

Research on Supply Chain Development Trends of New Energy Vehicles

--Taking BYD and Tesla as Examples

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Abstract: In the current global environment, supply chain uncertainty has increased, leading to a decline in supply chain stability, and even problems such as partial supply chain breaks, poor information, and rising comprehensive costs. This paper studies the current situation of the new energy vehicle market, selects two typical enterprises in this industry - BYD and Tesla for supply chain analysis, and finds that the supply chain of new energy vehicles faces many risks, such as unstable supply of raw materials and external environmental impacts. After further analysing the risks faced by the supply chain of new energy vehicles, the future development trend of the supply chain of new energy vehicles is proposed, as well as the conclusion that new energy vehicles will develop in the direction of sustainability, diversity and innovation.

Keywords: new energy vehicles, supply chain risk, supply chain development

1. Introduction

With global climate change and environmental protection becoming increasingly serious, new energy vehicles, as an effective means to reduce greenhouse gas emissions and traditional energy dependence, have become an important direction for the development of the global automotive industry. New energy vehicles not only embody the fruits of technological innovation, but also represent an inevitable trend towards a transition to cleaner and more sustainable energy sources. The popularity and development of new energy vehicles cannot be separated from an efficient and reliable supply chain system. However, in the face of increasingly stringent environmental regulations, a changing global environment, and new opportunities and challenges brought about by technological advances, the development of the new energy vehicle supply chain has been characterised by a number of aspects.

Therefore, understanding the development trend of new energy vehicle supply chain not only helps to improve the synergistic efficiency of each link in the industry chain, but also is the key to the sustainable and healthy development of new energy vehicle industry. This study aims to analyse the current situation of the supply chain of new energy vehicles, take BYD and Tesla, the typical enterprises in this field, as an example, to explore the supply chain of the two enterprises, and to analyse the risks existing in the supply chain of the new energy vehicle industry.

Research on the supply chain of new energy vehicles not only helps enterprises to grasp the direction of industry development and optimise the supply chain structure, but also provides policymakers with a basis for decision-making and guides the formulation of policy measures in line with the development trend of the industry. At the same time, it is also a key path for promoting economic transformation and achieving green development, helping to accelerate the transformation of traditional vehicles to new energy vehicles, promoting the transformation of energy consumption from fossil fuels to clean energy, achieving emission reduction targets, and contributing to the fight against global climate change.

2. Literature Review

Influenced by the return of anti-globalisation, the rise of trade protectionism, and the intensification of trade friction between China and the United States, the supply chain of new energy automobiles has been impacted and faces adjustment. At this stage, the new energy automobile supply chain is characterised by vulnerability, unpredictability, and low stability due to high dependence on technology[1]. These characteristics also lead to a certain degree of risk in the new energy vehicle supply chain. Yang Yang et al. assessed the new energy vehicle supply chain based on the SCOR model analysis, and concluded that the five stages of new energy vehicle supply chain risk from high to low are planning, purchasing, production, distribution and return [2]. The new energy vehicle supply chain involves more and wider industries, emphasises responsiveness, and is driven by demand for production [3], and also responds to the need for enterprises to choose the right supply channel. In the area of supply chain risk, Amine Belhadi et al. assess the short- and long-term response strategies used in the automotive and airline supply chains, and suggest that advanced technology and big data analytics can be used to address the corresponding risks[4], Jiang Lining et al. derive the impact of supply chain disruption probability on the strategy of choosing the supply channel through the analysis of expected profit and sensitivity analysis and derive the critical conditions of the channel selection strategy[5].

Based on the above, this paper believes that the new energy vehicle supply chain security has risks, facing adjustment and reconstruction, through the new energy vehicle market status quo, industry leading enterprises supply chain and supply chain risk analysis, the future development trend of the new energy industry to put forward proposals.

2.1. Status of the global supply chain

Supply and demand imbalance, manufacturing downturn. Affected by the COVID-19 epidemic, global bulk raw material prices have risen, and the price of raw materials purchased by the manufacturing industry has risen, resulting in higher manufacturing costs. At the same time, some parts of the global industrial chain and supply chain have been impacted, the supply chain facing the risk of disruption. Supply chain members are unable to exchange information effectively, and the supply side is unable to identify the demand effectively, resulting in an imbalance between supply and demand.

Focus on efficiency and cost savings. Enterprises give priority to suppliers that can guarantee the on-time supply of required products and efficient logistics and transport methods to ensure the completion rate of orders. At the same time, companies tend to open factories where labor or site rental costs are lower to reduce production costs.

When manufacturing efficiencies meet diversity goals supported by consumer awareness and concern, such as democracy, equity, inclusiveness and environmental friendliness, the result will be institutionalised conscious innovation. Through the shared values of its participants, the global economy will self-organise into a fast and decentralised supply chain structure. People from all walks

of life and backgrounds will be able to join in new adventures to forge a new equilibrium - Globalisation 2.0.

3. Current situation of the new energy vehicle market

3.1. Status quo of China's new energy vehicle market

According to the China Association of Passenger Vehicle Dealers, China's new energy vehicle sales in 2022 was approximately 5.674 million units, with monthly sales generally on an upward trend, and new energy vehicle market sales accounting for a relatively stable share of overall passenger vehicle market sales. The monthly retail penetration rate of China's new energy market continues to rise, and the global new energy vehicle penetration rate reached 27.6% in December 2022, up 12.8% year-on-year. China's new energy vehicle market will further expand.

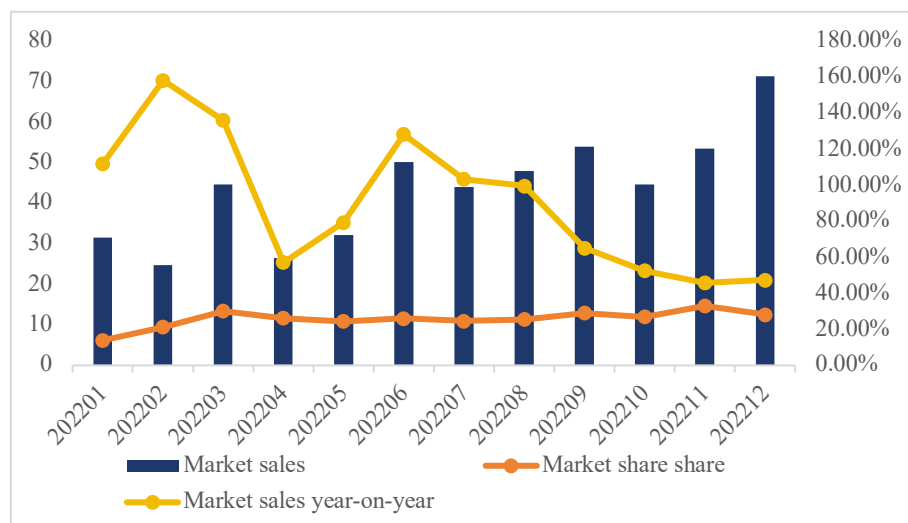


Figure 1: Monthly sales volume of China's new energy vehicles in 2022

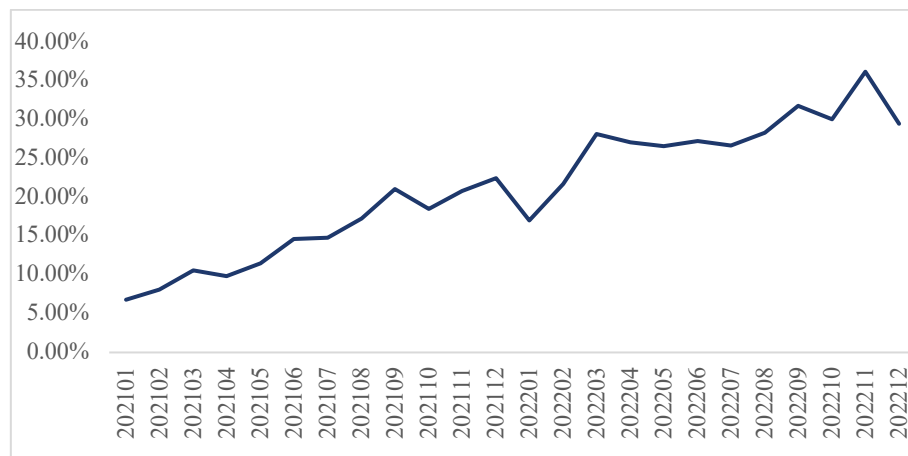


Figure 2: China's new energy vehicle penetration rate by month

3.2. Current situation of the global new energy vehicle market

According to Huatai Securities, in 2022, the sales of new energy vehicles in overseas countries was grow steadily, and global electrification penetration rate was grow steadily, with a good upward trend. In 2022 global new energy vehicle penetration reached 18.05% in December, increase of 6.2%

year-on-year, continuing to hit a record high, and the cumulative penetration rate for the whole year of 2022 was 13.31%, compared with 7.91% in 2021 years, increase of 5.39% year-on-year. 5.39%. Compared to the European and Chinese markets, the penetration rate in the US market still has significant room for growth, so the global development of electrification penetration is still in the stage where it can be improved. EU 27 environment ministers have been through the "2035 European new fuel cars and light commercial vehicles sold zero emission agreement", policy driven, Europe's new energy vehicle penetration rate will continue to improve. Therefore, the outlook for new energy vehicles is good.

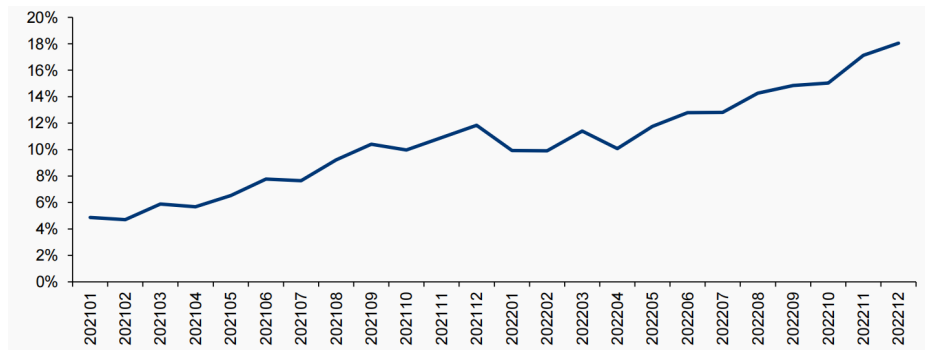


Figure 3: Global electrification penetration[6]

4. Supply chain of new energy vehicle enterprises

4.1. New energy vehicle industry chain

The new energy vehicle industry chain is divided into three parts: upstream, midstream and downstream. The upstream is mainly non-ferrous metals and chemical raw materials, the midstream is the assembly and manufacturing of parts and components, and the downstream is vehicle manufacturing, services and applications.

The upstream of the industry chain is mainly to provide raw materials and components for the assembly and manufacture of midstream components. Firstly, the mined mineral resources such as lithium, cobalt, nickel, aluminium, etc., are processed into chemical raw materials such as lithium carbonate and lithium cobaltate, and then these raw materials are used to make positive electrode, negative electrode, electrolyte, diaphragm and so on. The midstream of the industrial chain mainly include the assembly and manufacturing of core components, such as batteries, motors, electronic controls and related parts. The downstream of the industry chain is mainly divided into two major parts: vehicle manufacturing and automotive services. Among them, automotive services include charging services and after-market services: charging services include charging equipment, power exchange equipment and battery recycling, while after-market services include automotive finance, automotive insurance, automotive leasing, second-hand car trading, automotive repair and maintenance, and automotive dismantling and recycling.

4.2. BYD supply chain analysis

BYD's whole industry chain approach is based on the enterprise's ability to completely control the manufacturing links of the "three electric" system, and to achieve complete control of all links in the whole industry chain within the enterprise. The whole-industry model combines vertical integration and horizontal diversification, and the synergies in this model help firms to organise themselves in a dynamic network through clustering[7]. BYD's core components are self-researching and self-produced and self-supplied, and it adopts a "vertically integrated" supply chain system with high

stability and safety, and the self-sufficiency rate of parts is more than 50 per cent. Only some parts are supplied from outside, but they are also basically made in China, which has a greater cost and technological advantage, and also makes its production chain almost completely closed. Its parts are spread all over the country, the length of the Pearl River Delta and Yangtze River Delta mainly. Assuming that the production base wants to obtain readily available parts, the first thing you need to get to Guangdong, Shanghai-based suppliers of spare parts. Therefore, BYD new energy vehicle ground production, also need to solve the problem of connecting the supply chain logistics system. BYD factory more concentrated mode, the supply chain disruption of the greater impact, even if the high degree of self-supply also need to advance judgement, effective stocking, risk sharing.

4.3. Tesla Supply chain Analysis

Tesla's whole industry chain approach is based on the fact that the company is able to completely control the manufacturing links of the "three electrics" system, acquiring or setting up subsidiaries in some of the links, and controlling the whole industry chain in some of the links by means of strategic alliances, such as entering into co-operation agreements. Tesla is good at supply chain management, adopts self-development of core technologies such as three electrics and open supply chain, and selects upstream parts manufacturers and raw material suppliers, so as to enhance the bargaining power and reduce the cost of supply chain management by strengthening the competition among upstream enterprises. At present, most of Tesla's parts originate from China. The production capacity of Shanghai's super factory is more prominent among Tesla's factories in the world. According to the information previously announced by Tesla in the fourth quarter of 2021 and the full-year financial report, the annual production capacity of Tesla Shanghai factory reached 450,000 units, of which the output in December reached 70,847 units. In the whole year of 2021, the Tesla Shanghai Super Factory achieved an annual delivery of 484,100 units, which accounted for 51.7% of the total delivery volume. Domestic electronics companies have covered the supply chain of Tesla's new energy vehicles in industry chain segments such as central control system, battery management system, autopilot system, lithium battery pack and charging components. The manufacturing of Tesla cars is highly dependent on China's manufacturing industry.

5. Supply chain risks in the new energy industry

5.1. Supply Chain Interruption — Take the Shanghai epidemic as an example

5.1.1. Macro impact

China is the world's factory and the world's market, so a small disruption in China's supply chain could prolong supply chain woes and exacerbate inflationary pressures around the world. Shanghai is the centre of China's economy, the gateway to the Yangtze River Delta's foreign trade, and home to the world's largest container port, accounting for 3.78% of the country's GDP in 2021, one-fifth of China's foreign trade, and 14% of foreign direct investment. The Yangtze River Delta as a whole is in solidarity with Shanghai, and the high development of Shanghai's automotive industry has attracted the gathering of many supporting enterprises. Almost all of the world's top 100 parts and components companies have set up factories in Shanghai and the surrounding areas, and nine of the world's top 10 parts and components groups are headquartered in Shanghai. During the Shanghai epidemic in April 2022, the shutdown of production and logistics stopped, even if the host plant can carry out closed-loop management to maintain production, but by the impact of the zero inventory supply chain system, with the depletion of inventory parts and components, and ultimately will also face a stop peripheral ancillary enterprises are also faced with the plight of the shutdown of production and shutdown. Shanghai epidemic, the impact of the month on the national GDP in about 4 percentage

points. There are 7 percent of the loss from the indirect economic losses caused to other cities. At the same time, Shanghai as the world's largest container throughput port, the port of the "closed-loop" management reduces the short-term foreign exports, more than the international cargo ships are therefore stranded, impact on the global supply chain.

The epidemic for China's automotive industry chain layout to bring long-term impact, in order to avoid re-emergence of the situation caused by the entire industry shutdown, the future of auto parts companies may choose to be more fragmented layout, expanding to other regions, in order to ensure the stability of the industry's development, to enhance the supply chain resilience, reduce the risk of supply chain disruption.

5.1.2. Microscopic effects

5.1.2.1. Tesla Enterprise

Tesla Shanghai SuperWorks occupies an important capacity position in Tesla's corporate production. Tesla's Shanghai SuperWorks is responsible for the production of two main models, Model 3 and Model Y, with a weekly production capacity of around 17,000 units. As a result of the Shanghai epidemic, the factory was shut down for a total of 22 days. According to Tesla's daily production of about 2,500 units, the production loss caused by the epidemic is about 55,000 units. It not only puts huge pressure on the capacity of Tesla's other old factories, but also reduces the trust of international companies in China's supply chain.

5.1.2.2. Other enterprises

Parts shipments from China have been delayed by sea and air due to the shutdown of suppliers' factories. Mazda stopped operations at its headquarters plant and Hofu plant on 14 and 15 April, and Mitsubishi Motors shut down production lines at its main Okazaki Works from 11 to 15. Apple's main supplier, Taiwan's PEGATRON United Technologies, stopped work at its 2 factories in Shanghai and Kunshan, Jiangsu Province, leading to a decline in Apple's performance and delays in product deliveries. Impact on the global shipping industry: international cargo ships were stranded, seriously damaging trucking services, increasing transport costs and reducing transport efficiency.

5.2. External shocks

In September 2022, the United States Inflation Reduction Act became legislation. The proposed law will provide up to \$369 billion in subsidies to support the production of and investment in electric vehicles, key minerals, clean energy and power generation facilities, and automakers will be able to offer a \$7,500 tax credit for the purchase of a new "clean car", provided the car is manufactured and sold in the United States or North America. The essence of the bill is to sanction non-allied producers, promote the return of manufacturing to the United States and controlled areas around it, and firmly grasp the advantages of home-grown technology and the important technology of batteries and motors in their hands.

By the above Tesla, BYD supply chain analysis can be seen, the vast majority of new energy vehicle manufacturing industry is located in China, China in the new energy automobile parts and components manufacturing has an absolute advantage and a strong foundation, the core of the bill is the competition and confrontation between the United States and China, the Chinese side of the chip self-sufficiency is only 15%, mainly dependent on foreign imports. In the United States, Ningde Times is in a monopoly position in the manufacturing of new energy batteries, and Taiwan PEGATRON United Technologies is the main supplier of Apple. China and the United States in the manufacturing industry interdependent, in the future the relevant manufacturing industry can not be

completely withdrawn from China within a short period of time, and will not completely abandon the Chinese market, but for supply chain risk considerations, there will be a trend of some manufacturers to withdraw from China, looking for other backups, the future of the global supply chain will show a diversified development trend.

6. Conclusion

Sustainability, diversity and innovation will complement each other in the new energy vehicle supply chain in the future.

The future is not de-globalisation, but the era of Globalisation 2.0, and there will be no end to global co-operation between businesses and people. A sustainable global supply chain is important for the development of the manufacturing industry and promotes the stable and harmonious development of the world economy.

China, as an important part of the new energy vehicle supply chain, has been affected by the COVID-19 and external shocks, the world's credibility value of China's supply chain has been reduced, while various manufacturers are paying more attention to the stability of the supply chain, therefore, part of the manufacturing industry will show a tendency to pull out of China, so as to improve the ability to cope with the supply chain risks and enhance the resilience of the supply chain. The factories that move out of China will build factories in other regions, driving manufacturing in emerging regions and building a diverse supply chain.

Global supply chains are facing reorganisation, requiring businesses and people to collaborate and innovate to create new global supply chains. In a future where the focus is no longer only on efficiency and cost, but where businesses start to consider risks and opportunities, many previously unseen supply chain models will emerge to address supply chain risks.

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