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Opportunities and Challenges for China's Automakers during Transformation Empowered by Green Economy Development

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Abstract. As an indispensable part of the modern nationeconomy system, the green economy is becoming more significant and exerting more influence. It plays a key role in promoting sustainable and healthy economic development and strikes a balance between ecological environment protection and social and economic development, securing win-win results. Being one of the core driving forces of green economy development, new energy vehicle (NEV) companies contribute significantly to energy structure transformation and carbon emission reduction, pioneering the automotive industry in developing more environmentally friendly and efficient solutions. Empowered by the green economy development, Chinese NEV companies are facing unprecedented opportunities and challenges throughout the transformation. This paper analyzes the development issues of NEVs by discussing the limitations of the traditional automotive industry, the necessity of NEV development, and the challenges and opportunities. It is found that the traditional automotive industry is enduring issues such as high energy consumption and heavy pollution. The industry should be globalized with an improved supply chain. Measures such as promoting green economy development should be taken to address the imperfect supply chain as well as the environmental pollution and safety concerns associated with battery recycling, thereby shifting the automakers towards the new energy industry.

Keywords: green economy development, new energy vehicle, transformation of automakers

1. Introduction

Green development has become the leading trend and key strategic area on the path of advancing the economy. General Secretary Xi Jinping stressed that "Green development is an essential requirement of building a high-quality and modernized economic system and the fundamental solution to pollution". As the green economy prospers and prevails, it is crucial for companies to evolve with the times and achieve green transformation. Regarding the automotive industry, traditional automakers are faced with a series of severe challenges. Among them, the most prominent ones are the resource depletion crisis due to high energy consumption as well as environmental pollution, which have severely hindered the sustainable development of the automotive industry. This phenomenon has reflected the limitations of the traditional automotive industry and the necessity of green economy development.

This paper analyzes the opportunities and challenges in the market faced by BYD, a pioneer NEV manufacturer in China. Although BYD is leading in China's NEV industry, it confronts difficulties in terms of overseas market expansion, the supply chain, vehicle safety and quality, etc. The batteries used by NEVs are the substitute for fuel for conventional vehicles. BYD will be able to enhance its competitiveness by optimizing the battery performance. Safety issues also arise as the number of NEVs increases and the most common issue is the spontaneous combustion of NEVs caused by power batteries [1, 2]. Meanwhile, China attaches great significance to the development of NEV companies and has issued the New Energy Vehicle Industry Development Plan (2021-2035) [3], stressing that NEV development is essential for China to develop itself into a major automotive country. It is a strategic move to cope with climate change and develop a green economy. BYD is suggested to proactively respond to national policies, developing green companies and earning more opportunities. Meanwhile, it is suggested to improve its communication between domestic and overseas markets and resolve export issues, providing quality services. Problems confronted by BYD are also problems encountered by other similar automotive companies, as are the opportunities. By studying the opportunities and challenges for automotive companies during their transformation process empowered by the green economy, this paper not only unveils the opportunities and challenges for automotive companies but also inspires those who need transformation, thereby contributing to the green economy development and providing China solution for the global green economy development as well.

2. Limitations of Traditional Automotive Industry and Necessity of Developing a Green Automotive Industry

2.1. Limitations of the Traditional Automotive Industry

2.1.1. High Energy Consumption And Depletion Of Petroleum,Gasoline,and other Resources

Table 1. Global primary energy consumption from 2012 to 2021.

Type of Energy	Global	Petroleum	Natural gas	Coal
2012	524.61	176.64	119.54	159.08
2013	534.32	178.54	121.54	161.97
2014	539.56	179.65	122.4	162.5
2015	544.41	183.63	125.22	158.64
2016	551.74	186.87	128.11	156.61
2017	561.82	189.5	131.53	157.4
2018	576.13	191.33	138.16	159.26
2019	581.51	191.89	140.54	157.64
2020	564.01	174.17	138.44	151.07
2021	595.61	184.21	145.35	160.1

Data from: Global New Energy Development Report 2022

Conventional fuel vehicles consume petroleum, gasoline, and other fossil fuels for power. However, as the demand for fuels increases and the energy-intensive feature of conventional vehicles, petroleum, gasoline, and other resources are depleting, as shown in table 1. Conventional vehicles mainly consume gasoline and diesel. According to the data in Table 1, although the consumption of petroleum slightly decreased in 2020, it shows a rising trend overall. Currently, China has relatively low reserves of petroleum, relying heavily on petroleum imports [4]. Therefore, the transformation of automakers will improve China's petroleum shortage situation.

2.1.2. Health Effects of Environment Pollution

In 2020, China proposed the goal of "peaking carbon emissions" by 2030 and reaching "carbon neutrality" by 2060 (also known as the "dual carbon" goal). However, polluting gases emitted by conventional vehicles have diminished the effectiveness of "dual carbon" policies. According to statistics, traditional fuel vehicles produce 4.6 tons of carbon dioxide on average each year. Additionally, fuel combustion also produces carbon monoxide, sulfur dioxide, hydrocarbons, and other car exhaust pollutants.

Car exhausts mainly comprise carbon monoxide, hydrocarbons, nitrogen oxides, carbon dioxide, etc. The mixture of these gases causes great harm to human health.

A great amount of carbon monoxide exists in car exhausts. Long-term exposure to massive carbon monoxide leads to carbon monoxide poisoning. Meanwhile, the gas is easily combined with oxygen, which causes hypoxia, causing dizziness, fatigue, and even coma.

Meanwhile, carcinogens are present in car exhausts. There are also dust, oil, and other non-volatile particles due to incomplete combustion. They are likely to induce allergic asthma once inhaled by people and ultimately lead to cancer.

Car exhaust is one of the major sources of environmental pollution. Air pollution is significantly correlated with global climate change. Carbon emissions caused by car exhausts accelerate climate change [5]. The incomplete fuel combustion generates hydrocarbon while photochemical smog and secondary pollutants form due to the photochemical reaction of nitrogen oxide from car exhaust. To realize the sustainable development of the automotive industry, transformation is needed with environmental protection being the primary task.

2.2. Necessary of NEV Industry Development

2.2.1. Enhancement of Environment Awareness

Table 2. NEV sales of BYD in the recent decade from 2012 to 2022 (unit: 10,000 vehicles).

Year	Proportion within its own industry (%)	Market quantity	Ranking	Sales
2012	0.40	33.5	8	0.2
2013	0.30	32.1	7	0.2
2014	4.20	44.6	5	1.8

Table 2. Continued

2015	16.70	54.2	2	7.4
2016	40.80	73.5	2	20.3
2017	44.00	72.3	1	18.0
2018	53.60	107.2	1	26.9
2019	61.20	110.5	1	27.8
2020	68.40	132	1	28.8
2021	86.80	336.5	1	61.2
2022	99.70	649.8	1	185.7

As the new development philosophy is further implemented, public environmental awareness is accordingly enhanced. Although the traditional automotive industry is still dominant in the market, more and more people are getting to know and purchase NEVs. On the path to achieving the goal of "peaking carbon emissions" and reaching "carbon neutrality", China should adhere to the principles of "national coordination, priority on conservation, technological and institutional innovation, international connectivity, and risk prevention." Among them, the principle of "priority on conservation" requires that energy and resource conservation should be prioritized, a comprehensive resource conservation strategy should be implemented, energy and resource consumption per unit of output and carbon emission should be continuously reduced, input-output efficiency should be improved, and a simple, moderate, green, and low-carbon life philosophy should be advocated to effectively control carbon emission at the source. Proposed policies have demonstrated the national leaders' determination on environmental protection. Since the "dual carbon" goal was proposed in 2020, China's new energy industry has gradually entered the large-scale development phase during which its development is driven by market forces with a significant increase in NEV sales. It is not only the national policy support such as the purchase tax reduction, but also the enhanced environmental awareness of people that have contributed to the steady improvement of NEV production, as shown in table 2.

This paper researches BYD and analyzes the NEV sales in China's market in the recent decade. The ranking of BYD in the NEV industry has been steadily rising and remaining on top for six consecutive years. The proportion of BYD's NEV within its own industry has been gradually increasing and reached 99.70% in 2022. The market quantity has shown a rising trend. Data concerning market quantity can help companies and investors learn the market size, market trends, consumer demands, and other important information. The market quantity can reflect the market size, market structure, and consumer behavior. As it shows a rising trend, it indicates that the market size of NEV is growing, NEV transformation is trending, and demand for NEV by consumers is increasing, clearly demonstrating the rapid development of NEV at present.

2.2.2. Compliance with Market Economic Rules and Trends of Green Transformation and Economic Globalization

Against the backdrop of developing new energy industry, there are some opinions suggesting that China is experiencing "excess capacity" in its new energy industry. Nevertheless, China remains determined to continue its development. It is an issue that should be viewed comprehensively and objectively, considering that economies of scale formed by China during its long-term development offer significant advantages. From an economic perspective, judging whether an industry is experiencing "excess capacity" depends on the overall supply and demand. On a macro level, the perfect match between supply and demand is impossible to achieve. In many cases, demand is created by supply. During the process, there would be a phase where "insufficient demand" may occur, causing a short-term and periodic mismatch between supply and demand [6]. For emerging countries that are developing the new energy industry like China, many pieces of specialized equipment are not handled professionally due to a lack of auxiliary facilities, thereby leading to unmet demands. According to Liang Ming, researcher and director of the Institute of International Trade under the Chinese Academy of International Trade and Economic Cooperation, both domestic and international potential demand and market opportunities are immense. In the long term, if China continues to strengthen its investment in the research and development of the new energy industry and keeps in line with the globalized trend, it will be able to improve its core competitiveness of new energy products. The developing trend is closely related to the green and low-carbon developing trend across the world.

China has proposed multiple policies concerning green development. It has been implementing the renewable energy law since January 1st, 2006. Medium- and Long-Term Development Plan for Renewable Energy and Automotive Readjustment and Revitalization Plan were introduced in 2007 and 2009 respectively, proposing to develop solar energy, NEV, and other low-carbon industries, aiming to establish a clear and stable policy environment for new energy industry development. In the context of green development, the total NEV sales in China have been steadily rising with enhanced quality, which has been particularly evident after the "dual carbon" goal was proposed.

2.2.3. Technology Foundation of NEV Industry Based on New Productive Forces Development

General Secretary Xi Jinping stressed the current requirement to develop new productive forces. New productive forces have surpassed the limitation of the traditional economic growth mode and the evolution path of productive force, indicating the smarter,

greener, and more efficient transformation of the productivity structure. The transformation not only improves the efficiency and accuracy of resource allocation but also promotes the comprehensive upgrading and sustainable development of the economic system, thereby facilitating social productivity by leaps and bounds. New productive forces are bred by revolutionary breakthroughs in technologies, innovative allocations of production factors, and the upgrading of in-depth industrial upgrading with workers, means of labor, subjects of labor, and their optimal combination as basic connotations, a substantial increase in total factor productivity as a core hallmark. With innovation as their feature and quality as the key, new productive forces are essentially advanced productive forces. From the perspective of new productive forces, data empowerment offers new chains for industrial development. Firstly, data empowers automotive research and development. Secondly, data empowers automotive manufacturing. Thirdly, data empowers the automotive supply chain. Fourthly, data empowers automotive marketing. Fifthly, data empowers automotive transportation. Sixthly, data empowers the operation of automotive companies [7]. Hence, the development of new productive forces provides critical support in terms of automotive marketing and transportation for the automotive industry beyond technological support. "Green development underpins high-quality development while new productive forces are green productive forces in essence." To achieve innovative development in electric drive systems, battery technology, and charging infrastructure, it is required to optimize the production process and reduce production costs, providing more satisfying experiences for customers with high quality and efficiency through technology integration.

3. Challenges and Opportunities for Automakers: A Case Study of BYD's NEVs

3.1. Challenges

3.1.1. Insufficient Alignment with Overseas Markets

Although BYD enjoys sales increase in overseas markets to a certain degree, it slightly suffers from inconsistency in infrastructure between domestic and international markets, leading to its sufficient alignment with markets abroad.

The discrepancies are reflected in two aspects. The first is the difference in charging voltage between China and international standards. The export system of BYD's NEVs is not well-aligned with the charging facilities abroad, causing a waste of resources. Additionally, it will lead to slower charging times and other issues, thereby diminishing the value of the exported vehicles and increasing unnecessary costs.

The second aspect is the inadequate charging infrastructure. BYD's bi-directional charging/discharging technology is widely applied in China, making it more convenient for customers to charge. However, the charging technology is not compatible with charging infrastructure abroad, thereby hindering BYD's global reach process.

3.1.2. Battery Recycling

While the NEV industry is prospering, the disposal of waste batteries is a pressing issue of great concern at present. Most waste batteries are not efficiently recycled by original equipment manufacturers (OEMs) due to various factors. According to experts, a mobile battery weighing 20 grams could pollute a one-square-meter land for about 50 years. Larger electric vehicle (EV) batteries with heavier weights usually contain nickel, cobalt, manganese, and other heavy metals. Moreover, lithium hexafluorophosphate in the electrolyte easily hydrolyzes in an air environment, producing harmful substances such as phosphorus pentafluoride and hydrogen fluoride, posing bigger threats to the environment. Currently, there are still many issues in terms of EV battery recycling.

The first issue is the industry irregularities. Retired EV batteries have high recycling value. Nevertheless, there are non-compliant companies without relevant environmental protection regulations that obtain retired batteries by offering higher prices, preventing these batteries from being recycled by OEMs. Generally, sellers of these retired batteries rarely pay attention to whether the buyers are legitimate or not. Instead, they focus primarily on the proposed purchase prices, also hindering battery recycling.

The second issue is the imperfect policy system. Currently, the battery recycling system is not fully developed. It is difficult for many domestic companies to collect and handle all the waste batteries in a unified manner. Another difficulty for them is the cost occurred during transportation. Therefore, relevant policies should be introduced to address these difficulties. However, the implementation details of relevant policies have not been outlined yet [8].

The third issue is the risks that occurred during the recycling and handling process [9]. During the process of battery recycling, if the batteries are damaged and the electrolyte leaks, there might be risks of fire or explosion. The process of managing waste batteries consists of handling and metal recycling. Once the batteries are mishandled, the pollutants would be released into the air. The specific environmental hazards remain unclear yet.

The battery recycling chaos has imposed significant pollution and safety hazards on the environment, leading to worse pollution and waste of resources due to subsequent mishandling.

3.1.3. Quality Issues causing Buyer Hesitation

Despite that NEVs enjoys high popularity, a great number of consumers are taking a "wait-and-see" approach towards these vehicles. Lifespan, runtime, and safety issues of batteries remain the three major technical problems of NEV that need to be tackled. By customers' feedback, regarding the runtime, NEVs suffer issues including insufficient travel distance, shortened runtime caused by high or low temperature, increased energy consumption, or high discrepancy between the actual runtime and the supposed runtime. Regarding safety issues, some NEV owners have shown concerns such as the possibility of explosions that will threaten human life. They also mentioned difficulties in charging, including long charging times and the lack of charging piles. Objectively speaking, positive comments about BYD mainly highlight its unique design and attractive appearance while negative comments focus on technological problems. To encapsulate, significant progress remains to be made for NEVs to successfully earn widespread acceptance.

3.1.4. Imperfect Supply Chain

The operation of supply chain management aims to achieve the optimal supply chain overall through enterprise coordination from the perspective of consumers. In a successful supply chain management scenario, all activities within the supply chain are effectively coordinated, integrated, and seamlessly connected.

BYD has been integrating the industry chain vertically since acquiring Xi'an Qinchuan Automobile and entering the automotive industry in 2003. It has also tapped into lithium resources from salt lakes and been self-sufficient with supplies of metal materials, batteries, electric motors, and auto mold, assembling complete vehicles independently. The vertical integration of the supply chain has earned BYD great competitive advantages. In addition, many of the suppliers are its subsidiaries or sub-departments. In 2013, BYD specifically established the Shenzhen BYD Supply Chain Management Co., Ltd., officially indicating that it considers supply chain management as a major source of profit. However, the supply chain suffers from several weaknesses [10].

The first is that it is challenging to satisfy consumers' needs. Since BYD directs more attention to its internal production, it has less focus on current consumers' needs. Moreover, the suppliers of components are deficient in innovative practices, with their developed products not aligning with consumers' needs and present trends [5].

The second is the difficulty in managing the vast supply chain. Even though BYD's vertical integration of the supply chain has reduced costs to a certain degree, the extensive system has led to lagging information and communication with significantly increased management costs. Implementing a rational management system could greatly enhance the working efficiency of the supply chain [5].

3.2. Opportunities

3.2.1. Internationalization and Overseas Expansion

China has always been open with a cooperative mindset while promoting the development of the new energy industry, eagerly sharing developing opportunities with other countries. It embraces foreign-invested companies. In 2018, China lifted the foreign ownership restrictions on NEV manufacturing. Subsequently, Tesla, Volkswagen, BMW, Toyota, and other automakers invested in China for NEV manufacturing; It supports overseas investment in new energy. BYD is currently building an advanced, and highly-automated NEV production base in Hungary; It actively develops mutually beneficial trade. Aside from importing a large number of NEVs such as BMW, Audi, and Porsche, China also imports a great number of components such as lights, braking systems, tires, and shock absorbers for high-end NEVs. Meanwhile, the exported goods of China include a plethora of foreign-invested products. To effectively facilitate and optimize businesses, it is crucial to develop the new energy industry with an inclusive mindset and actively drive foreign trade growth in the process of learning from each other's strengths and offset each other's weaknesses. China has been upholding the idea of building a community with a shared future for mankind, firmly facilitating the green transformation of development approaches, deepening high-level opening-up, and promoting the development of the new energy industry and international cooperation. This will create more opportunities for common development for countries across the world, further addressing climate change and improving the livelihood of mankind.

3.2.2. Supply Chain Improvement

Firstly, a specific feedback platform for users should be established to analyze current market demands and source third-party suppliers. Since BYD has a relatively singular source of supply, it sells self-produced products, which hinders its external exchange and leaves many procedures unclear and non-transparent.

Secondly, digital and intelligent tools should be utilized for better management and after-sales services. Against the backdrop of rapidly developing technologies, digitalization and intelligentization are two key factors for transformation. Efficient utilization of digital and intelligent tools can facilitate better marketing decisions and promote innovation. Moreover, it can enable smart

procurement as well as smart tracking of customer feedback, thereby providing after-sales service promptly and boosting customer satisfaction.

Thirdly, the relationships among departments along the supply chain should be coordinated. With a vertical integration supply chain system, BYD should facilitate cooperation and deepen understanding among the departments along the supply chain, promote deeper collaborative awareness, and illustrate the development of each department using digital tools.

3.2.3. Ongoing Promotion of Green Development and Environmental Protection

The original aspiration of developing the emerging industry is to achieve green development. The new energy industry development in China is in line with the green transformation philosophy and the trend of economic globalization trend. Once the original aspiration is forgotten, the emerging industry will be swept away and ultimately eliminated. An industry that develops against the trend of the times will ultimately not be favored by the era. Hence, the philosophy of green development should continue to be promoted, facilitating green transformation for more automotive companies and presenting more successful cases. Additionally, automotive companies should focus on environmental protection, using environmentally friendly materials for NEV manufacturing, an action that will reduce future expenses on environmental protection. To further protect the environment, a rational battery recycling mechanism should be established, efficiently returning retired batteries to OEMs, thereby realizing their final value.

4. Conclusion

Under the framework of green economy development, it is crucial to advance the new energy industry. This paper discusses the opportunities and challenges encountered by China's enterprises in the context of green economy empowerment, analyzes and illustrates the limitations of conventional automotive enterprises and the necessity of green development for these enterprises, and examines the challenges and prospects for NEVs. The high energy consumption, heavy pollution, and severe harm caused by the traditional automotive industry have shifted people's attention to NEVs. Additionally, the national "dual carbon" goal has imposed stricter requirements on carbon emissions. This, combined with the enhanced environmental awareness among the public, has contributed to the growing acceptance of NEVs. The development of the NEV industry complies with market economy rules and the trend of globalization, contributing to the green economy development. In 2024, China proposed the concept of new productive forces at "two sessions" (the annual sessions of the National People's Congress and the National Committee of the Chinese People's Political Consultative Conference), indicating that the new productive forces focus on developing advanced technology, high efficiency, and high quality, aiming at achieving scientific and technological development through innovation ultimately. However, the current situation of the NEV industry is not optimistic. Despite that it is more energy-efficient than the traditional automotive industry, it faces issues such as quality, battery recycling safety, and supply chain challenges. Challenges also present opportunities. To further develop NEVs, automotive companies can access and expand the international market, improving the recognition of China's NEV brands. On top of that, the supply chain should be improved, providing a more satisfying experience for customers. The manufacturing costs should be reduced to achieve the green development goal. The focus should be shifted to environmental protection to promote the green development philosophy. All the aforementioned efforts will make green living a reality for the general public and promote China's NEVs worldwide.

References

[1] Chen, Z., Xiong, R., Tian, J., Shang, X., & Lu, J. (2016). Model-based fault diagnosis approach on external short circuit of lithium-ion battery used in electric vehicles. *Applied Energy*, 184, 365–374.

[2] Kim, G., Smith, K., Ireland, J., & Pesaran, A. (2012). Fail-safe design for large capacity lithium-ion battery systems. *Journal of Power Sources*, 210, 243–253.

[3] General Office of the State Council of the People's Republic of China. (2020). New energy vehicle industry development plan (2021-2035). *Resource Recycling*, 47-52.

[4] Pang, X. B., Liu, G., & Wang, J. N. (2008). Is there a causal relationship between oil consumption and economic growth in China. *Social Sciences*, 5, 3.

[5] Wang, H. Y., & Liang, Y. (2024). Hazards of air pollution and its control measures in environmental engineering. *Cleaning World*, 40(5), 158-160.

[6] Zhou, D. (2024). China's new energy products not only do not have 'overcapacity,' but also contribute to global supply. *21st Century Business Herald*. Retrieved from https://www.21jingji.com/article/20240703/32f710612f001bfb96547cc4c8e71ed3.html

[7] Yang, X. D. (2024). The logic and chain of data-enabled automotive industry from the perspective of new productive forces. *Library and Information*, (2), 13-15.

[8] Chen, Y., Cha, W., Zhang, X., & Swekwi, U. (2024). The current situation and suggestions of power battery recycling for new energy vehicles. *Battery Bimonthly*, 54(1), 94-97.

[9] Wang, Y. B., Guo, Y. W., Sun, Z., Ruan, J. L., & Zhang, J. Q. (2019). Discussion on environmental risk analysis and management countermeasures of waste power battery recovery in China. *Journal of Environmental Engineering Technology*, 9(2), 207-212.

Liu, Y., & Zhang, S. Y. (2023). Byd's smart supply chain reform and optimization strategy. *Supply Chain Management*, 4(4), 78-85.