

Research on the Resilience and Safety of the Industrial Chain of New Energy Vehicles in China

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Abstract

With the increasing global attention to environmental protection, new energy vehicles have gradually become the main force for governments to promote. The new energy vehicle industry chain in China has rapidly developed under policy support and achieved significant achievements. However, in the face of unpredictable risks such as natural disasters, market fluctuations, and technological changes, the resilience and safety of the new energy vehicle industry chain face enormous challenges. The resilience and safety issues of the new energy vehicle industry chain have also become the biggest bottleneck restricting the large-scale development of this industry in our country. This article comprehensively analyzes the current situation and problems of the resilience and safety of China's new energy vehicle industry chain, and proposes relevant countermeasures to provide valuable references for the healthy development of China's new energy vehicle industry.

Keywords

New energy vehicles; Industrial chain; Risk and prevention.

1. Introduction

With the increasing global energy crisis and climate change, new energy vehicles have become one of the development directions of the global automotive industry as the main means to solve energy and environmental protection problems and promote industrial upgrading and transformation. As an emerging automotive power, China has made significant progress in this field and became the second largest exporter of new energy vehicles in 2022. However, various developed countries are also deploying green industries in succession, such as the US Inflation Reduction Act and the EU Green New Deal Industrial Plan, which are aimed at encouraging the supply chain of new energy vehicle manufacturing to transfer to their home countries. In October 2022, in the report of the 20th National Congress of the Communist Party of China, Xi Jinping emphasized that "efforts should be made to improve the resilience and security level of the industrial chain supply chain." The resilience and security issues of the industrial chain and supply chain have been raised to unprecedented heights. The new energy vehicle industry chain covers a wide range of industries and products, and has the characteristics of high technological content, high production costs, and unstable market demand. The resilience and safety of the new energy vehicle industry chain and supply chain are of great research value.

New energy vehicles, as one of the important directions to replace traditional fuel vehicles, have received widespread global attention in recent years. According to data released by the New Energy Vehicle Chamber of Commerce of the All China Federation of Industry and Commerce, the global production and sales of new energy vehicles in 2019 were 2.6744 million and 2.726 million, respectively. Among them, China's production and sales of new energy vehicles were 975400 and 1.0228 million, ranking first in the world. It can be said that China has become one

of the leaders in the global field of new energy vehicles. However, the resilience and safety issues of the new energy vehicle industry chain have always been important issues that plague the development of China's new energy vehicle industry. The new energy vehicle industry chain covers a wide range of industries and products, and has the characteristics of high technological content, high production costs, and unstable market demand. The resilience and safety of the new energy vehicle industry chain have very important research value.

This study explores the key technologies to ensure the resilience and safety of China's new energy vehicle industry chain, which has significant theoretical value and practical significance for effectively enhancing the resilience and safety level of China's industry chain and promoting high-quality development.

2. Literature Review

2.1. Relevant research on the development status of the new energy vehicle industry

Scholars have conducted extensive research on issues related to quality and safety, technological bottlenecks, marketing, and policy support in the new energy vehicle industry. Li Kesong (2012) conducted a comprehensive analysis of the structure of China's new energy vehicle industry chain using the method of normative analysis, pointing out that there is a significant gap between China's new energy vehicle industry chain and foreign countries, with key components being the core of the gap [1]. At the same time, he recognized that improving the construction of a healthy new energy vehicle industry chain is the foundation for achieving an automobile power. Luo Zhenli (2010) focused on the development of the lithium battery industry in China's new energy vehicle industry chain [2]. He analyzed the innovative development of the lithium battery industry from the perspectives of horizontal production, academia, and research, vertical specialization, and policy dimensions. He proposed that the innovative research and development of the lithium battery industry is a key link in the integration of the new energy vehicle industry chain.

2.2. Research on the resilience and security of the industrial chain

The academic community has extensively discussed the resilience and security of the industrial chain, focusing on its connotation and segmentation dimensions. Regarding the connotation of resilience and security in the industrial chain, firstly, starting from the network structure characteristics possessed by the industrial chain, it is proposed that ensuring the security of the industrial chain requires both the security of the "subject" and the security of the "structure" (Li Tianjian and Zhao Xuejun, 2022) [3]. Among them, the security of the "subject" refers to the security of nodes in the industrial chain, including enterprises, countries or regions, etc. The safety of "structure" emphasizes the safety and stability of the relationships between nodes, including the input-output relationship between upstream and downstream, as well as the layout correlation in spatial attributes. The second is to point out the security of the industrial chain from a capability perspective, emphasizing that a country has risk prevention and control capabilities and international competitiveness in key links of the industrial chain (Zhang Yibo, 2021; Sheng Chaoxun, 2021) [4]. Further, domestic and foreign research, combined with the current practical problems facing the global industrial chain and China's actual development, focuses on the import diversification of intermediate products (Elliott et al., 2022) [5], import dependence (Daniel Chan and Yang Xiaoxia, 2022) [6], key core technologies The lack of raw materials and parts (Wang Xiaohong and Guo Xia, 2020; Li Wei and He Jun, 2022) [7] and value creation ability (Daniel Chan and Yang Xiaoxia, 2021) [8] and other dimensions have studied the resilience and safety of the industrial chain, which provides a useful theoretical basis for the safety assessment of the industrial chain in this paper.

Although previous research has provided us with important references, most of the existing research focuses on individual links or issues in the industrial chain, lacking global and systematic coherence.

3. Development Status of the New Energy Vehicle Industry Chain

At present, the development of China's new energy vehicle industry chain has begun to take shape and has formed a certain industrial pattern.

3.1. The scale and technological level of the battery industry are ahead of other countries in the world

The scale of China's battery industry has surpassed that of Japan and South Korea, and has now become the world's largest battery market. In addition, China's battery technology is also in the leading position in the world, including lithium iron phosphate battery, ternary battery, lithium titanate battery and other types of batteries.

3.2. The scale and technical level of the motor and controller industry need to be improved

Compared to the battery industry, the scale and technological level of China's motor and controller industry still need to be improved. At present, the market share and technological level cannot rival internationally renowned brands.

3.3. Slow progress in the construction and promotion of charging facilities

As a "gas station" for new energy vehicles, the construction and promotion of charging facilities are important guarantees for the popularization of new energy vehicles. However, due to various factors such as technological limitations and market size, the construction and promotion of charging facilities in China have been slow, which has had a certain impact on the development of the new energy vehicle market.

4. Resilience Issues in the New Energy Vehicle Industry Chain

In the development process of the new energy vehicle industry chain, resilience issues are mainly manifested in the following aspects:

4.1. Supply chain risk

The impact of supply chain risks on the new energy vehicle industry chain is particularly significant. The core components of new energy vehicles, such as motors and batteries, rely on the supply of suppliers. However, problems such as supplier bankruptcy, insufficient distribution, and delayed supply often occur, leading to the stagnation of production in new energy vehicle enterprises, thereby affecting the overall resilience of the industrial chain.

4.2. Safety risks

During the use of new energy vehicles, safety accidents such as fires and explosions are prone to occur due to various factors such as high temperature, high pressure, and chemical substances in power batteries. And all accidents will seriously affect consumers' trust and willingness to purchase new energy vehicles, thereby affecting the overall stability of the industrial chain.

4.3. Policy risks

The development of the new energy vehicle industry chain is also affected by policy risks. With the changes in policies, various factors, including subsidy policies, license plate policies,

restriction policies, etc., will affect the operation of new energy vehicle enterprises, leading to difficulties for enterprises in the industrial chain, and even closure and bankruptcy.

4.4. Market risk

The resilience of the new energy vehicle industry chain is also susceptible to market risks. The high price of new energy vehicle models, short range, and insufficient charging facilities are all manifestations of market risks. These factors may lead to a decrease in consumer willingness to purchase cars, causing enterprises in the industry chain to be unable to achieve large-scale production, thereby affecting the development of the new energy vehicle industry.

5. Safety Issues in the New Energy Vehicle Industry Chain

The safety issue of the new energy vehicle industry chain is a major obstacle to the sustainable development of the new energy vehicle industry. Including the following aspects:

5.1. Battery safety issues

The battery system is an important component of new energy vehicles, but the battery itself has significant safety issues. On the one hand, because batteries release a large amount of heat during the energy storage process, once the battery loses control, it may lead to major accidents such as fires and explosions. On the other hand, due to the hazardous characteristics of batteries such as high toxicity and corrosion, it is necessary to strengthen the safety control of batteries during production and use.

5.2. Automotive network security issues

With the continuous integration of new energy vehicles and information technology, the issue of automotive network security is also increasingly attracting people's attention. New energy vehicles are based on energy batteries and electric drive technology, and their safety and stability are directly related to the driving safety of the vehicle and the personal information security of passengers. If attacked by a network, it not only affects driving safety, but also may leak sensitive data such as user personal information.

5.3. Safety issues with charging facilities

The safety of charging facilities is an important guarantee for the sustainable development of new energy vehicles, but currently the safety management of charging facilities is relatively loose. Charging facilities may experience accidents such as fires and explosions during use, and key standardization and safety regulations need to be further strengthened.

6. Suggestions

6.1. The government implements precise policies and increases support efforts

The new energy vehicle industry has the characteristics of wide industry coverage and strong correlation between industries, which makes top-level design play an important role in industrial development. Doing well in top-level design is the foundation for promoting industrial development. At the government level, only by accurately aligning and implementing policies based on the actual situation, and increasing support for the industry, can the effective implementation of top-level design be achieved.

Firstly, the government should establish a regulatory system that can ensure the effective implementation of policies and the safety of production process results, strengthen the punishment of illegal behaviors, and guide enterprises to operate with integrity and comply with production, thereby improving the overall level of production safety.

Secondly, the government should analyze the development trend of the international and domestic new energy vehicle industry, and based on this, formulate an overall strategic plan for the national new energy vehicle industry, considering and operating the orderly promotion and coordinated development of various links in the new energy vehicle industry chain under the overall planning. At the same time, in the process of policy implementation, it is necessary to learn to pay real-time attention to the development status of the new energy vehicle industry, adjust the implementation path of policies in a timely manner, so as to achieve differentiated and precise policy implementation. For example, the central government regularly conducts policy fine-tuning or the central government determines unified standards but gives local governments some autonomy to adjust according to local conditions.

Thirdly, in the process of formulating relevant policies, the government should not only solicit the opinions of relevant stakeholders in the new energy vehicle industry, but also widely collect and carefully listen to the opinions of relevant scholars and experts in the new energy vehicle industry, and more importantly, the open platform should widely listen to the opinions of consumers and the public. Only when opinions have the characteristics of universality and diversity can the targeted and effective policies be guaranteed to a certain extent, thus providing good political support for the development of the new energy vehicle industry.

Fourthly, the government's policy of increasing support should include multifaceted policy support. In addition to necessary financial and tax policy support, it should also focus on taking multiple other effective measures to popularize the consumption concept of new energy vehicles for consumers at the social level, gradually dispel consumers' concerns and concerns about new energy vehicles, and gradually change consumers' traditional preferences and optimize consumption structure, Create a good social atmosphere that adapts to the development of the new energy vehicle industry. At the same time, effective measures can be implemented to enhance the environmental protection and energy-saving awareness of the entire society, fundamentally improving consumers' acceptance of the new energy vehicle industry.

6.2. Adhere to talent introduction and reserve high-quality resources

The healthy development of all aspects of the new energy vehicle industry, whether it is the provision of upstream raw materials and components, the collection of midstream vehicle equipment, or downstream sales and after-sales services, cannot be separated from excellent talents with professional technical capabilities. Only with sufficient high skilled talent resources within the industry can breakthroughs in key technological fields be achieved, thereby fundamentally optimizing the new energy vehicle industry chain and improving international competitiveness. Only with sufficient excellent management talents can the overall operating mechanism of the industry be improved and smoothly implemented to ensure the sustainable and healthy development of the industry.

The new energy vehicle industry should pay attention to the introduction of different types of talents, especially high-tech talents who are expected to break through key core technical barriers. In the process of talent introduction, we should actively draw on advanced talent cultivation concepts at the international level, provide a competitive work environment and salary conditions for the introduction of excellent talents within the industry, and give special preferential treatment to special talents, Attract high-end and leading talents from the field of new energy vehicles from abroad to China and form an excellent research and development team with excellent domestic experts and scholars to promote breakthroughs in key core technologies. At the same time, we will increase the training efforts for practitioners in the local new energy vehicle industry, practice order cultivation, cooperate with local universities, and encourage them to establish relevant majors for professional talent cultivation, thereby improving the quality of talent.

In the new energy vehicle industry chain, it is necessary to strengthen the organic integration between the industry chain, technology chain, capital chain, and talent chain, pay attention to the cultivation of industrial talents, promote school education and on-the-job training in the new energy vehicle manufacturing industry, and accelerate the cross-border talent cultivation combining informatization and manufacturing, in order to meet the demand for various outstanding talents in the new energy vehicle industry. The introduction of talents also requires a sound legal system foundation. The government should accelerate the improvement of talent introduction and training mechanisms both domestically and internationally, providing political support for the introduction of highly skilled talents.

6.3. Improve infrastructure and optimize downstream chains

An important link downstream of the new energy vehicle industry chain is the provision of supporting infrastructure related to the new energy vehicle industry. The ability to provide comprehensive and high-quality supporting infrastructure is an important influencing factor for consumers to choose different new energy vehicle industries, and also an important reference factor for consumers to decide whether to purchase or not. The range of new energy vehicles mainly adopts two methods: charging and battery swapping, and the convenience of charging is an important factor affecting whether consumers choose new energy vehicles. At present, an important facility issue downstream of the new energy vehicle industry chain is the issue of charging facilities, as inadequate facilities cannot provide sufficient power supply demand.

Firstly, relevant government departments should introduce policies to increase the construction of charging and swapping stations in public areas such as community parking lots and shopping mall parking lots, and accelerate the improvement of series of technical standards such as charging interfaces, in order to improve the convenience of charging and swapping for new energy vehicle owners. At the same time, after the completion of the infrastructure construction of the charging and replacement power station, it is also necessary to strengthen its effective maintenance in the later period, pay attention not to raise the price, and provide a market price with strong adaptability to better promote new energy vehicles in the society.

Secondly, attention should be paid to the construction of supporting infrastructure for the recycling and utilization of waste batteries, reducing the damage caused by replaced batteries to the environment, following the energy-saving and environmental protection trend advocated by the new energy vehicle industry, while protecting the environment, expanding the promotion of the green and environmentally friendly nature of the new energy vehicle industry, and increasing consumer recognition of new energy vehicles.

Thirdly, the development trend of the new energy vehicle industry should be regularly analyzed, and factors such as its internal industrial chain, supply chain, and core key technologies should be evaluated to accurately grasp the core issues of industrial development, establish a comprehensive industrial infrastructure evaluation system, and promote the evaluation and improvement of infrastructure.

6.4. Promote technological innovation and build intelligent networking

We should establish a new energy vehicle industry fund, adjust the research and development investment structure, increase investment in key core technologies, strengthen technology collaboration and resource allocation sharing, and organically combine domestic independent research and development with international circulation to create a good cooperative and open environment for technological innovation and research and development both domestically and internationally, promote the expansion of technological innovation breadth, and effectively improve the level and ability of technological innovation, Utilizing technological innovation to promote intelligent networking, integrating the development paths of automobiles and

communication, and building an intelligent chain for the new energy vehicle industry with comprehensive cooperation in systems, supporting infrastructure, and other aspects. This not only increases the promotion of renewable energy to combine consumer experience with intelligence, but also carries out collaborative research and development projects, thereby further promoting the establishment of an innovative system for intelligent networking of new energy vehicles.

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