

Analysis on Different Countries' Intelligent Connected Vehicle Industry Policy

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ABSTRACT

Intelligentization and network connection are the two inevitable trends of the future vehicle development. The Intelligent Connected Vehicle industry emerges at the historic moment, and a good policy environment is significant to the development of an industry. Therefore, based on the perspective of policy tools, this paper divides the policy tools into three types: supply-oriented policy tools, environmental policy tools and demand-oriented policy tools. In the main part of the paper, I have combed the relevant policies of the United States of America, Japan and China. I compared the different countries' policies of the Intelligent Connected Vehicle industry and analyzed the similarities and differences so as to get the policy implications and suggestions for the future development of Intelligent Connected Vehicle industry.

Keywords: *Intelligent Connected Vehicle, Industry policy, Policy tools.*

1. INTRODUCTION

We can imagine that a new traffic era seemed to be about to dawn when Intelligent Connected Vehicle (ICV) be driven on the road. Intelligentization, network connection, electrification and sharing are the development trend of ICV industry, the one of the most intensive industries, has become inevitable. The development of ICV industry has also become the focus of attention all over the world.

With the progress of a new round of technological revolution, the new technologies, methods and tools emerge prominently together, such as cloud computing, artificial intelligence, blockchain, pushing the ICV into a critical period of transition from test and verification to commercialization. For a long time, the development of ICV industry is dependent on the policy support. A good policy environment is fertile ground for ICV industry. Based on the perspective of policy tools, I will sort out and analyze different countries' policies of ICV industry in order to get the policy implications for the future development of ICV industry.

2. LITERATURE REVIEW

The ICV industry is a hot spot of global innovation and a commanding elevation for future development. At

present, the development of relevant policies is the main driving force for the development of the ICV industry.

Some authors presented future direction of development about the ICV industry through the systematic analysis of the industrial policies of ICV. They think the safety is the important by analyzing ICV road test regulations of different countries[1]. CCID think tank(2020) summarizes the impact of ICV on the existing rules, and presents suggestions for the revision of the policies and laws of ICV in China[2]. Guo Jun(2018) analyzed the current policy trend and existing problems from the perspective of industrial promotion, demonstration testing, information security, supporting facilities, laws and regulations, technical standards, furthermore, he discussed how to improve the industrial policy[3].

Some authors mentioned the industrial policy of ICV in the research on relevant industry. The use of ICV can enhance performance of transportation systems[4]. In some comparative studies, the authors introduced the road test policies of ICV in different countries and regions around the world [5]. Some researchers suggest to focus the discrepancy between the objectives of urban transport planning and federal government's policy [6]. Li Yuke(2016) analyzed the policy environment from three aspects, which are development strategy, policies and regulations, testing and demonstration[7], and he

put forward suggestions for the development of ICV in China[8].

There are some other studies on the industrial policy of the vehicle mentioned ICV. Zuo Shiquan(2020) combed and analyzed the foreign industrial policies from four aspects which are strategic planning, R & D innovation, application, and intelligent connection so as to get the enlightenment[9].Liu Wenqiang(2019) pointed out that new energy vehicles and intelligent Internet connected vehicles have become the focus of industrial policy since 2008[10].

To sum up, the existing researches on the industrial policies of the ICV are not perfect. Most of authors refer to the policy environment issues and analyze them in their papers about development or current situation of the vehicle industry.

3. THEORETICAL BASIS

As an important path of public policy research, the theory of policy tools emerged in the 1980s. According to different division basis, different scholars also classify different policy tools. I select Rothwell and Zegveld's(1984) classification method, which based on the objects of policy tools[11]. The policy tools are divided into supply-oriented policy tools, environmental policy tools and demand-oriented policy tools.

Supply-oriented policy tool means the government's support for information, technology, capital, talents and other elements at the supply level, so as to improve the supply of relevant elements. Through the Supply-oriented policy tools of ICV industry, which includes human resource training, infrastructure construction, support of capital and technology, the development of ICV industry is promoted. Environmental policy tool means providing a policy environment that is conducive to the development of the industry through tax system, laws and regulations, including goal programming, tools of financial finance, tax preference, regulatory standards ad so on, in order to indirectly promote the development of ICV industry. Demand-oriented policy tool means the measures of procurement and trade control to expands market demand. Including government procurement, outsourcing, trade control and overseas institutions, the demand-oriented policy tools can promote the development and utilization of the ICV industry. According to this, the impact model of policy tools on the ICV industry can be built as shown in figure 1.

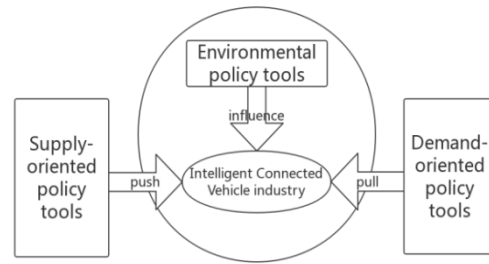


Figure 1Policy tools of Intelligent Connected Vehicle industry

Based on the theoretical basis, the ICV industry can develop with high-speed and high-quality only under the policy environment suitable for the current situation of industrial development. Actually, the policy effect can be better through synergy of three policy tools.

4. OVERVIEW OF INDUSTRY

According to the definition of intelligent networked vehicle by China Association of Automobile Manufacturers, the Intelligent Connected Vehicle means the new generation of cars without human operation, equipped with advanced on-board sensors, controllers, actuators and other devices. It can exchange and share intelligent information between car and X (person, car, road, backstage, etc.) to ensure safe, comfortable, energy-saving and efficient driving, with functions of complex environment perception, intelligent decision-making, collaborative control and execution, etc.[13].

The origin of Intelligent Connected Vehicle dates back to 1939, when General Motors exhibited Futurama, the first self-driving concept car in the world, at the New York World Expo. However, the self-driving car has been stayed in the conceptual stage over the next 30 years because of the limit of computer, communication and electronic technology. Since the 1970s, some technology like computers, communications and electronics have been gradually applied in the vehicle industry, which has greatly promoted the development of basic research about intelligent networked vehicles. In 2009, Google started its self-driving car program, and established an independent subsidiary named Waymo. After the 21st century, with the support of science, technology and policy, many automobile enterprises such as Volvo, Tesla, Toyota and others have made great progress in ICV in the US and Japan.

Compared with developed countries, the research of ICV started late in China. The development of ICV in China has experienced several stages as small-scale research and development, research and development supporting in national level, the concept of the Internet of vehicles, the concept of intelligent Internet connected vehicle since the 1980s[8].With the release of

Made in China 2025 strategy and its series of interpretation documents in 2015, Chinese automobile, Internet and other enterprises have carried out the research and development of self-driving vehicles, such as Baidu, Shanghai Automotive Industry Corporation and Didi, etc., which have also made some achievements.

5. OVERVIEW OF DIFFERENT COUNTRIES' INTELLIGENT CONNECTED VEHICLE INDUSTRY POLICY

The policy environment is a strong guarantee for the prosperity of an industry. With the gradual development of the ICV industry, the relevant policies of different countries or regions are also promulgated and revised. Based on the perspective of policy tools, the relevant policies of the United States of America, Japan and China are combed and analyzed in this paper.

5.1. The United States of America

In 2010, the U.S. Department of Transportation released ITS Strategic Plan 2010-2014. This is the first time to put forward the development of V2X technology and automobile application from the national strategic level [14].

Through the analysis of the above policies according to the classification of policy tools, it can be found that the relevant policies of the ICV industry in the US are mainly improved from two aspects which are the strategic level, laws and regulations level, among which the environmental policy tools are the most, while the policies in tax preference and financial are relatively few. In addition, the federal government established C-V2X Technical Committee and promoted the construction of intelligent road network infrastructure, which are a supply-oriented policy tools, less than environmental policy tools. There is no obvious human resource training policy; and the demand-oriented policy tools are largely absent.

Table 1. Industrial policies of American Intelligent Connected Vehicle

Years	Policies
2010	ITS Strategic Plan 2010-2014
2014	ITS Strategic Plan 2015-2019
2016	Federal Automated Vehicles Policy
2017	Automated Driving Systems2.0: A Vision for Safety
2017	Self Drive Act
2017	C-V2X Technical Committee is established
2011—2017	the parliamentary bills about self-driving automobile are passed in Washington and other 21 states
2018	Automated Vehicles 3.0: Preparing for the Future of Transportation
2020	Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0

Table 2. Industrial policies of the Japan’s Intelligent Connected Vehicle

Years	Policies
2016	Road map of automated driving popularization
2016	Guide for automated driving vehicle road testing
2017	Road traffic Act is revised
2017	Road Transport vehicles Act is revised
2017	Standards for processing remote test Permit Applications
2017	Auto Liability Protection Act is revised
2018	Outline of system recondition related to automated driving
2018	Guide for automated driving car safety technology
2019	Road Transport vehicles Act is revised

5.2. Japan

Since 2016, relevant policies about automated driving was successively released in Japan, which has made clear the development goals and directions of automated driving. On the whole, it was the main way that policy makers revise existing laws and regulations to improve the policy environment of ICV industry in Japan.

Japan’s industrial policies of ICV are mainly environmental policy tools such as laws, regulations and standards. The laws and regulations were gradually revised by the cooperation of multi-department, which are IT Integrated Strategy Headquarters, National Police Agency, Ministry of Land, Infrastructure and Transport, Ministry of Economy trade and Industry. At the same time, the environmental policy tools of Japan's ICV industry also include the adjustment of the ICV insurance policy. Auto Liability Protection Act stipulates that any automobile driver should sign the automobile liability insurance contract; and the traffic accidents under the automated driving mode can also be compensated. However, there are almost no direct supply-oriented and demand-oriented policy tools; it means that the distribution of policy structure is uneven.

5.3. China

Since the release of Made in China 2025 strategy in 2015, a series of policies and documents related to the ICV industry has been successively issued, which has made clear the development objectives and tasks. At the same time, it was the requirements of development that demonstration bases are established to conduct pilot demonstration for the intelligent Internet connected vehicle.

Through the analysis of the above-mentioned Chinese policies by policy tools classification, it can be found that ,China promotes the development of ICV

industry mainly from two aspects in the current stage of development, which are environmental policy tools and supply-oriented policy tools. Among them, environmental policy tools mainly focus on goal planning, regulatory standards and strategic measures, while supply policy tools mainly focus on infrastructure construction and scientific and technological information support. However, the demand-oriented policy tools is relatively lacking.

6. DISCUSSION

6.1 Similarities

From the perspective of policy tools, it’s not difficult to see that the policies of the US, Japan and China are mainly based on environmental policy tools, while the demand-oriented policy tools are lacking so far. The application of target planning and regulatory standards, as environmental policy tools, are very frequent in various countries. As a new industry, the ICV industry needs the support of policies from the beginning to the exploration and then to the current development stage. Therefore, the government prefers to start with environmental policy tools to provide an environment of good technology research and development and market for the development of the ICV industry, especially the goal planning, which provides clear development direction. At present, the standards of the ICV industry have been basically formed in these countries, but they need to be improved.

In terms of the application of supply-oriented policy tools, most countries mainly make efforts in infrastructure construction at present. The foundation of ICV requires interconnection between vehicle and vehicle, and coordination between vehicle and road. So promoting infrastructure construction is the foundation of the development of ICV industry, especially the construction of road network.

Table 3. Industrial policies of the China’s Intelligent Connected Vehicle

Years	Policies
2015	Made in China 2025 strategy
2015	Guidelines on actively promoting the "Internet Plus"
2015	Carry out pilot demonstration of Intelligent Connected Vehicle
2016	Three year Action Plan of "Internet plus" Artificial Intelligence
2017	Guidelines for the construction of national standards system for the Intelligent Connected Vehicle
2018	Intelligent vehicle innovation and development planning
2018	Management Regulations on road test of Intelligent Connected Vehicles
2018	Guidelines for the construction of national standards system for the Intelligent Connected Vehicle
2018	Management Regulations for the use of 5905-5925MHz frequency range in the direct communication of the Internet of vehicles
2018	Action plan for the development of Intelligent Connected Vehicle industry
2019	Outline of Digital Transportation Development Plan
2019	Outline of Building a Powerful Transportation Country
2019	Action plan for promoting the development of comprehensive transportation big data (2020-2025)
2020	Innovation and Development Strategy of Intelligent Vehicle

In addition, there are still some deficiencies in the use of policy tools. In the application of environmental policy tools, indirect tools are often used, while direct tools such as financial and tax incentives are seldom used. The lack of financial and tax policies leads the market of ICV to lack enough energy after unleashing market vitality. Based on the current situation of the market, the lack of demand-oriented policy also makes the policy security less balanced.

6.2 Differences

The industry of ICV started late in China, but it's growing fast because of the high efficiency of government's implementation in policy. According to policy tools, the differences in the policy of ICV industry of different countries mainly lie in the degree of application of supply-oriented policy tools.

Compared with the United States and Japan, China's use of supply-oriented policy tools is not limited to the construction of infrastructure; on the contrary, a number of demonstration bases have been established to carry out vehicle road collaborative testing and prove the feasibility of ICV through the application of demonstration first; and the pilot projects in many regions have achieved good results so far.

In addition, through the establishment of cross-border cross integration innovation platform, China also provides the support of scientific and technological information for the ICV industry. At the same time, China government encourages the development of new technologies such as big data, Internet, artificial intelligence, blockchain, supercomputing, etc., and further promotes the development of China's ICV industry through the support of scientific and technological information. Compared with other countries, the application of supply-oriented policy tools in China is more balanced, but it still needs to be further improved in personnel training, financial support and other aspects.

7. CONCLUSION

According to Rothwell's and Zegveld's classification of policy tools, the relevant policies of the ICV industry in the United States, Japan and China are analyzed in this paper. The comprehensive comparison shows that environmental policy tools are the first choice of the government for the development of the ICV industry; the supply-oriented policy tools are relatively less used; the demand-oriented policy tools are extremely lacking. Therefore, the market innovation power is difficult to be stimulated. On this basis, we can get some policy implications and suggestions:

The government can further increase the environmental policy tools, especially the relevant laws

and standards. Besides, they can strengthen the application of direct tools such as financial and tax, which will help to unleash market vitality and promote the process of research and development.

The government can increase the application of supply-oriented policy tools. The development of ICV depends on the construction of infrastructure such as intelligent road network, so the investment can be increased appropriately. Meanwhile, human resource training is a supply-oriented policy tool that needs to be focused on.

It's time to appropriately apply demand-oriented policy tools to stimulate market demand and promote industrial innovation. The uneven distribution of policy tools is easy to cause the lack of industrial development momentum. Therefore, the government should select the industrial policies adapt to the different development stages of the industry. In a word, in order to ensure the rapid development of industry, it is necessary to keep the balanced development of three policy tools.

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