

# Summary of Research on Automobile Power Strategy in New Era (I)

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**Abstract:** This article is the first part of a summary of research on automobile power strategy (comprising two parts) sponsored by the Chinese Academy of Engineering. This study investigates and summarizes the overall situation of automobile development, and analyzes the environment and the development trend of the automobile industry in China. We conclude that the Chinese automotive industry is experiencing a vital development period. Based on our analysis, we describe the essence of automobile power in the new era. We propose focusing on quality improvement and efficiency enhancement in the automotive industry and on the coordinated development of the automotive society as two main features of automobile power in the new era. In addition, we discuss the importance of building an automobile power from ten aspects.

**Keywords:** automobile power, automotive industry, automotive society

## 1 Overall summary

According to the report delivered at the 19th National Congress of the Communist Party of China, China has entered a new era of socialism with Chinese characteristics. Currently, the main social conflict has become the contradiction between unbalanced and inadequate development and the people's ever-growing needs for a better life [1]. Therefore, the major objective and mission in the new era of automotive development is, at present, to devote energies to solving the problem of unbalanced and inadequate automotive development.

The automobile is a "machine that changes the world." Its emergence and popularization have significantly accelerated

the development and advancement of the human society. The automotive industry is a typical capital-, technology- and talent-intensive industry. It is characterized by high input, high output, increasing returns to scale, a high level of industrial linkage, strong economic stimulus, high technological level, strong employment stimulus and other distinct properties. The automotive industry is universally recognized as a pillar industry of the national economy and an important marker of a country's overall economic, technological and national defense power as well as its social development level. Historically, the explosive economic growth of developed countries and regions like Europe, the U.S., Japan and South Korea was accompanied by the rapid growth of the automotive industry; their economic

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statuses are also generally in line with their global rankings in the comprehensive power of the automotive industry (Table 1) [2]. The widespread popularization of the automobile has expanded people's travel radius and transformed urban and rural structure, accelerating social development. Hence, the degree of construction of automotive society is also one of the important signs of social development.

The automotive industry is a pillar industry of China's national economy. The output value of the automobile manufacturers (automobile-manufacturing industry) accounts for around 2% of the economic aggregate [3]. Take the ratio of the automobile manufacturers' output to their contribution to the national economy—1:6-1:8. The value-added related to the whole industry chain (automotive industry) accounts for over 10% of GDP. In 2016, the principal operations of the automotive industry accumulated 8 334.5 billion yuan in total revenues, outshining other typical industries (Fig. 1). In recent years, the tax revenue and employment derived from China's automotive industry have accounted for over 10% of the national tax revenue and the total urban employment respectively [4]. The automobile remains the top commodity in China. In 2017, the sales volume of automotive products was 4 222.2 billion yuan, accounting for 11.5% of China's total retail sales of consumer goods [5].

It is also the primary means of transport, generating most passenger and cargo traffic in China. Commercial highway passenger traffic (excluding private cars) and cargo traffic in 2016 accounted for 81.19% and 77.46% of the total national passenger and cargo traffic respectively [6]. As of late 2017, the number of vehicles per 1 000 inhabitants in China was approaching 150. The automobile has found its way into every family's home and become the main mode of transport. It has significantly expanded people's activity space and altered their production methods and ways of living, accelerating social progress significantly.

For nine consecutive years, China has ranked first among countries in automobile production and sales volume. In 2017, China produced and sold 29.01 million and 28.88 million vehicles respectively. It is estimated that, by 2025, the volume will grow to 35 million vehicles [4]. Within the next five years, the automobile will form an enormous market and bring tens of trillions of dollars in revenue. The automotive industry will become a major pillar of China's economic development. While the automobile will be deeply integrated into people's work and daily lives, the construction of an automotive society will also advance.

Nevertheless, China's past automotive development was largely characterized by extensive quantitative growth and

lacked fine qualitative improvement. The automotive industry is placed in a dilemma where it is enormous but lacks strength. There is still a huge gap between China and global automobile powers like Germany, the U.S., Japan and South Korea. In terms of the automotive industry, China is currently faced with a variety of issues, including weakness in independent innovation, sluggish development of the automotive component industry, a lack of competitive automobile companies and a low level of globalization [7]. In terms of the automotive society, with the rapid annual increase in the number of vehicles owned in China (Fig. 2), the contradiction between automobile and unbalanced and inadequate social development has been increasing and even intensifying. A series of serious social problems, such as energy waste, environmental pollution, traffic congestion and traffic safety are present in the life cycle of the automobile, including the design, manufacture, use, maintenance, scrapping and recycling of vehicles. With the new wave of technological and industrial revolutions, the constant emergence of new technologies, new business models and new business formats has also posed new challenges to automotive development. While the scope of automotive development is expanding by the day, the integration of the automotive industry and other industries advances progressively. The influence of the automotive industry increases every day. There is an urgent need for us to examine the development of the automotive industry and society from a higher, further, and broader perspective.

Therefore, "automobile development" mentioned in this article entails two parts—the development of the automotive industry and that of the automotive society. Automobile development is not only associated with China's sustainable economic and social development but also closely related to people's daily lives. It is an important component for building China into a country that is prosperous, strong, democratic, civilized, harmonious and beautiful in the new era.

## 2 New situations of China's automotive development

### 2.1 Major structural changes in automotive development

The new wave of technological revolution and industrial reforms has promoted automotive reforms and development. Technological breakthroughs such as big data, artificial intelligence, 3D printing and advanced materials have driven multiple technological reforms, transformation to upgrade the automotive industry. With the emergence of subversive product technologies,

**Table 1.** Rankings of GDPs of major countries and comprehensive power of the automobile industry.

Country	U.S.	China	Japan	Germany	U.K.	France	Italy	South Korea
Gross domestic product (GDP)	1	2	3	4	5	6	8	11
Comprehensive power of the automobile industry [2]	3	8	2	1	7	5	6	4

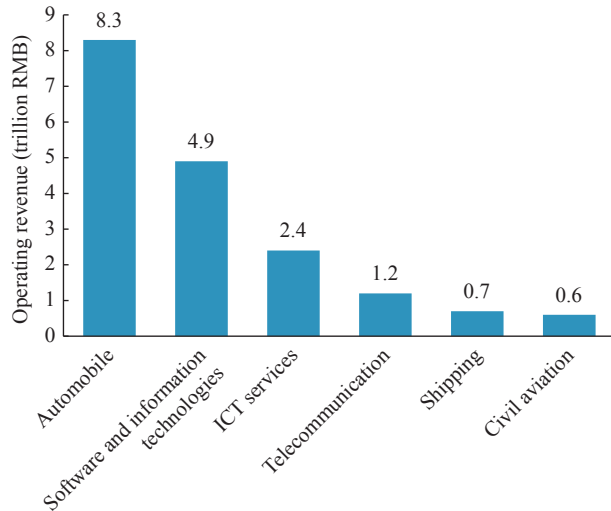


Fig. 1. Operating revenue of the automobile industry and some typical industries in 2016.

represented by new energy vehicles and intelligent vehicles, new industrial organization patterns such as asset-light subcontracting and mass customization and business models such as car sharing and the platform economy have utterly changed the industrial organization. With the restructuring of the value chain that pivots on the industrial, innovation and talent supply chains and the rearrangement of the division of labor, the industrial structure is being reshaped (Fig. 3).

The rise of global energy, environmental and transportation revolutions has put forward new demands for automotive development. With the aggravation of the global energy crisis and environmental pollution caused by the automobile, different

countries are actively seeking new forms of automotive development using various methods such as promoting automotive technological advancement and exploring new business models. To satisfy the ever-growing demand for energy and environmental conservation, developed countries and regions like Europe, the U.S., Japan and South Korea have increased their research and development (R&D) investment in new energy vehicles and car sharing one after another. On top of that, global transportation reforms are on the rise. Alongside the accelerated development and upgrading of traditional modes of transport, composed mainly of general aviation, rail transport, marine vessel traffic and road traffic, new forms of transport are constantly emerging; examples include supersonic airliners, high-speed rail and super high-speed trains. A new ecosystem of intelligent, diverse, multi-dimensional and high-efficiency transportation is taking shape. Overall, this has added impetus to the development of the automotive industry toward convenient, free, green and safe transportation as well as intensive development, among other goals.

Both the connotation and the denotation of the automobile have been growing unceasingly. The automotive industry will shift from manufacturers to mobility service providers. The industrial domain will extend from R&D and manufacture of automotive products to vehicle leasing, mobility services, data support, recycling and other related fields. Strategy&, a subsidiary of PricewaterhouseCoopers (PwC), predicts that in 2030 the global digital and mobility service industry can expect a market valued at 2.2 trillion USD; meanwhile, the share of profits generated by the current automobile manufacturers will be cut by half [8]. The integration of the automobile and the Internet; communication; and even industries like tourism, catering and entertainment continues to deepen. The automobile is thoroughly

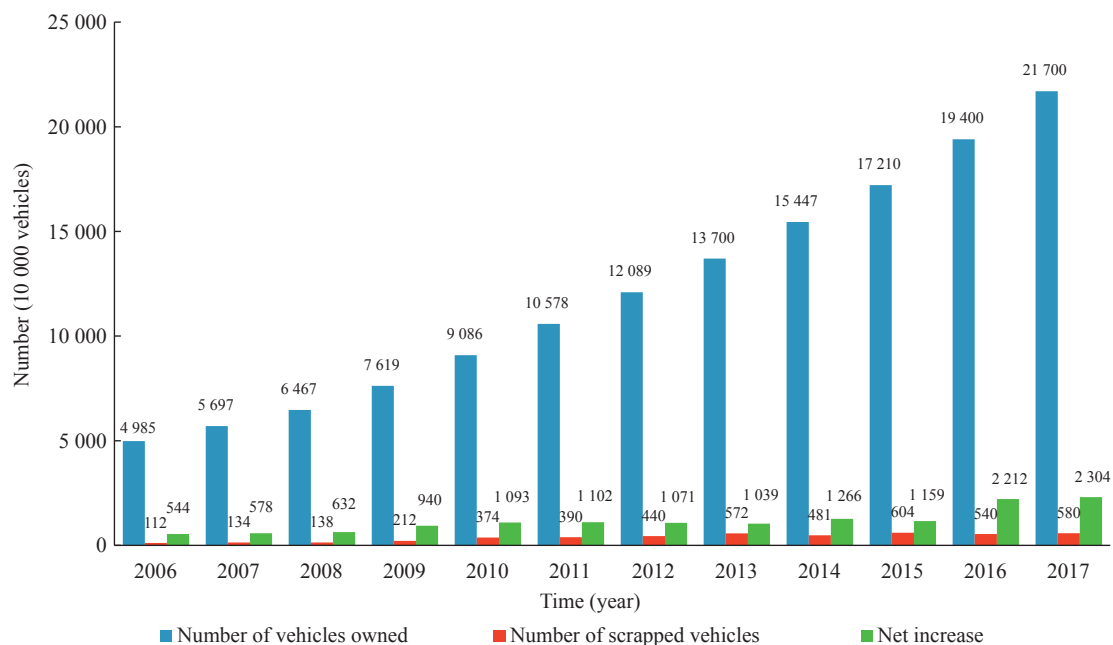


Fig. 2. Vehicle ownership/ scrapping/ net increase in China in 2006–2017.

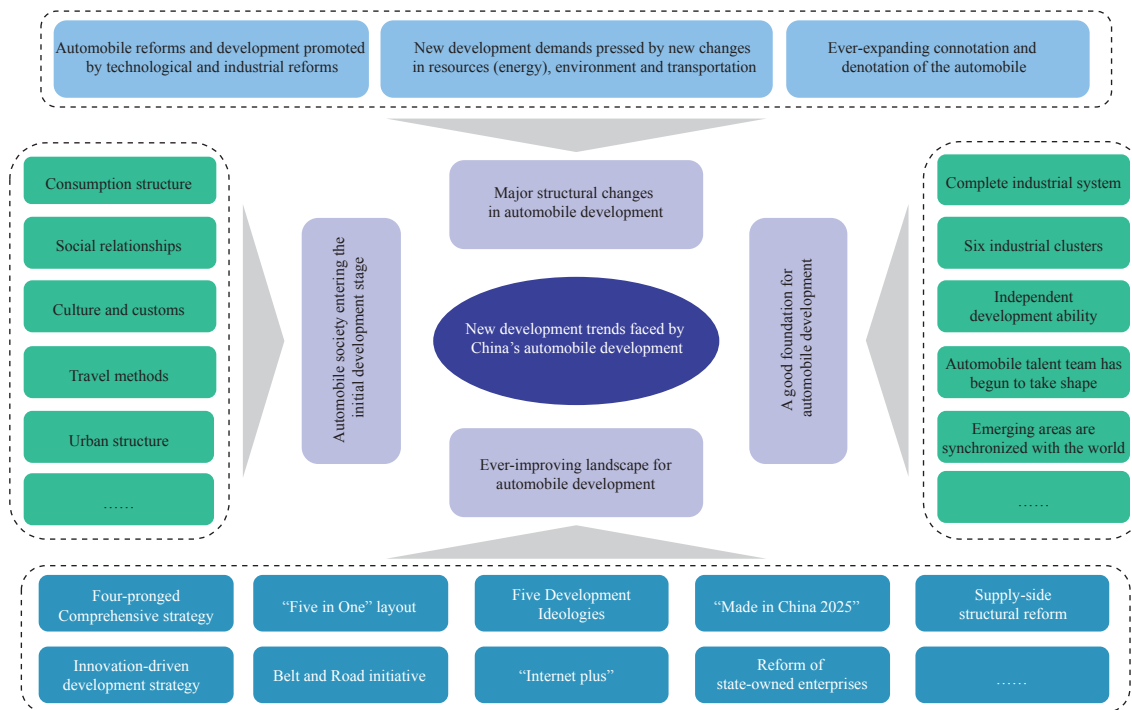


Fig. 3. New development trends faced by China's automobile development.

integrated into social development, and an ecosystem of new vehicles is slowly coming into being. The automobile is gradually shifting from a single-attribute means of transport to a mobile terminal, turning into a “machine that is changed by the world.”

## 2.2 Continuous optimization of the automotive development environment in China

The “Five in One” layout and the “Four-pronged Comprehensive Strategy” proposed by the Central Committee of the Communist Party of China have both pointed automotive development and strategy formulation in a clear direction. The five development ideologies of “innovation, coordination, green development, openness and sharing” have provided directional guidance for driving the transformation and upgrading of automotive development. The strategy of “innovation-driven development” has further defined the prominence of innovation and acknowledged the urgency and necessity of automotive development that is oriented toward independent innovation and the establishment of Chinese brands. The steady advancement of supply-side structural reform has brought immense opportunities to improve supply efficiency and structural adjustment of the automobile. Energy-efficient and new energy vehicles will become one of the 10 key development areas of “Made in China 2025.” With the aid of information technologies, the “Internet plus” will form a new pattern of “Internet plus automobile,” which accelerates the revolutionary development of the automobile. Guided by the Belt and Road Initiative, China’s automotive industry will

be able to explore larger markets and fully leverage the existing production capacity to boost international cooperation, speeding up the pace of the Going Global Strategy (Fig. 3).

Under the unified plans by the Central Committee and the State Council of the People’s Republic of China, state-owned automotive enterprises have accelerated their reforms. In September 2017, FAW Group Corporation activated systematic reforms that involved the management framework, brand layout and personnel system. The state-owned automotive enterprises have embarked on new exploration for their reforms. In April 2017, the former Central Leading Group for Comprehensively Deepening Reforms proposed the vigorous promotion and development of entrepreneurship and seized the key points of the market economy, including the “critical minority” and “special talents.” This produced positive impacts on China’s state-owned enterprises, especially the persons-in-charge of automotive enterprises, in terms of breaking through administrative leadership, stimulating enterprise vitality and accelerating the adaptation to the market economy.

Apart from that, the various policies on the development and support of the automotive industry formulated by different administrative departments also play an active role in driving automotive development. Currently, the government’s financial subsidies for new energy vehicles have exceeded a hundred billion yuan. The “double-integral” policy, which benefits the development of energy-efficient and new energy vehicles, was also announced in due course. The strategy of intelligent vehicle development will also be launched soon.

In summary, the Chinese government’s active support has

built a favorable environment for the automotive industry to develop from being large to being powerful.

### 2.3 A good foundation for automotive development

After advancing through hardship for more than 60 years, China's automotive industry has developed a more complete industrial system. Substantial improvement has been obtained in various aspects, including industrial development, production and sales scale, R&D innovation, establishment of Chinese brands and development of new energy and intelligent vehicles. Six industrial clusters and a number of automotive groups have been formed. The industrial concentration has been increasing continuously. In 2017, six automotive enterprises made their way into the Global 500 list. Chinese brands like SAIC Motor, Changan Automobile, GAC Group, Geely, Great Wall Motors and BYD have been developing rapidly, possessing stronger market competitiveness in some specialized areas. China's automotive industry has also continued to reinforce its participation in the global division of labor. Some auto and parts enterprises represented by Geely and Fuyao Glass have been actively exploring new paths for developing Chinese brands through overseas mergers and acquisitions and overseas expansion planning (Fig. 3).

In terms of technical ability, the automotive enterprises in China basically possess the ability to independently develop components such as automobile bodies, chassis, powertrains, electronics and electrical appliances and interior and exterior decoration. While completely localized automobile assembly has been achieved, the rate of localization of core auto parts is also on the rise. The automotive industry has fundamentally realized the transformation from technological dependence to independent development. In terms of brand building, Chinese brands continue to take up increasing market share in the passenger vehicle market and hold certain advantages in some specialized areas. Furthermore, the national team of automotive talent has also begun to take shape.

China's new energy vehicle industry is ranked front in the world, with the world's largest production and sales volume. With the rapid development of key components like power batteries, motor drivers and electrical control system, the technical ability, production capacity and after-sales service level of the major enterprises continue to improve. Due to China's advantages and prospective layout in aspects like communication and the Internet, the industrialization level of intelligent vehicles is basically synchronized with the rest of the world.

### 2.4 Rapid advancement of the automotive society

With the continuous expansion of the scale of automotive development, the importance of the automobile will be increasingly manifested in the development of the automotive society.

According to the universal standard for an automotive society (20% of households possess vehicles), China entered the initial phase of an automotive society in 2012. As of late 2017, the total number of vehicles owned in China exceeded 217 million. On average, there were over 45 vehicles per every 100 households nationwide. China has rapidly become an automotive society. The automobile is closely related to Chinese people's work, daily lives and travel. The impacts on various aspects of society, including the public's consumption structure, way of travelling, culture and customs, have been substantial (Fig. 3).

The rapid development of the automotive society has exerted tremendous pressure on the carrying capacity of social resources. The social problem brought about by the automobile has become extremely serious. In recent years, the growth in the amount of oil consumed by China's automobiles has stimulated the continuous growth in petroleum consumption. In 2017, China's foreign oil dependency reached 67% [9]. Oil consumption by automobiles accounts for up to 50% of total crude oil consumption. The use of vehicles has also resulted in pollution problems, such as air, soil, water and noise pollution. The exhaust gas from vehicles is one of the major air pollutants in large cities. Traffic congestion has become the most prominent issue for China's urban transportation; problems like driving and parking difficulties and traffic chaos are increasingly noticeable every day. Statistics show that every year, China suffers from an economic loss of a trillion RMB due to traffic congestion. The problem of road safety remains serious. In 2016, China had a mortality rate of 2.14 deaths per 10,000 vehicles due to traffic accidents [10], which was over six times higher than that of Japan.

## 3 New dynamics in China's automotive development

### 3.1 Gradual clearing-up of the new characteristics of automotive development

The new characteristics of China's automotive development, including low carbon, electrical, connected, intelligent and shared vehicles, have generally become clearer. The low-carbon development of vehicles is directly correlated with the carrying capacity of the social environment, as the large-scale usage of vehicles has led to energy consumption and carbon emissions, which are the primary causes of the ever-deteriorating environment in some regions, especially the densely populated urban areas. There is an urgent need for such low-carbon development. Electric-powered vehicles, represented by pure electric vehicles and fuel-cell electric vehicles, have been the mainstream. Vehicle electrification is an irreversible trend. With the constant development of communication, information and artificial intelligence technologies, intelligent connected vehicles have also become the main orientation of automotive development. Related studies indicated that advanced automatic driving can significantly im-

prove traffic efficiency and reduce traffic accidents by over 90%; it is, therefore, the inevitable direction of future automotive development. Car sharing can also enhance the vehicle utilization rate substantially, especially in cities, where it will significantly improve the traffic efficiency of urban roads and effectively reduce the number of vehicles and tolls. Advanced development of car sharing will even provoke a new round of transportation reforms and urban–rural structural transformation.

Currently, different countries are focusing their power on these new characteristics of automotive development. Automotive enterprises are adjusting their strategic directions and increasing their R&D investment in terms of these characteristics, laying out the next-generation automotive development in an active manner.

### 3.2 Further expansion of the automotive industry

The experience of developed countries shows that the automotive development of a country or region is tightly related to its economic development and urbanization. Although China currently ranks second in the world in terms of GDP gross, due to its enormous population of 1.39 billion (end of 2017), its GDP per capita is only around 9,200 USD, which continues to place it at a middle-to-low position in the world. There is still a substantial gap between China and moderately developed countries (with GDPs per capita of 25,000 to 30,000 USD). In terms of urbanization, the urbanization rate of China in 2017 was up to 58.52%, which was just level with the global average and still very far behind that of developed countries (most with urbanization rates of over 80%). As China is striding toward the status of a middle-income country, its income per capita and urbanization rate will continue to improve steadily. This will undoubtedly create a lasting demand for automobiles. Therefore, for a rather long period in the future, the scale of China's automotive production and sales will display a steady increase, and its automotive market will maintain its position as the world's largest market. Other than that, with the continuous strengthening of the power and openness of the automotive industry, overseas markets will also bring new opportunities to China's automotive development.

### 3.3 Scale of the automotive industry still in rapid growth stage

In the more than 100 years since the birth of the automobile, it has gone through three major global shifts: Europe—the U.S.—Europe—Japan and South Korea. Each of these global shifts greatly stimulated the economic, social, cultural, technological and industrial advancement of the destination countries. During the first three shifts, countries like the U.S., Germany, Japan and South Korea developed into global automobile powers one by one. In-depth analysis of the development history and characteristics of these automobile powers reveals that they all basically

went through two stages during their emergence—rapid growth and stable maturity. The rapid growth stage generally takes 20 to 30 years. At present, the global structure of the automotive industry is undergoing reconstruction. The general belief is that developing countries, represented by China, India and Brazil, will become the main bodies of the fourth global shift of the industry.

China is the country that has shown the greatest dynamism and potential in global automotive development during recent years. The number of vehicles owned in China is still growing continuously at an annual rate of over 10%. On the basis of the development experience of global automobile powers, China's automotive development is still at the stage of rapid growth and has yet to enter the stage of stable maturity (Fig. 4). In addition, due to China's vast territory and enormous population, its automotive development is more complicated. The rapid growth stage may, to a certain extent, be longer than that of the global automobile powers.

Many domestic and overseas research institutes and authoritative experts have predicted the scale of China's automotive development (examples are listed in Table 2). The prediction results show that a relatively wide gap remains between the actual vehicle production and sales volume and the predicted values. The scale of China's automotive industry will continue to grow for the next period of time.

### 3.4 A New round of major opportunities for automotive development

Currently, China's automotive industry has entered a critical development stage of shifting from being large to being powerful. A new wave of technological and industrial reforms will drive radical changes in the forms, production methods and business models of automotive products. In the future, new-energy and intelligent vehicles will constitute the main battlefields for competition within the automotive industry. As new technologies, business formats and business models emerge unceasingly, the competition landscape of the global automotive market will be reshaped. Overall, China's automotive development is at a stage where it is enjoying new opportunities brought about by the reforms; the late-developing advantages outrun the disadvantages. The overall development will bring considerable opportunities for the building of China into an automobile power.

The current landscape of China's automotive development is generally improving, with the ever-increasing optimization of the external environment, as in the macro-policies. The domestic demand for vehicles is steadily rising. The market still has relatively large potential, particularly in new-energy and intelligent vehicles, which are going strong alongside the automobile powers. The automotive society is at an initial stage and experiencing rapid growth, which forms a favorable foundation for building an automobile power.

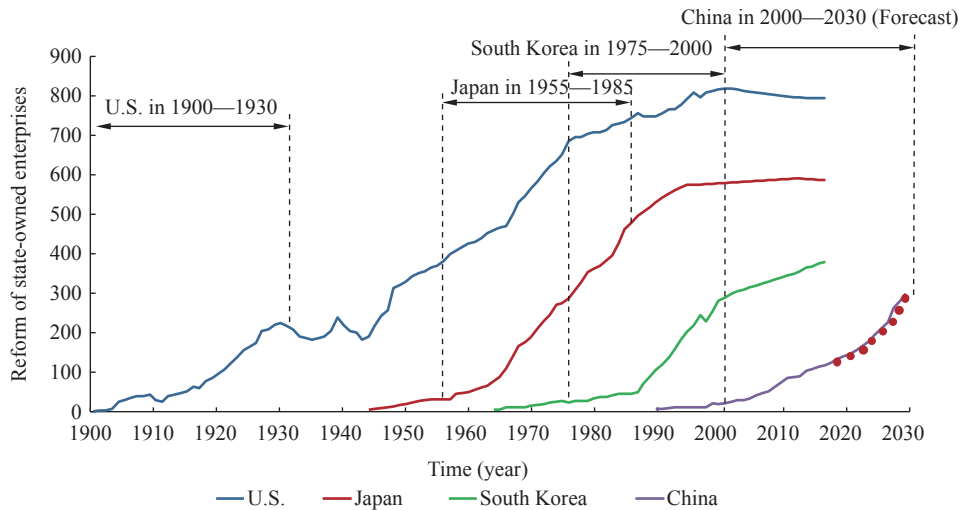


Fig. 4. Comparison of the rapid growth stage of the automobile industry in the U.S., Japan, South Korea and China.

Table 2. Several predictions about the growth of China's automobile industry.

Source	Prediction
Mid-long term development plan for the automobile industry	35 million vehicles by 2025
Michael Dunne (Forbes)	40 million vehicles by 2030
McKinsey & Company	41 million vehicles by 2030
Edward C. Prescott, a Nobel laureate	70 million vehicles by 2030
Xu Changming from the State Information Center of China	Theoretical peak of 42 million vehicles
Dong Yang from the China Association of Automobile Manufacturers	Theoretical peak of 50 million vehicles
Zhao Fuquan from Tsinghua University	Theoretical peak of 40 million vehicles

Overall, China's automotive development has welcomed a new phase of major opportunities. If China follows the current development trend, seizes any strategic opportunities and actively explores new paths suited to the domestic conditions for building itself into an automobile power, after five to ten years of endeavor, it is expected to be able to secure a position among the world's automobile powers.

#### 4 The essence and characteristics of the automobile power in the new era

In May 2014, Xi Jinping, the General Secretary of the Communist Party of China, put forward the idea of "automobile power" during his visit to SAIC Motor. In April 2017, the "Mid-long term Development Plan for the Automotive Industry," jointly issued by the Ministry of Industry and Information Technology, National Development and Reform Commission and the Ministry of Science and Technology of the People's Republic of China, specified for the first time the overall goal of building an automobile power. Correspondingly, the Chinese Academy of Engineering activated the "Automobile Power Strategy Research" program, which aims at exploring the paths and methods for building China into an automobile power in the new era. On

the basis of such research, the essence and characteristics of an "automobile power" are elucidated as follows.

First, the essence of "the automobile" has been constantly developing and changing. In 1953, China established the automotive industry, which mainly comprised the complete vehicle and parts manufacturing industry. Before the large-scale penetration of vehicle ownership among households in the 20th century, China's automotive development mainly referred to the development of the automobile-manufacturing industry, as in the *Automobile Manufacturing Industry Policy* enforced in 1994 under the approval of the State Council.

After the beginning of the 21st century, with the explosive expansion of the automotive market, the term "automobile-manufacturing industry" no longer sufficed to cover all the aspects of automotive development accurately. The manufacturing industry was used as a core for attracting upstream and downstream sectors to gradually construct a complete automotive industry chain. The idea of the "automotive industry" became widely accepted, as in the *Automotive Industry Development Policy* issued by the National Development and Reform Commission in 2004.

With the progress of China's automotive industry, especially the large-scale popularization of vehicles over the last decade, both the connotation and the denotation of the automobile have

been expanding continuously. On the one hand, new technologies, business models and business formats have brought about fundamental changes to the overall automotive development. The integration of the automotive industry with other industries, such as the information, communication, Internet and tertiary industries, further deepens. Radical changes have taken place in the automotive industry per se. On the other hand, hundreds of millions of vehicles have exerted an immense impact on China's economic, social, cultural and ecological development. Automotive development has become tightly connected with social development. Under such circumstances, the term "automotive industry" can no longer accommodate all the aspects involved in automotive development. Therefore, "the automobile" in the new era should include automotive products, the automobile-manufacturing industry, the automotive industry, the automotive society, and many other automobile-related aspects. In this article, all these aspects are simply summarized as the "automotive industry" and the "automotive society," collectively referred to as "automobile development" (Fig. 5).

Second, the "power" of "automobile power" has two connotations: "power," as in the adjective "powerful," which means China is determined to become a country with a powerful automotive industry and a coordinated and balanced automotive society; and "power" as a verb, which means building China into a world power through the enhancement of the automotive industry, which shifts from quantitative to qualitative, and the healthy, sustainable development of the automotive society.

The "automobile power" discussed in this article is distinctively characterized by qualitative improvement and efficiency enhancement in the automotive industry as well as the coordinated development of the automotive society (Fig. 6).

## 5 The significance of building an automobile power

### 5.1 Improvement in China's overall economic power

The development of the automotive industry and its associated industries serves as a substantial driving force for the sustained growth of China's economy. The tax revenue and employment generated from the automotive development, along with other things, are closely related to national macroeconomic indicators. On the one hand, the construction of an automobile power can significantly stimulate the real economy, in turn serving as an important force driving the shift from the virtual to the real economy. On the other hand, the experience of the "Latin American whirlpool," the "East Asian bubble," and the "MENA crisis" indicated that many developing countries are caught in the "middle-income trap," mainly because they lack autonomy and control of the major industries, the automotive industry in particular. They have had some painful lessons to learn. The building of an automobile power can substantially increase China's autonomy and control of the pillar industries, thereby serving as the key measure for helping China overcome the "middle-income trap."

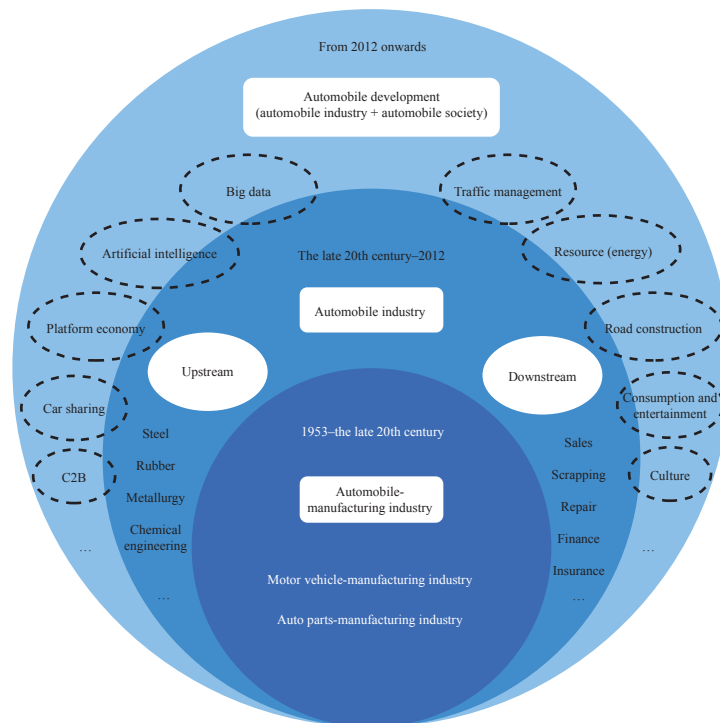


Fig. 5. Illustration of automobile development (automobile industry + automobile society).



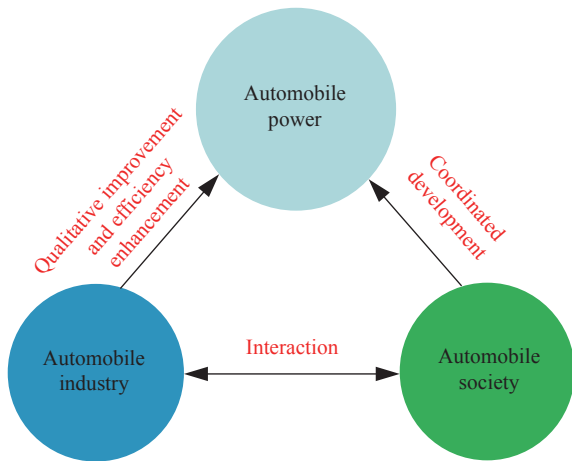


Fig. 6. Characteristics of an automobile power in the new era.

## 5.2 Construction of the new-type industrialization system

On a global scale, the automobile-manufacturing industry is a miniature version of the regular development of industrialization, leading the direction of industrial development. Over the course of modern industrial development, the most advanced methods for industrial management were largely innovated by automobile manufacturers. The quintessential examples of these advanced industrial models ranged from Ford's assembly line production to Toyota's lean production system. The industrial level of a country's automotive industry marks the highest standard of the national industrial system. An advanced automotive-manufacturing industry can transmit its institution, talents and management ideologies continuously to other industrial sectors, consequently driving the improvement in the overall industrial level of the country. China's automobile-manufacturing industry occupies an important position in the industrial system. Its transformation, upgrading and technological breakthroughs will stimulate the upgrading and a series of structural adjustments to the basic industries. At the current stage, its innovative management, production and utilization methods and innovative integration with other aspects—such as information, artificial intelligence and green development—can hopefully lead to the construction of the “new-type industrialization” system, making it become the leading example of the world's advanced industrial systems.

## 5.3 Realization of the goal of building a manufacturing power

The automotive industry serves a crucial role in the manufacturing industry, as the rise and fall of the latter is often closely related to the former. As a highly-integrated industry, the automotive industry nearly covers all the manufacturing sectors along the industry chain, including metallurgy, materials, energy, chemical engineering, electronics and information technologies. Hence, it is immensely powerful in stimulating and driving the

entire manufacturing industry. The strength of a country's automotive industry is basically a sign of the strength of its manufacturing industry. The global automobile powers are, without exception, also the global manufacturing powers. From the overall perspective of building China into a world manufacturing power, the realization of this goal requires a certain powerful leading industry. In terms of its scale, influence, stimulating effects and other aspects, the automotive industry can achieve a major breakthrough in the building of a manufacturing power. Therefore, an automobile power can act as the engine for building a manufacturing power by stimulating the comprehensive improvement of the manufacturing industry.

## 5.4 Increase in international competitiveness

As the largest traded commodity, the automobile has a profound impact on international trade and international relations. It has always been used as an important bargaining chip in international negotiation. Automotive development is fundamental to enhancing a country's international competitiveness. Take the example of the world's top 500 enterprises that were worth over 100 billion USD in 2017. Excluding industries with lower technological value-added, such as banking, insurance and retail, there were 25 enterprises with an annual operating revenue of over 100 billion USD. Overall, they can be divided into three types: energy, automobile and information and communication technology (ICT) enterprises (Fig. 7). Among them, nine were automobile enterprises, taking up a ratio of 36%. This shows that the automotive industry is the economic pillar of most developed countries. For Japan and Germany in particular, it is even the absolute pillar of their economic development. As for China, even though SAIC Motor made its way onto the list, the vehicle sales volume of its Chinese brands in 2017 only accounted for around 7.5% of its total sales volume, which implies that there is still a large gap between Chinese brands and the world-class automotive giants. From this viewpoint, the automotive industry is China's weakness when it comes to its international competitiveness. The building of an automobile power can effectively alter China's passive role in future international competition.

## 5.5 Promotion of the building of an innovation-oriented country

The automobile is the ideal medium of high and new technologies. The new technologies involved in the automotive industry are unmatched by those in other industries, with regard to their breadth and abundance as well as the enormous investment put into them. The automotive industry has invested a considerable amount into R&D. Every year, automobile manufacturers worldwide spend over 100 billion USD on R&D, which is four times the R&D investment in aerospace and national defense (25.5 billion USD) [11]. The automotive domain has harvested

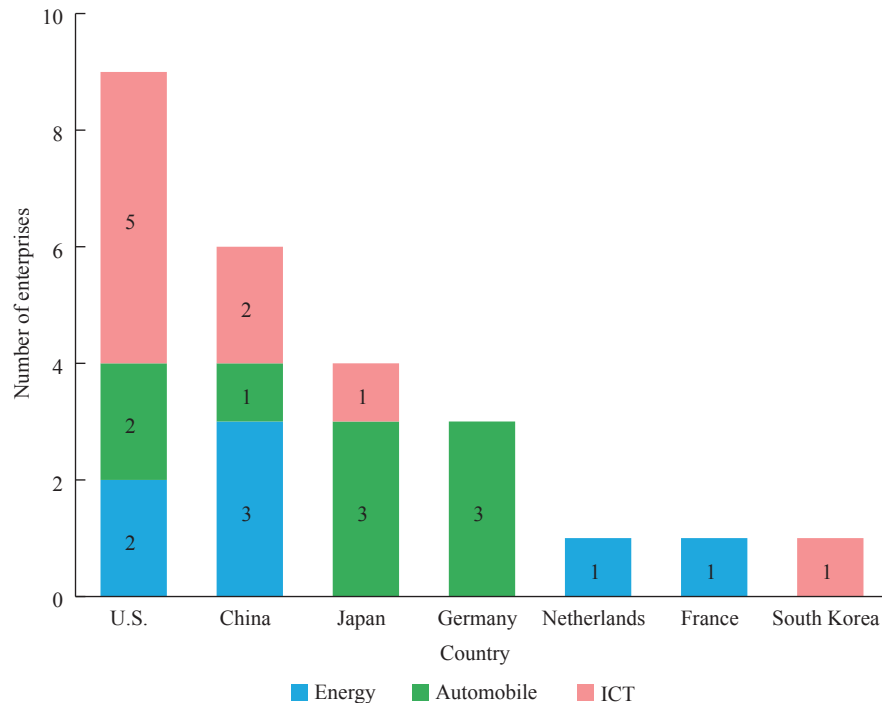


Fig. 7. The number of world's top 500 enterprises worth over 100 billion USD in 2017.

an abundance of innovative achievements. In 2016, the global automotive industry owned a total of 189 000 patents for their inventions, which accounted for 11% of the total number of patents worldwide. Currently, new automotive technologies, represented by new energy and intelligent vehicles, are ever-changing; technological innovation is advancing at a remarkable speed. This will push China further toward all-round innovation and promote cross-disciplinary integration. Thus, the building of an automobile power will guide national technological advancement and serve as an important driving force behind the building of China into an innovation-oriented country.

### 5.6 Formation of a new open market

The automotive industry is a competitive industry with distinct market attributes. Excellent automotive enterprises and products can only stand out from the crowd through continuous development and improvement in an adequately competitive environment. As a field that was opened up at an earlier stage, China's automotive industry has achieved good results, but the degree, intensity and pace of opening up still fail to catch up with the development of the automotive market. For a long time, the imperfectly competitive environment in the domestic market and the difficulty in implementing the "going global" strategy are the main bottlenecks restricting automotive development. Under the context that China is currently expanding the scope of its opening-up, the measures of leveraging international and domestic resources fully, promoting further opening-up of the automotive market and taking advantage of the Belt and Road

Initiative to make substantial efforts in "going global" are of great significance to building a more dynamic and open market system in China.

### 5.7 Resolution of contradictions in the automotive society

The core of social contradictions caused by China's rapid shift to an automotive society, such as energy waste, urban overcrowding, road safety and environmental pollution, lies in the lack of good management of the coordinated development and relationship of "human-automobile-society." The automobile happens to be the link and core of this relationship. Currently, it has become a universal mode of transport and is integrating deeply into the public's entire daily routine. During such integration, pushing forward the building of an automobile power in all aspects, planning the solutions to the current contradictions built around the automobile, and realizing the coordinated and balanced development among humans, automobiles and the society are the three keys to solving the various contradictions in the automotive society. They are also important issues that China must tackle urgently during the construction of social, cultural and ecological civilization.

### 5.8 Enhancement of China's cultural soft power

As the development of China's automotive society started rather late, the construction of its automotive culture lags behind that of other countries. Ever since China has become an automotive society, the relationship between vehicles and the public has

become increasingly close. The automotive culture has gradually become a symbol and medium of the social culture as well as an important component of China's socialistic culture. During the integration of the automobile into society and culture, a unique automotive culture with Chinese characteristics will also gradually take shape. It will be manifested in various aspects, including R&D, design, manufacturing, consumption, and usage of vehicles as well as road traffic and environmental protection. When building China into an automobile power, guiding the development of the automotive culture appropriately and constructing a new automotive culture characterized by innovation, energy conservation, green development, convenience, safety and other aspects are crucial to increasing the soft power of China's socialistic culture.

### 5.9 Acceleration of the construction of a resource-conserving and environment-friendly society

Building a resource-conserving and environment-friendly society is an important feature of a "beautiful China." Vehicles are the major sources of resource (energy) consumption and pollution emission. Hence, by promoting the building of an automobile power, planning the development of clean-energy vehicles with diverse power sources—such as hydroelectricity, wind power, nuclear power and biomass—and accelerating the formulation and implementation of energy-conserving and emission-reducing measures, China can conserve resources, reduce emissions, and optimize the energy structure from the source. Currently, the automobile is gradually expanding from large and medium-sized cities to small cities and the vast villages. It is steering into urban communities and driving into rural farmlands. In light of this, promoting the coordinated and balanced development of the automotive society is an important driving force of a resource-conserving and environment-friendly society. It also carries great significance for the building of a "beautiful China."

### 5.10 Elevation of national defense power

As the main tool for land transport of a variety of modernized weapons and equipment, the automobile is an important component of China's defense power. In modern warfare, the strength of a country's manufacturing industry determines its military power. As the core of the manufacturing industry, the automotive industry can effectively stimulate the overall development of China's weapons and equipment. Historically, Ford Motor Company, which invented assembly-line production, manufactured fighter aircraft and bombers with phenomenal efficiency during wartime; this greatly improved the military power of the U.S. In a modern army, vehicles remain the most common mobile equipment on land, serving as a guarantee of the motorization of the

army, military weapons and equipment. With the future development of information-based and intelligent vehicles, an increased number of military functions will be performed by vehicles. Hence, promoting the building of China into an automobile power can effectively strengthen its national defense power.

## 6 Conclusions

Currently, China is faced with an unprecedentedly favorable opportunity for building itself into an automobile power. As the largest developing country and the economy with the greatest potential, it should seize this once-in-a-lifetime opportunity and accelerate the construction of this automobile power, contributing to the realization of the Chinese dream of "the great rejuvenation of the Chinese nation."

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