

China's Development Strategy for Becoming an Automotive Industrial Powerhouse

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Abstract: As an important supporting industry of the national economy of China, the automotive industry has an important impact on the overall economic strength of the country. To cope with the scenarios of motorized transformations, intelligent network connections, and operational mode innovations of the global automotive industry, a strategy for developing a powerful automotive industry in China is necessary, as it will contribute toward improving the international competitiveness of China's automotive industry. Given these new technologies, in this study, through analyses of domestic and international automotive industries, we identify opportunities and existing problems of the domestic automotive industry, such as the development of a new energy automotive industry and use of intelligent networks in automobiles. By establishing a multilink development path that considers Chinese automobile enterprises as its main elements, we provide corresponding measures and suggestions for preparing a new development strategy for China's automobile industry.

Keywords: automotive industry; Chinese brands; strategic power; development path

1 Introduction

The Chinese automotive industry is an important industrial pillar of the national economy and has a large economy of scale effect and industrial linkages, which help it play a prominent role in economic development and social stability [1]. Since the Chinese economic reform and in the ten years since joining the World Trade Organization, the Chinese automotive industry has achieved rapid development. The industry is ranked first in the world in automobile production and sales, making it a veritable automotive industry powerhouse. As the world's second-largest economy, the world's largest automotive market, and the world's largest automotive industry, it is necessary to strengthen and improve the positioning and role of Chinese brand vehicles in the national economy for the development of China into an economic powerhouse and for the industrial development of the automotive industry. From a global perspective, the automotive industry is currently at a stage of rapid change. The upgrade and

development path of the transformation of this industry is being gradually established. In the context of the electrification revolution, enhancement of intelligent network features, and the gradual improvement of production methods and operating models [2], exploring the development strategy of China's automotive industry to turn itself into an automotive industrial powerhouse is crucial for improving the international competitiveness of China's automotive industry, in terms of both value and significance.

2 Opportunities for the automotive industry amidst the new changes

After sixty years of development, particularly, since the Chinese economic reforms, China's automotive industry has grown into an all-encompassing industrial system. After more than one hundred years of existence, China's automotive industry has helped transform China into the world's largest automotive manufacturing country. China's automotive production and

Received date: January 15, 2018; **Revised date:** January 31, 2018

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Funding program: CAE Advisory Project "Research on Automobile Power Strategy" (2015-XZ-36)

Chinese version: Strategic Study of CAE 2018, 20(1): 037-044

Cited item: Zou Peng et al. China's Development Strategy for Becoming an Automotive Industrial Powerhouse. *Strategic Study of CAE*, <https://doi.org/10.15302/J-SSCAE-2018.01.004>

sales have been ranked first in the world for eight consecutive years, making it the world's largest automotive manufacturer. In 2015, China's automotive sales accounted for 27.9% of total global sales with its net increase accounting for 71.1% of global growth. Total automotive sales are rising (Fig. 1), and multinational automotive companies have accelerated their distribution strategy for the Chinese market, implemented in-depth localization of research and development, and developed extensive product portfolios, downstream channels, and pricing scope. At the same time, the role that the development of the automotive industry plays in national economic development continues to grow, and its role in international trade has begun to be apparent. Automotive products satisfy the needs of the people and have become one of the most important symbols of an improved quality of life among citizens. For the automotive industry itself, the industry is capital and labor-intensive, characterized by high production intensity, and high technological integration. The automotive industry is a typical representative of indirect social production activities, which occupies an important position in the national economy [3]. In addition to the large market and its prominent status in the national economy, the transformation of the automotive industry has provided numerous opportunities for various countries.

The changes in the automotive industry are mainly reflected in the fact that the center of gravity of the automotive industry may shift and that new energy vehicles and those equipped with intelligent networks have become crucial segments. New features such as electrification, light-weighting, and intelligence are new opportunities for the industry. At the same time, the automotive industry is being reshaped by changes in automotive consumption trends, manufacturing processes, and business models. By using new energy and intelligent networks as the breakthrough points to lead the transformation and upgrading of the automotive industry, the Chinese automotive industry has good opportunities but also faces many challenges.

2.1 Market space for new energy vehicles

The Chinese government has been encouraging the develop-

ment of new energy vehicles since 2009. From 2009 until the end of 2016, cumulative sales of new energy vehicles in China have exceeded one million units, making it the world's largest new energy vehicles market by volume. In recent years, sales of new energy vehicles in China have gradually increased (Fig. 2). According to the Ministry of Public Security statistics, at the end of 2017, the number of new energy vehicles in China reached 1.53 million units, accounting for 0.7% of total vehicles. Among them, 650 000 new energy vehicles were registered in 2017, which was an increase of 156 000 units compared to 2016 or an increase of 24.02%. In the overseas market, new energy vehicle sales in the United States was at 477 000 units in 2017, with a 5.6% growth and the total sales volume was lower than that of China. Among them, all-electric vehicle sales rose by 23% to 168 000 units. China is now ranked first globally for new energy passenger cars in terms of sales for 2016 (Fig. 3).

According to the multifaceted interpretation of new energy vehicles in the Made in China 2025 initiative, new energy vehicle sales in China will exceed three million units in 2025 while sales of Chinese brands of new energy vehicles (all-electric + plug-in) will exceed one-third million units and these vehicles will account for 70% / 80% of total vehicles. The vast market space and the global development trend of new energy vehicles have brought great development opportunities to China.

2.2 Promotion of the corresponding automotive industry policies

To better respond to new changes in the automotive industry, many countries have introduced the appropriate policies that support the new energy vehicle industry and appropriate policy guidelines for intelligent network vehicles. Foreign new energy vehicle industries have been supported by policies such as cash subsidies, tax subsidies, and points systems to promote industrial development. The most beneficial policies are fiscal policies, which are also a widely used method globally. At the same time, countries have placed varying emphasis on technological subsidies and R&D subsidies.

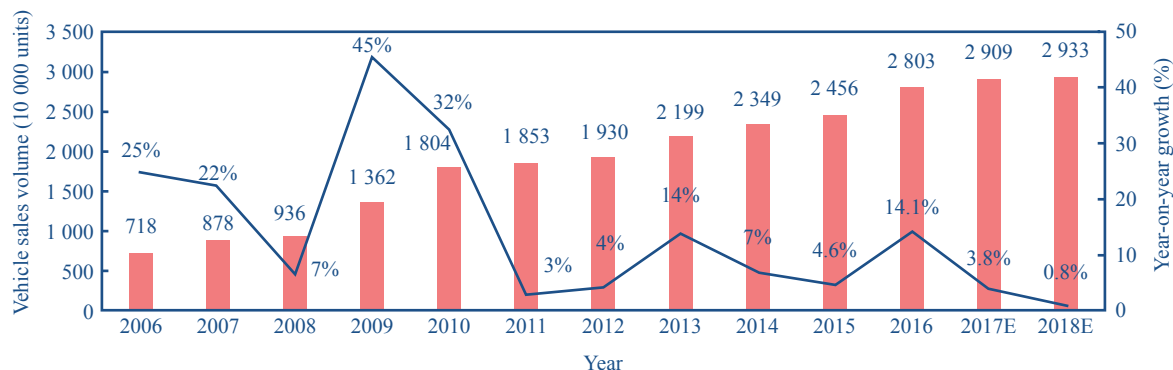


Fig. 1. Vehicle sales growth by volume in China.

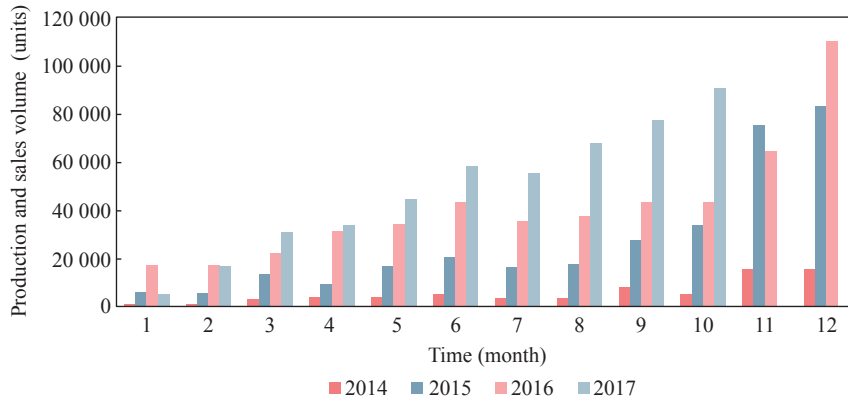


Fig. 2. Production and sales volume of new energy vehicles in China.

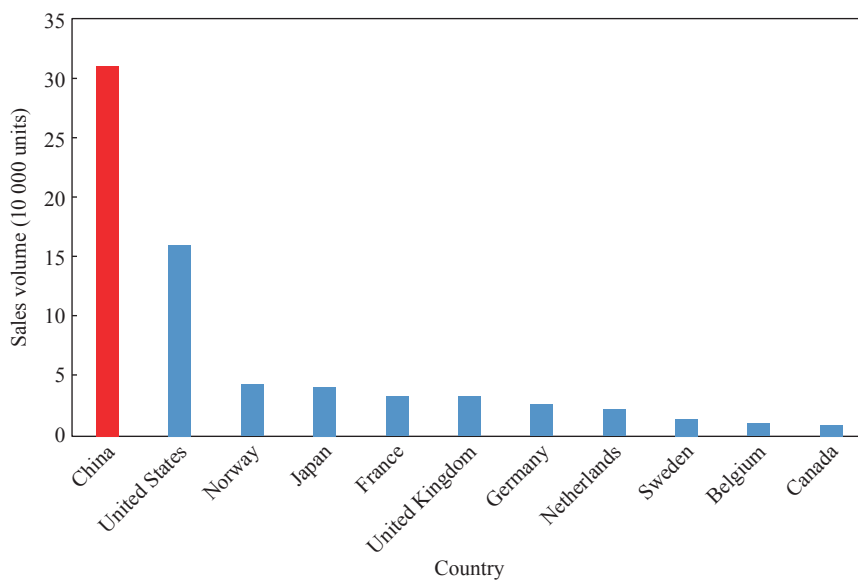


Fig. 3. Global sales volume of new energy passenger vehicles by region in 2016.

As the world's largest automotive market, China has adopted the "point system" policy and taken the lead in the global automotive industry revolution. By implementing this policy, for every gas vehicle manufactured by the traditional automotive industry, a percentage of funds needs to be paid for the purchase of new energy vehicle points, while new energy automotive companies will also receive the same subsidies that traditional automotive companies receive for every unit manufactured. At the same time, the proposed policy will also promote the expansion of production scales and, subsequently, new energy vehicles will be rapidly developed.

2.3 The rapid development of the intelligent networked automotive industry

With the continuous development of transportation intelligence, the integration of intelligent networks has become a focus of the automotive industry. Intelligent transportation and automated driving are significant trends for the future of the auto-

motive industry. The automotive industry is an essential vehicle for industrialization and informatization. The integration of the automobiles with industrialization and informatization will, on the one hand, promote networking, intelligence, light weighting, electrification of vehicles, increase the modularity and digitization of automobile manufacturing, promote the formation of a modern automobile service industry, and accelerate the establishment of a modern automobile industrial system. On the other hand, it will promote the development of related industries and information industries throughout the entire industry chain such as automotive R&D, manufacturing, marketing, automotive service industries, as well as the development of intelligent network integration vehicles, thereby promoting the actualization of industrialization and the improvement of informatization. At the same time, some intelligent network automotive companies such as Baidu driverless vehicles and NIO automobiles have emerged in China, which provide a basis for the development of the Chinese intelligent automotive industry.

3 An analysis of the major issues of China's automotive industry amidst the new revolution

Although the current state of the global industry and prospects and trade development in the domestic market provide China with excellent opportunities for industrial development, the automotive industry still suffers from the following issues compared with the international automotive industry in the context of the new automotive revolution.

3.1 The weak competitiveness of the core technologies of traditional and emerging automotive industries

Given the new revolution, weak competitiveness is mainly apparent in the relative weakness of the internal combustion engine technology of the traditional automotive industry along with the state of new energy and intelligent network core technologies. Most of the automotive manufacturing profits come from the internal combustion engine technology, which is the traditional core automotive technology [4]. Most companies that set up factories in China adopt sole ownership structures to control core technologies and core components along with achieving control over the auto part industry chain. Bosch (China) Investment Co., Ltd., Denso (China) Investment Co., Ltd., and Siemens (China) Ltd., and other such multinationals have a combined market share of 60%. The core technologies that go into new products in the Chinese automotive industry are still mainly reliant on foreign components.

Amidst the revolution in the automotive industry, China's output of electric vehicles and smart cars is first in the world regarding output and market size, but there is still a significant gap between domestic technology accumulation and the international standards. Regarding new energy vehicles, this technological gap is mainly manifested in core battery technology, core electronic control technology, and other areas. Taking battery technology as an example, improving energy density, mileage, and reducing costs will become critical points in upgrading the technology. At the same time, in terms of the continued operation of electric passenger vehicles, there is a particular gap between the mileage and energy consumption of Chinese vehicles compared with those from foreign countries. Regarding intelligent network integration, the core technology lies in designing and implementing advanced driver assistance systems (ADAS) [5]. Vehicle sensors such as millimeter-wave radar, ultrasonic radar, infrared radar, laser radar, and millimeter-wave radars are currently a mainstay in ADAS systems. Compared with international standards, China still exhibits a gap in millimeter-radar research. Another core technology is the core processors of control units. The control unit, which is the processing chip, analyzes and processes the information collected by various sensors and then issues corresponding instructions to the communication module and the control module. The processing capability of the processing

chip is an important factor that affects the intelligence of the ADAS system. China is still relatively behind when it comes to processing chip technology. Therefore, creating breakthroughs in core technologies remains a significant issue that needs to be resolved given the revolutions in the Chinese automotive industry.

3.2 The high dependence of the new energy automotive industry on government policies

The promulgation and implementation of new energy industry policies are summarized in the following four steps. First, a pilot operation was initiated, where the corresponding indicators and pilot initiatives were selected to begin operation. The second step was the use of a more considerable amount of industry subsidies to increase the expansion and scale of the new energy automotive industry. The third step was to increase the relevant standards and use technical requirements as a guideline for eliminating enterprises that are falling behind technologically. The fourth step was to enhance the strength of leading companies by primarily subsidizing those that are technologically advanced. Looking at the overall state of subsidy policies in recent years, subsidies have been declining. With all-electric passenger vehicles, for example, subsidies for these vehicles declined between 2013 and 2017. While the size of the new energy industry has not reached a large scale, and their own brands and technologies have not yet reached a relatively stable state, the decline in subsidies may increase the production pressure experienced by new energy vehicle enterprises. This, in turn, could eliminate some SMEs that demonstrate potential but rely on subsidies early on. This forms a monopolistic situation favoring leading enterprises, which is not conducive to the sustainable development of the new energy automotive industry. Improving the coordination of the relationship between the development of the new energy automotive industry and policy support to achieve the optimal industrial development results is still an issue that requires further exploration.

3.3 The relative lack of industry standards and supporting infrastructure

The promotion and implementation of emerging technologies and industries, and the catching up and improvement of industry evaluation standards and supporting infrastructure are significant issues. National standards for new energy vehicles are not perfect; many vehicle models need to undergo negotiation for technical product standards with bodies regulating vehicles and vehicle manufacturers during the demonstration and promotion period [6]. There is a lack of construction acceptance standards for associated infrastructure such as charging ports and charging stations, national standards on acceptable parameters are unclear, and key technical parameters are inconsistent. Aside from the

relevant standards, supporting infrastructure is still lacking. Regarding charging stations, the number, and types of charging stations need to be further refined. The layout and setup of charging stations for ordinary passenger vehicles, buses, and taxis have not yet formed a large scale while the low number of charging stations and their layouts have a significant influence on the purchase behavior of consumers and pose an obstacle to the development of the industry.

Regarding the development of intelligent networked vehicles, road traffic conditions in China are highly complex, which poses a significant challenge for the widespread application of intelligent transportation and intelligent vehicles. More infrastructure and breakthroughs in key technologies will be required. The integration of intelligent network integration vehicle development strategies between the information industry and the automotive production industry at the national level is not very high. Creating intelligent vehicles and developing network integration have become the development strategies of the United States, Japan, Europe, and other countries and regions. After nearly ten years of implementing national projects, the framework for driving the traditional automotive industry, information industry, and electronics industry using the development of intelligent and networked vehicles have begun to take shape. Countries and regions such as the United States, Japan, and Europe have estab-

lished a thoroughly coordinated system of promoting organizations [7]. Although China has a strong Internet industrial base, it is overly focused on sales and services. The integration of areas such as information services and after-market offerings in the automotive industry with informatization still has a long way to go.

4 An analysis of the development path of China towards an automotive industrial powerhouse

By analyzing the domestic and foreign automotive industries in the context of the new revolution along with the opportunities and problems that China currently faces, this research proposed a multilink development path that considers Chinese automotive enterprises as its main elements (Fig. 4). Chinese brand vehicles, along with principles such as insisting on independent innovation, insisting on industrial transformation and upgrading, insisting on perfecting joint ventures, and insisting on deepening reforms, are the core components of building an automotive powerhouse [8]. To achieve a significant increase in independent innovation capabilities, Chinese brand vehicles need to occupy a leading position in the market, develop new energy vehicles, improve the degree of intelligence in their products, and increase the degree of internationalization.

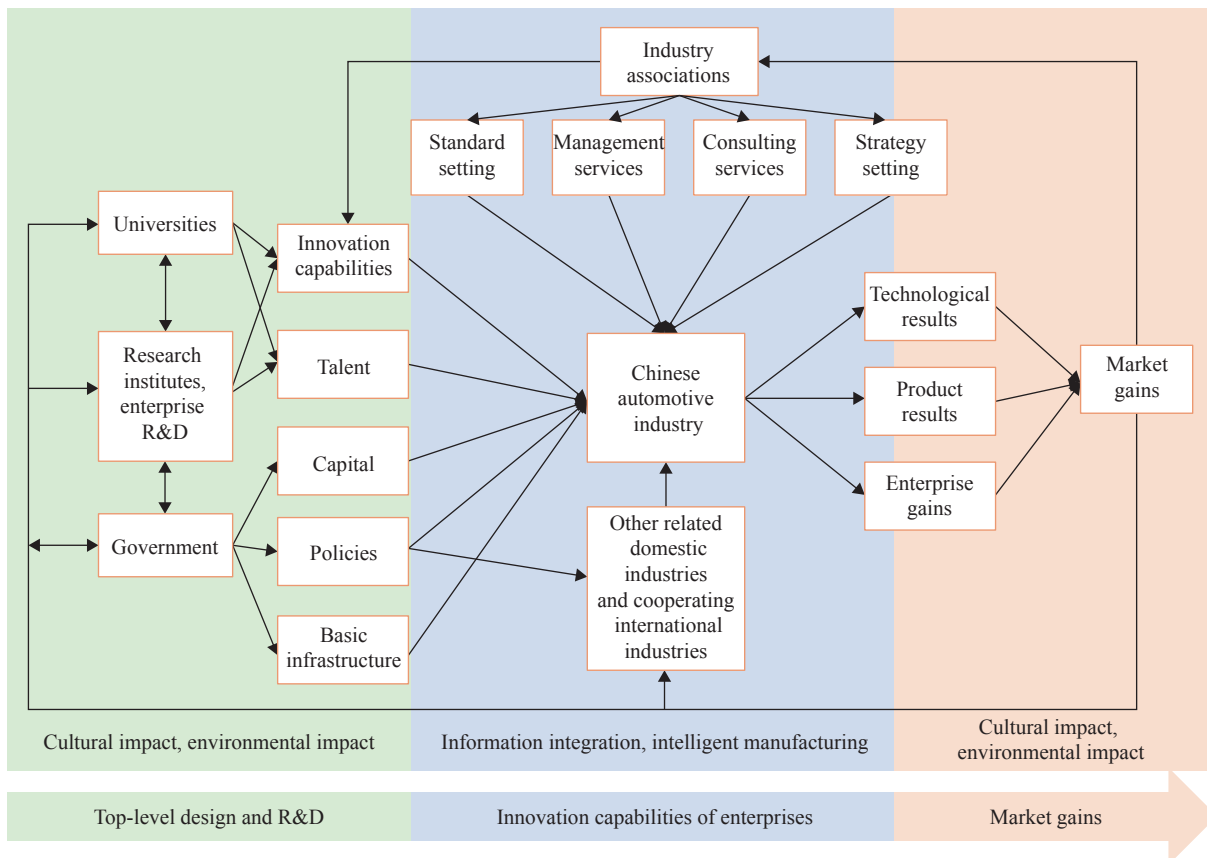


Fig. 4. Development path of the Chinese automotive industry.

4.1 Top-level design support

In the development of vertical integration, the state plays a vital role as the top-level design proponent in guiding the top-level design and direction of industrial development. The strategy of “innovative development, coordinated development, green development, open development, and shared development” mentioned in the development program of the “13th Five-Year Plan” has become a powerful basis for the top-level policy formulation for the automotive industry. The opinions of the *Automotive Industrial Development Plan in the “13th Five-Year Plan”* clearly state that eight key tasks such as deepening management reforms, vigorously developing Chinese brands, and implementing innovation-driven development will set the direction for the sustainable development of the automotive industry. This will help to establish gradually a series of policies that support the development of the industry. Among policies supporting intelligent network integration, the relevant laws and distribution of responsibilities for unmanned vehicles are areas of high concern.

4.2 Strengthen independent innovation by Chinese automotive enterprises

Independent innovation by the Chinese automotive industry requires human resources, financial resources, and material resources. For automotive enterprises themselves, it is necessary to improve their scientific and technological capabilities, build core technologies, and enhance innovation capabilities. In this process, the government can promote and encourage automotive scientific and technological innovation through many channels such as financial subsidies and policy support. To accelerate scientific and technological R&D, the cooperative development of the industry, academia, and research could be the right approach. A technological chain, which enhances innovation capabilities, will be established by improving awareness of independent innovation and strengthening both independent and collaborative R&D.

Innovation can be improved through the cultivation of talent. By establishing a talent pool system for the automotive industry, the government can actively absorb core technology and management talent both at home and abroad. Additionally, the government can guide and encourage talented individuals to work toward the development of Chinese brands. The government can also grant special state allowances to talented individuals who enter the talent pools of Chinese brands. The government can implement more open talent policies and vigorously attract high-level talent to return to China to become innovators and entrepreneurs. The government should improve the system for protecting talent and intellectual property and establish a secure chain of innovative talent.

4.3 Improve the informatization integration of the development of the automotive industry

Smart manufacturing and intelligent networking promote the integration of the automotive and information industries. Regarding smart manufacturing, digital technologies such as big data and artificial intelligence are used to perform digitized manufacturing. For intelligent networking, its role in further strengthening the development of automotive networking, big data traffic, intelligent transportation, and intelligent vehicles is to form a highly intelligent information chain.

4.4 Relevant industry associations play a supporting role for third-party services

Relevant industry associations have a wide range of micro to macro industry experience and background, which allow them to centralize advantageous resources and development trends in the industry. These qualities allow them to provide management services, consulting services, and formulate corresponding regulations, standards, and development strategies to address the issues currently faced by their industry, promote the harmonious development of the automotive industry, and create a high-quality service chain.

4.5 Create a supply chain that meets international standards

The supply chain of the automotive industry is complex; it involves many upstream and downstream enterprises. Regarding the supply of spare parts, it is necessary to strengthen the cooperation of parties both at home and abroad to integrate all the separate entities and create sources of high-quality spare parts. Regarding materials and devices, the automotive industry needs to further strengthen its links with the standards of the relevant industries and achieve world-class standards. With regards to downstream clients, the industry needs to strengthen cooperation with international customers, create a brand effect that is internationally competitive, promote the evolution of results into tangible benefits, and form a world-class supply chain.

5 Proposed policy measures for the development strategy of China for becoming an automotive powerhouse

Based on the analysis of the status quo of the Chinese automotive industry and comparing it with that of other countries, although the Chinese automotive industry is leading in terms of scale and market demand, it lacks in core technologies. Additionally, domestic brands show low levels of internationalization, the development of new energy technology and intelligent vehicles still lags behind other countries, and the relevant policies

and systems still need improvement. Therefore, a multilink development path that considers Chinese automotive enterprises as its main elements is proposed. The specific measures proposed are described below.

5.1 Support independent innovation by automotive enterprises

It is proposed that the protection for innovation in key technologies and the results of these innovations be protected by enterprises during the process of independent innovation. For core technologies, the main measures proposed include:

(1) Based on international experience, basic research in the automotive industry, common key core technologies, and ways to build comprehensive framework platforms, it is proposed that through national policy support, a national-level “Joint Innovation Center for Automotive Technology” be established for key spare parts, advanced materials, new energy technology, smart technology, and intelligent transportation. This center can incorporate enterprise research centers, research institutes, and university research teams. It will become a powerful and guaranteed way for the automotive industry to enhance its core competitiveness. The focus of the Joint Innovation Center for Automotive Technology will be innovation results and the evaluation of innovation results. For example, patent and new product data can be used as indicators to evaluate the development of the Joint Innovation Center for Automotive Technology. At the same time, the establishment of the “Automotive Battery Innovation Center” will be based on existing battery research and development institutions. It will strengthen automotive battery testing and verification, and possess industry-wide service capabilities. It will include a battery research and development center (including research on standards), pilot center, testing and verification center, and an industry service center. It will have the ability to develop cutting-edge vehicular batteries and promote the technological progress within the existing body of vehicular battery research.

(2) Concerning financial support, it is proposed that taxes, subsidies, and funds will be used to support independent innovation in the new energy automotive industry. Some increases in refined oil consumption tax revenue will be used as a special fund to support the development of new energy vehicles. Additionally, the policy for tax deductibles toward automotive research and development expenses will be further implemented. Subsidies and funds will be used to increase the support for research and development for new energy technology and intelligent network technology. The scale of the automotive industry innovation and liaison fund will also be increased. However, according to the analysis of existing issues, some SMEs are excessively dependent on subsidies. Determining the value of subsidies granted based on the development stage and scale of enterprises is a measure that can be adopted to address this phenomenon. Additional measures include promoting enterprise development and growth in scale through high subsidies in the early stages with a reduction later on, and through increasing

incentives for innovation enterprises indirectly from subsidies. This will reduce the dependence of companies on government subsidies and effectively enhance their ability to innovate independently.

(3) For the results of innovation, the protection of intellectual property rights must be strengthened, and penalties increased, a core think tank for the automotive industry be established, and incentives to increase output be adopted. In general, the goal is to use various methods to support basic research and cooperation for research into common technologies through technological and financial support. This will promote national capabilities in basic research, focus resources towards developing electrification and intelligent vehicles, invest in additional cutting-edge research, and increase investment in basic automotive research. A special national fund will be established through an annual partial tax increase on the automotive industry to support investment in technological innovation by automotive enterprises.

5.2 Strengthen the establishment of standards and supporting infrastructure

For new energy vehicles, it is necessary to establish and improve the system of standards that govern charging facilities and formulate plans for the development of new energy vehicle charging facilities. ① The number and location of charging stations needs to be planned in a manner that is integrated with social capital to utilize existing sites and facilities, thereby improving their construction. Power grid companies need to connect the power infrastructure with the installation and expansion of charging facilities. ② The construction of charging facilities and power grids, and urban planning needs to be planned holistically. The relevant construction standards should be raised, and the construction requirements for charging facilities along with the required proportion of charging facilities to parking spaces need to be clarified. It is proposed that entities accelerate the construction of residential parking spaces revolving around charging facilities. Urban public parking spaces and temporary parking spaces must be equipped with charging stations to complement the variety of charging stations in urban environments, and a reasonable number of charging facilities shall be set up. Furthermore, charging facilities on expressway service areas must be established, and the construction of a network of charging facilities on intercity expressways should be actively pursued.

With regards to the joint development of intelligent networks, it is necessary to quantify indicators used for standards and promote the rapid development of intelligent networking. The primary goal is to create an intelligent traffic environment that includes online and offline infrastructure. ① Online infrastructure currently supports the establishment of intelligent vehicle networks and intelligent transportation through big data. At the same time, it can create a third party or public automotive industry cloud platform that provides online integration services such as

design services, equipment management, logistics management, and business services. ② Offline infrastructure currently consists of the establishment of specific intelligent transportation environments such as the construction of an unmanned bus track and site. At the same time, government departments must assess the degree of proper urban planning necessary for the introduction of intelligent technology. Regarding manufacturing, the establishment of national-level automotive production and the use of information databases will make data feedback and big data analysis a reality. They can also help to develop a common basic design software platform, and carry out special demonstration projects for intelligent automotive manufacturing.

5.3 Strengthen the service role of industry associations

Industry associations will provide management services and consulting services for the development of the automotive industry, and formulate corresponding regulations, standards, and development strategies to solve the current problems faced by the industry. ① Associations should study the development goals of the industry, and submit information and suggestions on the development planning, regulatory systems, standards, and regulations to the appropriate authorities through industrial research projects. ② Associations should prepare and establish strategic platforms for various innovation centers such as the “Joint Innovation Center for Automotive Technology” and the “Automotive Battery Innovation Center.” ③ The role of industry organizations should be utilized to promote the development of the industry, for example, by creating platforms that connect vehicle manufacturing with various seminars and exchanges on Chinese brand passenger vehicles and commercial vehicles. When it comes to evaluation activities within the industry, industry associations should select leading companies that supply spare parts to facilitate centralized purchasing and a focus on the areas that require support. Associations should establish a component certification system compliant with QS9000 and VDA6.1 standards that is suitable within the Chinese context. They should also build a platform for high-quality automotive components to facilitate cooperation and development.

5.4 Establish a leading group to build a harmonious automotive society and automotive industrial powerhouse

National fiscal taxes and international financial platforms should be used to support key enterprises in conducting more strategic and extensive overseas share purchases and acquisitions. Global resources can be used to improve the operational capabilities of Chinese enterprises and improve the competitiveness of Chinese automotive brands, thereby gradually transforming China into an automotive export powerhouse. The first action is to strengthen the development of homegrown brands and stimulate an increase in the proportion of homegrown brand

vehicles in sales. The second action is to suspend the restrictions on the number of shares in automotive joint ventures to provide time and space for Chinese brands and multinational brands to develop their competitive advantages.

A leading group should promote harmonious development and develop guidelines for the development of a harmonious automotive society to promote the integration of automobile development and urbanization. A traffic flow system that is smooth, fast, convenient, smart, safe, and environmentally friendly should be created, and the construction of parking lots and parking facilities should be accelerated. The development of the urban public transportation system and the improvement of public facilities that connect vehicles with public transport should be vigorously pursued.

From the consumer point of view, a social environment dominated by the consumption of Chinese brand vehicles should be formed. Public opinion and measures will guide the public towards creating the “Chinese dream, Chinese cars” car culture with Chinese characteristics. Under the leadership of the State Council, the consumption of Chinese brand vehicles will be promoted. The relevant national ministries and organizations should jointly study, formulate, and promulgate the “China’s Development Strategy for Becoming an Automotive Industrial Powerhouse.” This strategy can then be used as a guiding tool to concentrate the core resources and strengths related to the development of the automotive industry. Lastly, it can promote a concerted effort to build a harmonious automotive society and transform China into an automotive industrial powerhouse.

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