

Optimization of CATL's Overseas Supply Chain: A European Market Case Study

Qiu Taoyi

China Jiliang University, Hangzhou Zhejiang, China
724430679@qq.com

ABSTRACT

The global new energy vehicle industry has grown rapidly, making the international configuration of power battery supply chains a core competitive factor for enterprises. Judging from the strategies taken by the European market, CATL not only leads the world in supplying power battery, but also promotes the improvement and restructuring of its overseas supply chain in a systematic manner in recent years. Researches show that CATL has effectively strengthened its capability in supply chain operation, risk resilience and sustainable development by establishing local production bases in Europe, setting up a strategic cooperation network with upstream material suppliers and downstream logistics enterprises, and carrying out green manufacturing and digital management solutions. These measures taken by CATL have proven to be useful in achieving breakthrough in its overseas business, reflecting from key indicators including gross profit margin, inventory turnover rate and carbon emission reduction. This case can be seen as an important reference for the supply chain strategic planning of Chinese enterprises in internationalization.

Keywords: CATL; European Market; Supply Chain Optimization

1. INTRODUCTION

Driven by the global carbon neutrality goal, the electric vehicle industry has embarked on a fast track of growth. As a major global automotive industrial base, Europe is increasing its reliance on electricity. Statistics from the European Automobile Manufacturers Association shows that the proportion of new energy vehicle sales in total car sales in Europe exceeded 20% in 2023 and continues to increase. Power batteries serve as the core component of electric vehicles. The production rhythm and cost structure of vehicle manufacturers will be affected by the stability, sustainability and operational capacity of the supply chain. Founded in 2011, CATL has long ranked the world's first amount in power battery installation volume. Since 2019, it has introduced an upgrading strategy of Europe-led overseas supply chain.

2. LITERATURE REVIEW

Existing studies have found that against the macro backdrop of rising global new energy vehicle penetration, it has become an industry consensus for Chinese power battery enterprises to restructure the global value chain through technology export and overseas factory construction. By deepening cooperation with international giants such as Hyundai Motor on CTP cell-to-pack technology, CATL has initially accelerated its global layout ^[1]. Boasting aggressive electrification transformation policies and a sophisticated automotive industrial system, Europe has become a key competitive battlefield for Chinese-funded battery manufacturers ^[2]. Although Chinese new energy enterprises face shortcomings in brand premium and lacks support from the international financial system ^[3], CATL, amid fluctuations in capacity utilization, has set a new model for advancing overseas expansion through an asset-light approach ^[4]. When addressing the challenges of internationalization, CATL's steadily improving profitability and development capabilities provide endogenous driving force ^[5]. With its dual listing strategy anchoring the next-stage development focusing on the European market ^[6], the company has achieved substantive leaps in its overseas business ^[7].

Taking the social responsibility into consideration, CATL has built a green industrial ecological chain with in-depth synergistic effects ^[8]. The company's localized resource allocation and low-carbon manufacturing processes promote the optimization of the cost structure of the battery supply chain ^[9], the benefit distribution mechanism underpins the supply chain stability ^[10], and the integrated service model effectively supports the in-depth international development of the industry ^[11].

The maturity of ESG development acts as a core intermediary regulator between supply chain integration and consumer market upgrading, and strengthens brand recognition in the terminal market ^[12]. Amid the increasingly complex external risks, the dynamic impact of lithium resource supply disruptions on all links of the industrial chain, CATL's modern supply chain management has shifted from simple cost optimization to a multi-dimensional governance system covering social responsibility, contractual trust, ecological integration and risk resilience. The CATL's transition towards digital transformation in financial management and business processes provides accurate data-based decision support and transparent resource allocation capabilities for the enterprise to address uncertainties in the international supply chain ^[13].

The overseas expansion of power battery enterprises has evolved into a complex process shaped jointly by management reshaping driven by digital transformation and compliance upgrading under green manufacturing standards instead of the simple geological transfer of production plants. This enables enterprises to better observe the strict requirements for sustainable development of mature markets such as Europe. Through the in-depth integration of data flow and low-carbon production, they can steadily consolidate their positions in the global value chain.

3. THE SUPPLY CHAIN STATUS OF CATL BEFORE OPTIMIZATION

Before 2021, CATL adopted a relatively traditional supply chain model in the European market. It mostly relied on production in China followed by export to Europe. The procurement of upstream raw materials such as lithium, cobalt and nickel mainly depended on domestic and global suppliers, with only limited cooperation with local European material enterprises. The production of mid-stream cells and battery packs was concentrated in domestic bases in Fujian, Jiangsu, Sichuan and other regions. Finished products were transported to Europe by sea freight or China Railway Express. The local European agents or customer pick-up will be responsible for downstream distribution and after-sales services without systematic green logistics solutions being established, which causes three major problems:

3.1 Supply chain facing high logistics costs and long cycle

The overall delivery cycle will exceed 60 days including customs clearance, inland transportation and 35-45 days of exporting goods to key European ports by sea freight. As hazardous goods, batteries will bring higher warehousing and transportation costs compared with those of ordinary commodities. In addition, the battery product quality will be potentially exposed to changes in temperature and humidity, vibration and other factors during maritime transportation. The CATL's public data shows that the average delivery cycle to European customers stood at 60 to 70 days in 2021, far exceeding the customer expectation of within 30 days. In the event of order adjustments or technical revisions, the company faced great difficulties in flexible response and arrangement.

3.2 High carbon footprint and restrained by green trade barriers

Following the official implementation of the EU's New Battery Regulation, power batteries sold in the European market have been required to declare their carbon footprint starting from 2024, with maximum carbon footprint limits to be set in 2026. Due to long-distance cross-border transportation and the relatively high carbon emission intensity of China's power grid, Chinese exported batteries generally have a larger carbon footprint than that of the local European counterparts. In 2021, the average carbon footprint of CATL's batteries exported to Europe was already close to the procurement threshold set by some European clients. If following the original export model, CATL could hardly fully demonstrate its low-carbon advantages in European production links and was confronted with market access risks. Meanwhile, the EU will ponder over imposing additional tariffs on Chinese new energy vehicles, which casts uncertainty over the prospect of assembling complete vehicles with Chinese exported batteries.

3.3 Insufficient customer response capability

Automakers including BMW, Daimler and Volkswagen require suppliers to deliver rapid response and achieve JIT (Just-In-Time) delivery. However, long-distance transportation made it difficult for CATL to flexibly cope with fluctuations in customer orders. Emergency orders often relied on air freight, resulting in a sharp rise in costs. After customers put forward demands for cell specification changes, CATL had to complete sample production and testing in China before shipping the samples to Europe for customer verification. The whole process usually took three to four months, failing to meet customers' fast-paced product iteration and development needs. As early as around 2016, Korean enterprises such as LG Energy Solution, Samsung SDI and SK On had already conducted production in Europe. If CATL continued to rely on the export model, it would struggle to maintain a leading position amid intensifying competition in the European market.

Prior to strategic adjustment, CATL encountered headwinds in the European market, ranging from high logistics costs, prolonged delivery cycles, excessive carbon footprints, lagging customer response, mounting compliance pressure to prominent disadvantages according to the analysis. These challenges jointly prompted CATL to advance the upgrading of its European supply chain.

4. OPTIMIZATION PRACTICES OF CATL'S SUPPLY CHAIN

Those difficulties drive CATL to make all-out efforts for the upgrading of its European supply chain since 2019. Its optimization practices cover multiple dimensions, including upstream raw material procurement, midstream production and manufacturing, downstream logistics and distribution, as well as the upgrading of management methods, forming a relatively complete supply chain restructuring system.

4.1 Strategic Cooperation with BASF in the Upstream

The chemical enterprise of BASF Societas Europaea boasts sophisticated technology in cathode material and robust production capabilities, with manufacturing bases spread across European countries. After the announcement of strategic alliance in September 2021, BASF supplies high-performance cathode active materials to CATL's European plants, and the two parties work together for the development of eco-friendly battery materials to lower reliance on scarce metals such as cobalt. The material recycling and closed-loop solutions have been provided by the BASF to support CATL in achieving the circular utilization of battery materials.

4.2 Construction of Three Major European Battery Plants in the Midstream

CATL has planned and constructed three battery manufacturing plants across Europe, forming a localized production network covering Central and Southern Europe (Table 1).

Table 1. Basic information of CATL's Operating, Under-construction and Planned Battery Projects in Europe

Factory Location	Announcement Date	Commissioning Date	Investment Amount	Planned Capacity	Main features
Thuringia, Germany	2019	January 2023	1.8 billion euros	14GWh	First European plant, serving the three major German automakers
Debrecen, Hungary	August 2022	Under construction	7.34 billion euros	100GWh	Europe's largest single battery plant
Zaragoza, Spain	December 2024	Under planning	4.1 billion euros	To be announced	Joint Venture with Stellantis, focusing on LFP Batteries

Data Source: CATL's official announcements and public reports

Acting as the primary supplier of battery cells and packs for BMW, Volkswagen and Daimler, Thuringia boasts the first cell manufacturing plant built by CATL in Europe. Adopting the Flexible Manufacturing System (FMS), the plant enables rapid adjustments in production line via computers to meet the manufacturing needs of diversified battery models. Rooftop solar installations supply clean electricity for on-site operations, and a dedicated NMP recycling system has also been put into service. CATL's Debrecen plant in Hungary is its most large-scale investment project in Europe, targeting clients such as Mercedes-Benz, BMW and Stellantis by supplying LFP and ternary batteries. Situated in proximity to key European automotive clusters, the facility keeps its regional logistics radius within 300 kilometres to boost delivery efficiency. The joint venture plant in Spain marks in-depth cooperation between CATL and European vehicle manufacturers. It not only ensures consistent battery supply for Stellantis, but also cuts CATL's independent investment risks faced by CATL.

4.3 Construction of Downstream Green Logistics System

The two parties expanded their collaboration to include electric vessels, commercial vehicles, warehousing and logistics for digital transformation and green and low-carbon development in 2024. CMA-CGM offers low-carbon shipping for CATL by transporting raw materials and finished goods with vessels fueled by bio-fuels or LNG-powered vessels. DHL has been designated as its preferred logistics service provider in 2025 as the result of its logistics network. A set of green logistics solutions have been introduced by virtue of DHL's global network of New Energy Vehicle Excellence Centers. The adoption of electric and hydrogen-powered trucks for land transportation will be used to optimize delivery routes and reduce empty mileage. A local spare parts warehousing network has been established across Europe, greatly accelerating after-sales response.

4.4 Digital and Intelligent Empowerment

As for the operation of European factories, the digital management has been rolled out by the CATL. The MES system monitors production energy consumption in real time and optimizes process parameters. The AI forecasting system predicts customer demand and automatically adjusts inventory levels and production schedules on the basis of historical orders and market data. Meanwhile, the IoT logistics platform tracks the location and status of in-transit materials in real time, with automatic early warnings and replenishment triggers for abnormal conditions. The above technical measures support the CATL in improving the fulfillment rate of the production schedule for its German plant, thus shortening inventory turnover days.

Across the entire industrial chain, fueled by the industrial chain collaboration, the close ties with upstream suppliers represented by BASF, the tiered layout of three midstream factories, and coordinated development of green logistics at the downstream end, CATL has built a localized supply chain system which is efficient, resilient and environment-friendly in Europe after being empowered by digital technologies.

5. ACHIEVEMENTS OF CATL'S SUPPLY CHAIN OPTIMIZATION

After the supply chain optimization, CATL's tangible outcomes can be judged from four dimensions: business performance, supply chain efficiency, green and low-carbon achievements, as well as strategic risk control.

5.1 Significant Improvement in Operating Performance

An increase from 26.1% in 2022 to 29.65% in 2023 can be seen in gross profit margin of CATL, and the number remained stable in the first half of 2024 due to the launch of the German plant in 2022. The lower logistics costs and its less reliance on air freight and more on sea shipping are conducive for the margin increases. The roles of refined local logistics networks and mitigated tariff burdens have come into play. Localized manufacturing allows the company to circumvent partial import duties. Furthermore, strengthened customer loyalty and intensified strategic cooperation have further sharpened its bargaining edges.

The sales volume of battery systems reached 390 GWh in 2023, representing a year-on-year increase of 134.5% compared with that of 2022 after the launch of the German plant; the production volume stood at 389 GWh, up 119.6% year-on-year, and the production capacity rose by 141.5% from the year earlier. With the release of localized production capacity in Europe, CATL has witnessed enhancement in overall delivery capability, while its capacity utilization rate has remained at a relatively high level.

5.2 Supply Chain Efficiency Optimization

CATL's localized production in Europe has yielded notable results in supply chain capacity. The refined supply chain has registered substantial improvements in delivery lead time, inventory turnover, emergency order handling and customer satisfaction. As disclosed in CATL's official report, the company's overall inventory turnover days have stayed steady at approximately 90 days. Following the release of localized production capacity in Europe, inventory turnover efficiency has been greatly improved thanks to shorter transportation distances and more flexible production scheduling. The proportion of air freight for emergency orders has dropped substantially, demonstrating that local production capacity delivers stronger flexible response capability. It enables replenishment via land transportation rather than costly air freight to meet customers' sudden demands. The overall improvement in supply chain efficiency has exerted a positive impact on customer experience.

5.3 Green and Low-carbon Achievements

As shown in Table 2, the German plant runs entirely on renewable energy. Meanwhile, the electrification of on-site logistics and full waste recycling have led to the reduction of the carbon emissions per Wh of battery production, which remains far below those of exported products from China. In addition, as disclosed by CATL at COP30, nine zero-carbon battery plants have been set up globally. At present, zero-carbon energy accounts for 75% of its overall power consumption, while the carbon emission intensity per unit product has fallen by 21% compared with that of the baseline year.

Table 2. Progress in Environmental Performance Between 2022 and 2023

Indicators	Rate of Change
Total photovoltaic power generation	↑ 313.36%
Greenhouse Gas Emission Intensity	↓ 28.06%
Total Scope 1 plus Scope 2 Emissions	↓ 34.99%
Number of carbon emission reduction projects	↑ 38.33%
Proportion of zero-carbon power consumption	↑ 28.71%

Data source: CATL ESG Report.

5.4 Value in Strategic and Risk Management

CATL's local production capacity in Europe has bolstered its resilience against external shocks including the Red Sea crisis and China-EU trade frictions when it comes to strategy and risk management. Despite encountering the suspension of Red Sea shipping routes at the end of 2023, CATL's European factories also stabilized supply, while rival manufacturers relying on exports from China suffered widespread delivery disruptions. Meanwhile, proactive steps have been taken by CATL to comply with the carbon footprint requirements stipulated in the EU New Battery Regulation, averting potential compliance expenses and market access restrictions in the future. CATL has evolved from a pure component supplier into a key strategic partner through research and development projects and joint ventures with BMW, Mercedes-Benz, Stellantis and other major automakers.

6. CONCLUSION

Taking the European market as its starting point, CATL has advanced the optimization of its overseas supply chain, providing valuable experience for Chinese manufacturing enterprises pursuing the "Going Global" strategy. To address the predicaments of the original export-oriented model, CATL has restructured its European supply chain through localized factory construction, strategic cooperation, green manufacturing and digital management. After optimization, it has achieved remarkable results in operational efficiency, supply chain resilience, low-carbon development and customer service. CATL's practice indicates that the transition towards localized production, green development, digitization, and smart technologies of supply chains serve as an effective way for international enterprises to cope with challenges in overseas markets.

REFERENCES

- [1] Lin W. CATL Steps Up Global Business Layout [J]. *New Energy Science and Technology*, 2022(12): 17-18.
- [2] Xueqin Z. CATL "Using Europe as a Gateway" with Global Ambitions [J]. *Auto Review*, 2023(10): 57-60.
- [3] Ke L. Research on the Strategies of Chinese Enterprises in Expanding the Overseas New Energy Market——Based on SWOT Analysis [J]. *China Collective Economy*, 2024(1): 13-16.

- [4] Chi G. CATL Steps Up: Partners with Tesla to Develop Ultra-Fast Charging Batteries, Boosts Global Expansion via Licensing Model [J]. *Automobile & Parts*, 2024(7): 44-45.
- [5] Wanyu X. Research on the Internationalization Path of the Power Battery Industry——Taking CATL as an Example [J]. *Marketing Management Review*, 2025(12): 46-48.
- [6] Chi G. Set to Become the World's Largest IPO of 2025, CATL Sets Sights on Europe for Its Next Move [J]. *Automobile & Parts*, 2025(10): 42-43.
- [7] Chaoge N. CATL to Deeply Integrate into Global Capital Markets [J]. *China Economic Weekly*, 2025(10): 68-69.
- [8] Qian J, et al. CATL: relying on strategic corporate social responsibility to build a sustainable industry chain[M]//SAGE Business Cases Originals. London: SAGE Publications, 2024.
- [9] Shixuan X. Study of battery supply chain optimization resource localization and green manufacturing processes within the emerging electric vehicle industry in the mountainous regions of Southwest China[J]. *Journal of Mountain Science*, 2024.
- [10] Chen J L, et al. Supply chain contracting with asymmetric cost information and behavioral preferences: Theory and experiment[J]. *Omega*, 2024, 122: 102970.
- [11] Xiangxiao D, Fang F, Zhaoyu L, et al. Link through Cooperation, Share the Future via Supply: Build a World-Class Industrial Ecosystem for Power Battery Supply Chain [J]. *China State-owned Enterprise Management*, 2025(S1): 611-613.
- [12] Chen X H Y, Sun N B. The mediating role of ESG development in the relationship between supply chain integration and consumer market upgrading[J]. *Journal of Business and Economic Research*, 2025, 1(6).
- [13] Xu J L, Yu H Y. Case study of digital financial transformation—taking CATL as an example[C]//SHS Web of Conferences. Vol. 208. Paris: EDP Sciences, 2024.