rich countries, thereby achieving the shift from passive response to proactive early warning.

5. Conclusion

5.1 Key Findings

This study analyzes the structural characteristics and risk

sources of EVE Energy's overall supply chain and identifies three core risks: geopolitical risks, price volatility and risk transmission, and excessive supplier concentration. Research indicates that due to the high external dependence of EVE Energy's lithium supply chain, once key nodes are disrupted, it will lead to risks transmitting rapidly along the entire industrial chain.

5.2 Research Implications

This study proposes strategies such as procurement diversification, equity-based supplier binding, backup supplier activation, hedging optimization, and recycling network development based on EVE Energy's raw material costs and the concentration of the top five suppliers. These strategies can help EVE Energy shift from passive risk-bearing to proactive prevention and control. The framework in this paper can be extended to similar midstream battery firms, based on the goals of carbon peaking and carbon neutrality, as well as national resource safety strategies, and can help improve the overall resilience of the lithium supply chain.

5.3 Limitations and Future Research Directions

This study has two main restrictions. The first is that the annual reports and statistics come from secondary data, without being processed through detailed interviews and questionnaires. It is hard to obtain the granular internal decisions from EVE Energy. Moreover, specific firm cases indeed contribute to in-depth analysis. Second, the characteristics and resources of EVE Energy's lithium supply chain are distinctive, which means that some findings may not be applicable to other types of companies; its generalizability needs further examination.

Future research can rely on more highly relevant cases to cover different types of battery manufacturers to strengthen the generalizability of the findings and offer more valuable references for other firms. At the same time, combining interviews with industry questionnaires could yield primary data and reveal firms' true considerations in responding to supply chain risks.

This study is a preliminary exploration of resource dependence theory and supply chain resilience in the key mineral sector, to provide a reference for academic research and industrial practice, and to contribute to the sustainable development and long-term stability of the global lithium supply chain.

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