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Global Competitiveness of China's New Energy Vehicle Industry: The Dual Role of Production Factors and Market Demand

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Abstract. In recent years, China's new energy automobile industry has risen rapidly and become an important player in the global market. Against the background of the global response to climate change and the promotion of green development, the development of the new energy automobile industry is not only related to China's economic transformation, but also occupies a pivotal position in the global industrial chain. This paper explores the dual impact of production factors and market demand on the global competitiveness of China's new energy automobile industry. By analyzing production factors such as technological innovation, R&D capability, human capital, supply chain efficiency and policy support, this paper describes the competitive advantages of China's new energy automobile industry in terms of technology and production. At the same time, this paper examines the driving role of domestic and international market demand and explores the impact of market demand on the globalization of the industry. Finally, this paper summarizes the achievements of China's new energy automobile industry in global competition, and looks forward to the path and strategy to enhance global competitiveness in the future.

Keywords: China's New Energy Vehicle Industry, Global Competitiveness, Production Factors, Market Demand, Technological Innovation, Supply Chain Management, Policy Support, Market Expansion.

1. Introduction

With the increasing global concern for environmental protection and sustainable development, the new energy vehicle industry has become one of the key areas in which countries are competing for development. As the world's largest automobile market, China has made remarkable progress in the field of new energy vehicles and gradually become an important force in the global market [1]. Through a series of policy support and industrial planning, the Chinese government has promoted the rapid growth of the new energy vehicle industry, which not only dominates the domestic market, but also actively explores the international market [2]. However, with the intensification of global competition, China's new energy vehicle industry is facing challenges of technological upgrading, market expansion and internationalization, and how to enhance global competitiveness has become an urgent issue.

The purpose of this paper is to discuss in depth the formation and enhancement path of the global competitiveness of China's new energy automobile industry, with special attention to the dual role of production factors and market demand [3]. By analyzing how production factors such as technological innovation, human capital, supply chain efficiency, and policy support affect industrial competitiveness, and how domestic and international market demand drives industrial development, this paper will reveal the key factors and strategies to enhance global competitiveness.

This article adopts a combination of qualitative and quantitative research methods, synthesizes literature analysis, case studies and data statistics, and systematically explores the dimensions of global competitiveness of China's new energy automobile industry [4]. The article is structured as follows: the first part analyzes the current situation of the global competitiveness of China's new energy automobile industry, the second part discusses the impact of production factors on global competitiveness, and the third part studies the driving role of market demand [5].

2. Status of Global Competitiveness of China's New Energy Vehicle Industry

Globally, the new energy vehicle industry has become a strategic high ground for competition among countries [6]. With increasingly stringent environmental regulations and growing consumer demand for sustainable transportation, major economies around the world have increased their investment and policy support for new energy vehicles [7]. China, as the world's largest production and consumption market for new energy vehicles, has achieved remarkable development over the past decade. Chinese new energy vehicle companies, such as BYD, Azure and Xiaopeng, have gradually emerged in the international market, and their participation in global competition has been increasing. However, in terms of technological innovation, brand recognition and market share, China's new energy vehicle industry still faces competitive pressure from traditional auto powerhouses such as Europe, the United States and Japan. Battery Energy Density Calculation:

$$E_d = \frac{C \times V}{m} \tag{1}$$

The level of technology is one of the most important indicators of the industry's global competitiveness. In recent years, China's new energy vehicle industry has made great progress in battery technology, intelligent driving systems, and vehicle design [8]. Especially in the field of power batteries, Chinese companies such as Ningde Times have become important players in the global supply chain. However, compared with international leaders, there are still some gaps in key technology areas such as high energy density batteries and advanced intelligent driving systems [9]. In order to gain a foothold in the global market and further enhance their competitiveness, Chinese companies must continue to increase R&D investment and promote technological innovation, showed in Figure 1 :

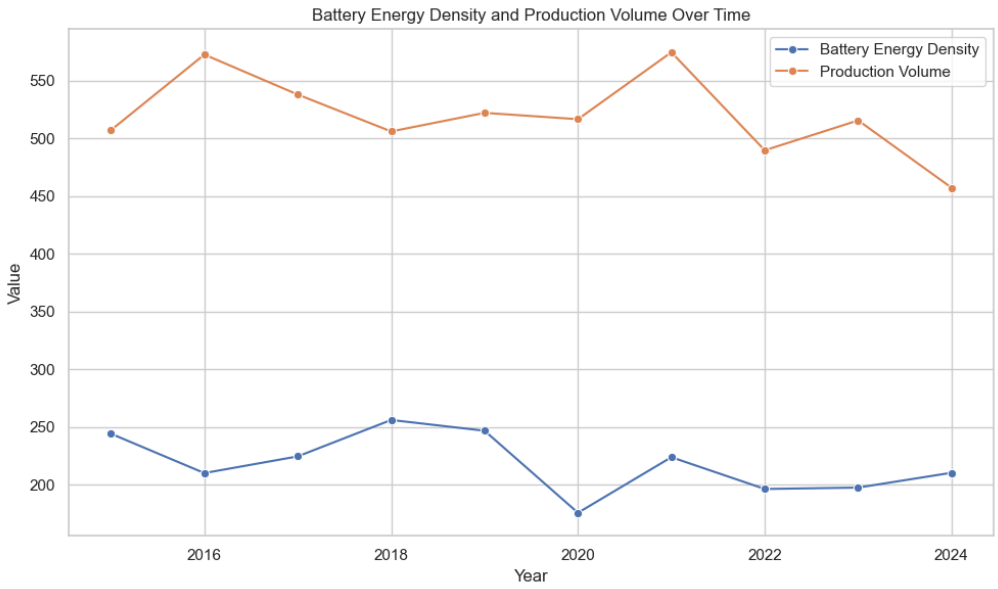

Figure 1. Battery Energy Density and Production Volume over Time.

The Chinese government has played a key role in promoting the development of the new energy vehicle industry. From the early financial subsidy policy to the recent double points policy, the Chinese government has incentivized the research and development, production and consumption of new energy vehicles through a variety of means [10]. These policies have provided strong support to Chinese new energy vehicle companies, enabling them to rapidly dominate the domestic market. In addition, the government has laid the foundation for the industry's long-term development by supporting the construction of charging infrastructure, standardization policies and other measures. However, with the gradual retreat of subsidy policies, how the industry can maintain competitiveness and achieve sustainable development has become an important challenge now.

Driven by strong demand in the domestic market, China's new energy vehicle industry has realized rapid growth. In recent years, China's new energy vehicle sales have accounted for a large share of global sales, especially in the pure electric vehicle sector. However, despite the strong performance in the domestic market, the performance of Chinese companies in the international market is relatively limited. Global market expansion is still faced with low brand recognition and high barriers to overseas market access. In order to enhance global competitiveness, Chinese new energy vehicle enterprises need to increase their international market development efforts, enhance their brand influence, and align their technology and services with international standards. Total Cost of Ownership (TCO) Calculation:

$$\mathrm{TCO} = P + M + E + R \tag{2}$$

3. The Impact of Production Factors on the Global Competitiveness of China's New Energy Vehicle Industry

Production factors serve as the fundamental drivers in bolstering the global competitiveness of China's new energy vehicle industry. The triad of technological innovation and R&D capacity, the enhancement of human capital and skills, alongside supply chain management and production efficacy, form the cornerstone of industrial growth. These elements not only dictate the extent of a company's technological superiority but also influence the collaborative dynamics across the entire industrial chain and its market competitiveness. By fortifying these three pivotal domains, China’s new energy vehicle industry can secure a more advantageous standing in the global arena, paving the way for its shift from a "follower" to a "leader."

3.1. Technological innovation and R&D capabilities

Technological innovation is the essential catalyst driving the advancement of the new energy vehicle sector and a critical factor in boosting global competitiveness. With the rising global emphasis on low-carbon transportation, the technological prowess of new energy vehicles is crucial in determining whether companies can excel in the intensely competitive market. Breakthroughs in core areas such as battery technology, intelligent driving systems, and lightweight materials have become vital strategies for Chinese new energy vehicle firms to sustain their competitive edge on the world stage. Continuous technological advancements are imperative for Chinese companies to secure a strong position within the global industrial chain and to contribute to the elevation of industry standards.

In recent years, Chinese new energy vehicle companies have markedly ramped up their R&D investments, progressively closing the technology gap with leading international competitors. Notably, companies like BYD and CATL have made considerable strides in battery technology, introducing high-energy-density, long-life battery products that have garnered widespread acclaim in both domestic and international markets. Additionally, new entrants like NIO have achieved significant advancements in intelligent driving and connected vehicle technologies, successfully launching a series of competitive smart models. These technological developments have not only bolstered the competitiveness of China’s new energy vehicles but have also expanded the opportunities for these companies in the global market.

However, China's new energy vehicle industry continues to encounter numerous challenges in the realm of technological innovation. The capacity for independent research and development of core technologies still requires enhancement, particularly in the domains of high-energy-density batteries and advanced intelligent driving systems, where there remains a noticeable gap compared to international leaders. Furthermore, inefficiencies in the allocation and integration of R&D resources have resulted in lower innovation output for some companies. The shortage of skilled talent and the incomplete development of an innovation ecosystem are also impeding the industry’s overall technological innovation capabilities. To achieve a leading position in the global market, Chinese

enterprises must address these bottlenecks and further strengthen their capacity for independent innovation, showed in Figure 2 :

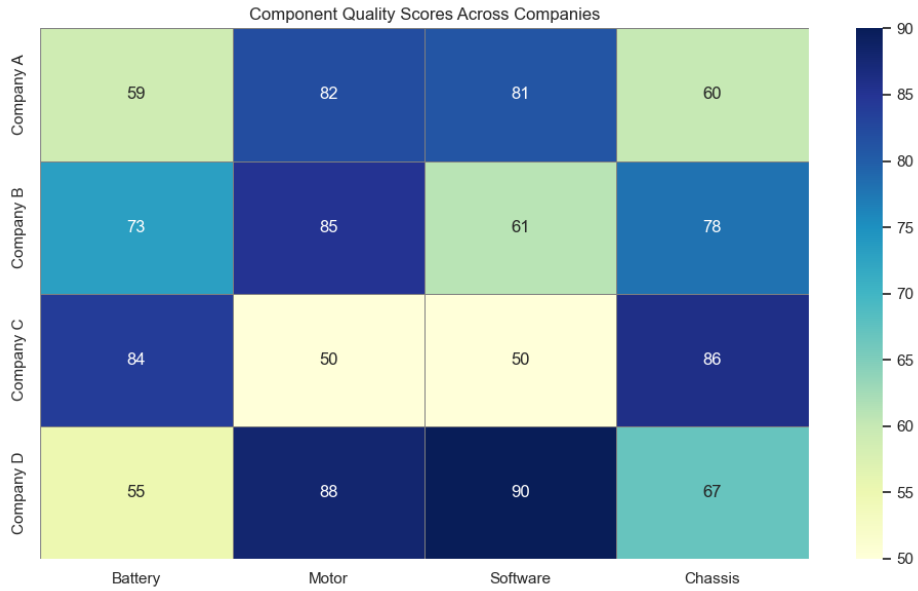

Figure 2. Component Quality Scores across Companies.

To further elevate their technological innovation capabilities, Chinese new energy vehicle companies should implement several key strategies. Firstly, it is essential to increase investment in R&D, with a particular focus on basic research and frontier technologies, to strengthen the independent development of core technologies. Secondly, fostering stronger collaboration between industry, academia, and research institutions is crucial. By harnessing the expertise of universities and research centers, companies can collectively tackle significant technological challenges. Additionally, businesses should actively recruit and nurture top-tier R&D talent, establishing comprehensive innovation incentive mechanisms to ignite creative potential. Lastly, promoting international technological cooperation and exchange is vital; by incorporating advanced technologies and expertise from abroad, companies can significantly boost their global competitiveness in innovation. These initiatives will enable China's new energy vehicle industry to achieve technological leadership in the global marketplace and secure a solid foundation for its long-term growth.

3.2. Human capital and skills upgrading

In the evolution of the new energy vehicle industry, human capital emerges as a critical catalyst for technological advancement and industrial innovation. High-caliber professionals not only bolster a company's R&D capabilities and technological prowess but also drive the optimization of production processes and the enhancement of product quality. The availability and cultivation of talent are directly linked to a company's competitiveness, especially in the technology-intensive realm of new energy vehicles, where employees with advanced expertise are crucial for achieving technological breakthroughs and securing market leadership. As such, fortifying human capital is a strategic imperative for China's new energy vehicle industry to boost its global standing.

Currently, China’s new energy vehicle industry has achieved notable progress in attracting and nurturing high-quality talent. Numerous enterprises and research institutions have established specialized training programs and R&D teams, emphasizing the recruitment of high-level talent with global perspectives. Concurrently, several universities and vocational schools have introduced specialized curricula related to new energy vehicles to address the industry’s growing demand for skilled professionals. However, there remains a considerable shortage of senior engineers and R&D personnel, particularly in cutting-edge fields like battery management systems and intelligent driving technology. This talent gap hinders the industry's capacity for technological innovation and market expansion.

Despite these advancements, significant challenges persist in enhancing human capital within China's new energy vehicle sector. First, the training period for senior technical talent is lengthy, making it difficult to quickly supply the immediate expertise that enterprises require. Additionally, the high turnover rate of technical and R&D personnel poses a challenge to the stable growth of companies. Furthermore, the existing systems for talent development need improvement, as current educational and training resources do not fully align with the rapid pace of industry growth. Addressing these issues necessitates enhanced coordination and collaboration within the industry and beyond, as well as the optimization of talent development systems and incentive structures to improve the overall quality and stability of human capital.

To effectively strengthen human capital, China's new energy vehicle industry must implement several strategic measures. First, companies should increase their investment in talent development, creating comprehensive training systems and clear career pathways to attract and retain top talent. Secondly, fostering collaboration between industry, universities, and research institutes is essential; by establishing cooperative platforms, companies and educational institutions can jointly develop curricula and training programs that enhance the practical skills and innovative capabilities of the workforce. Moreover, companies should design incentive mechanisms that include well-structured compensation packages and career progression opportunities to motivate and engage employees. Finally, encouraging knowledge sharing and technical exchanges within the industry is vital to elevating the overall talent pool and skill level. Through these strategies, China's new energy vehicle industry will be better positioned to cultivate a workforce that meets market demands, thereby providing a robust foundation for enhancing global competitiveness.

3.3. Supply Chain and Productivity

Supply chain management plays a crucial role in the new energy vehicle industry. The production of new energy vehicles involves many complex links, including raw material procurement, battery manufacturing, vehicle assembly, etc. The efficiency and coordination of each link directly affects the overall production capacity and cost control. An efficient supply chain ensures timely supply of raw materials, rapid production of components, and on-time delivery of finished products, thus improving production efficiency and reducing operating costs. Optimizing supply chain management not only improves market responsiveness, but also enhances competitiveness in the global market.

China's new energy vehicle industry has achieved some remarkable results in supply chain management. First, China has a complete battery industry chain, from lithium mining, material production to battery manufacturing, which provides a stable supply of raw materials for the production of new energy vehicles. Secondly, Chinese companies have excelled in supply chain integration, improving production efficiency and response speed by establishing close supplier partnerships and information sharing mechanisms. In addition, some leading enterprises have applied advanced intelligent manufacturing technologies and automated equipment in the production process, further enhancing production efficiency and product quality.

Despite many achievements, China's new energy automobile industry still faces some challenges in terms of supply chain and production efficiency. First, the complexity and globalization of the supply chain have brought about difficulties in supply chain management, especially under the influence of fluctuations in raw material prices and changes in international trade policies, and enterprises face certain supply chain risks. Second, the supply chain management and coordination capabilities of some enterprises are still inadequate, leading to problems such as long production cycles, high costs and poor inventory management. In addition, the improvement of production efficiency is also limited by the level of technology and the updating of equipment, and some traditional manufacturing processes still rely on manual operations, which affects the overall production efficiency.

In order to optimize supply chain management and improve productivity, Chinese new energy vehicle enterprises need to adopt several strategies. First, establish a flexible supply chain network and reduce the risk of supply chain disruption through diversified supplier selection and risk management

mechanisms. Second, promote the digital transformation of the supply chain, and utilize technologies such as big data and the Internet of Things for real-time monitoring and management to improve supply chain transparency and responsiveness. Third, invest in advanced production equipment and smart manufacturing technologies to automate and intellectualize production, and improve production efficiency and product consistency. Finally, strengthen coordination with global supply chain partners to form a collaborative innovation ecosystem and jointly enhance production capacity and market competitiveness. Through these measures, China's new energy automotive industry can further optimize its supply chain and improve production efficiency, thereby enhancing global competitiveness.

4. Market Demand Driving Global Competitiveness of China's New Energy Vehicle Industry

Market demand is an important force driving the development of new energy vehicle industry, which directly affects the production scale, technological innovation and market competitiveness of enterprises. With the increasing global demand for environmentally friendly and energy-saving vehicles, the market outlook for new energy vehicles is becoming broader and broader. As the world's largest market for new energy vehicles, China's huge domestic demand market provides important development opportunities for local enterprises. Changes in market demand not only determine the speed and direction of product updates, but also motivate companies to continuously optimize product performance and improve quality to meet consumer expectations and gain a foothold in the fierce international competition.

China's domestic demand for new energy vehicles continues to grow, providing a strong impetus for industry development. With the support of government policies, increased awareness of environmental protection and the gradual improvement of the charging infrastructure for new energy vehicles, more and more consumers are choosing new energy vehicles as a means of transportation. This strong market demand has prompted companies to increase R&D investment and accelerate the launch of new models to meet the needs of different consumers. In addition, the diversification of domestic market demand has driven the layout of enterprises in different market segments, such as electric passenger cars, commercial vehicles and micro electric vehicles, which has further enhanced their competitiveness and market share.

With the rapid expansion of the new energy vehicle market globally, Chinese companies have also begun to actively expand into the international market. In developed countries such as Europe and the United States, the demand for new energy vehicles is mainly focused on high-performance, high-quality and highly intelligent models, which puts forward higher requirements for Chinese enterprises to enter these markets. In addition, due to environmental protection and energy security considerations, the demand for economical and energy-saving new energy vehicles is gradually increasing in some developing countries, which provides new market opportunities for Chinese enterprises. The diversification of international market demand has prompted Chinese enterprises to continuously improve their product quality and technology level in order to adapt to consumer preferences in different countries and thus occupy a larger share of the global market.

In order to better meet domestic and international market demand and enhance global competitiveness, Chinese new energy vehicle enterprises need to adopt a series of strategies. First, enterprises should strengthen their analysis of market trends and consumer demand, adjust the direction of product development in a timely manner, and launch models that meet market demand. Second, they should improve the core competitiveness of their products, especially in terms of range, charging speed and intelligent technology, to enhance the market attractiveness of their products. In addition, enterprises should increase brand building and international market promotion, enhance brand awareness and reputation, and further open the overseas market. Finally, they should actively participate in the cooperation and integration of the global new energy vehicle industry chain, optimize supply chain management, and enhance production efficiency and cost competitiveness. Through these measures,

Chinese new energy vehicle enterprises will be able to better grasp the changes in market demand, enhance competitiveness in the global market, and realize the sustainable development of the industry.

5. Conclusion

The global competitiveness of China's new energy vehicle industry has improved significantly in recent years, an achievement that has been made possible by efforts on multiple fronts, including the improvement of technological innovation and R&D capabilities, the effective cultivation of human capital, the optimized management of the supply chain, and the strong impetus of market demand. However, in the face of increasingly fierce international competition, Chinese companies still need to continue to deepen their technological innovation and overcome existing technological bottlenecks, as well as optimize their supply chain and production efficiency, in order to maintain their competitive edge in the global market.

In the future, China's new energy automobile industry must further expand its international market on the basis of consolidating the domestic market and improving product quality and brand influence. At the same time, companies need to flexibly respond to changes in global market demand and adjust their strategies to consistently meet the needs of consumers in different regions. This will not only help enhance China's new energy vehicles' position in the international market, but also promote the sustainable development of the global new energy vehicle industry.

China's new energy vehicle industry has made significant progress on the road to global competitiveness, but it still needs to continue its efforts to occupy a more important position in the future global market through continuous innovation and optimization, and to realize the transformation from industry follower to leader.

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