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Research on collaborative innovation operation mechanism of automobile industry based on national inspection service platform

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Abstract: Based on the analysis of the existing problems in the collaborative innovation of the automobile industry, this paper puts forward the collaborative innovation model of the automobile industry based on the national-level third-party automobile testing service platform, and constructs the operating mechanism of the collaborative innovation of the automobile industry, and then analyzes its dynamic incentive, risk control, incentive, communication and coordination mechanisms.

Keywords: Industry-university-research collaborative innovation; Automobile industry; Operating mechanism.

1. Introduction

With the increasingly rapid development of science and technology, technological innovation has become an important factor in promoting national economic development. Collaborative innovation is an innovative organizational model in which the government, manufacturing enterprises, universities and research institutes, intermediaries and other relevant institutions integrate resources across fields to achieve the goal of scientific and technological innovation. In the report of the 18th National Congress of the Communist Party of China, Comrade Hu Jintao took "building a technological innovation system with enterprises as the main body, market as the guidance, and the combination of production, education and research" as an important part of the implementation of the innovation-driven development strategy. In many ways of technological innovation, collaborative innovation of industry, university and research has gradually become one of the most important ways of technological innovation [1]. Scholars at home and abroad have carried out a series of exploration and research on industry-university-research collaborative innovation model, built a diversified industry-university-research innovation model, and provided theoretical basis and practical experience for industry-university-research collaborative innovation [2]. The operation mechanism is an important guarantee for the cooperation among the subjects of collaborative innovation. Only by establishing a perfect and effective operation mechanism of collaborative innovation can the collaborative innovation project run smoothly [3]. With the continuous improvement of automobile safety, environmental protection, energy conservation and other performance requirements, as well as the continuous development of Internet of Things, artificial intelligence and other technologies, the automobile industry needs continuous innovation to adapt to the needs of the new situation. This paper studies the dynamic incentive, risk control, incentive, communication and coordination mechanism of collaborative innovation in automobile industry.

2. Main problems in collaborative innovation of automobile industry

2.1. Inadequate impetus for collaborative innovation of industry, university and research

As a labor-intensive, capital-intensive and technology-intensive industry, the automobile industry has high technological content in its products and production process; On the other hand, as a pillar industry, the automobile industry has the characteristics of huge scale, high output value and tax benefits, great promotion to economic development, and fierce market competition. The characteristics of the automobile industry determine the demand and orientation of collaborative innovation of enterprises related to the automobile industry.

The automobile and main engine manufacturing enterprises have a strong power to update their products. However, from the perspective of the industrial chain, at present, the parts manufacturing enterprises in China's automobile industry, in addition to the intelligent driving system and electronic control system manufacturing enterprises, are generally low in technical content, and most of them are in a subordinate position. It is difficult to generate the power of collaborative innovation between the manufacturers of complete vehicles and main engines and the manufacturers of spare parts. Due to competition and technical confidentiality, the intention and motivation of collaborative innovation cannot be generated among the whole vehicle manufacturers and the main engine manufacturers.

2.2. Inadequate collaboration between industry, university and research

As a capital-intensive and technology-intensive industry, the automobile and main engine manufacturing enterprises benefit from their strong financial strength. Whether it is the strength of talent introduction or the investment in specialized test equipment, universities or scientific research institutions cannot compete with it. In particular, due to the fact that the

automobile and main engine manufacturing enterprises have formed their own unique product development procedures and design specifications in the long-term production and operation process, due to the consideration of the protection of trade secrets, as well as the distribution of intellectual property rights, and the difficulty of linking between research and development and production links, the automobile and main engine manufacturing enterprises, and universities or general scientific research institutions, It is difficult to directly form a deep integration of collaborative innovation, especially for Chinese-foreign joint investment in automobile and mainframe manufacturing enterprises.

2.3. Incentive mechanism for collaborative innovation of industry, university and research

The property right structure of China's automobile manufacturing enterprises is relatively complex. A considerable part of the complete vehicle factory is a Sino-foreign joint venture with major automobile manufacturers in the world. Although the state-owned capital holds a controlling proportion, most of the core technologies of the joint venture are still controlled by foreign capital. In addition, there are state-owned automobile manufacturing enterprises represented by Chery Automobile Co., Ltd., private automobile manufacturing enterprises represented by Geely Automobile Group and BYD Co., Ltd., and Internet automobile manufacturing enterprises represented by Xiaopeng Auto, a subsidiary of Guangzhou Orange Smart Motion Automobile Technology Co., Ltd. The property right structure of high-tech and relatively independent auto parts manufacturers, especially the drive system manufacturers of electric vehicles and the supporting development and production enterprises of intelligent networked vehicles, is also relatively complex.

As an economic entity, automobile manufacturing enterprises must pursue the goal of maximizing benefits. The purpose of technological innovation is to form new products produced by enterprises in batches. There is no doubt about the demand for intellectual property rights of independently owned collaborative innovation products. How to obtain the rights and interests of collaborative innovation achievements and how to motivate other subjects to give full play to the enthusiasm of collaborative innovation have become the problems that must be solved in collaborative innovation of industry, university and research.

2.4. The risk of industry-university-research collaborative innovation disclosure

Due to the large scale and high efficiency of the automobile industry, the great impact on the social economy, the rapid technological update, and the extremely fierce market competition, trade secret disputes in the automobile industry continue to arise. A large number of automobile trade secret infringement disputes have occurred at home and abroad, especially in the field of new energy vehicles and automatic driving. Whether there is a leakage of trade secrets and how to prevent the leakage of trade secrets have become issues of concern for automobile manufacturers. As the process of technological innovation in the automobile industry, especially when it comes to the development of core technologies, the innovation concept, application of new technologies, and creativity of new functions are crucial. The participation of non-enterprise personnel in innovation will increase the risk of trade secret disclosure, and the fear of disclosure will form a certain obstacle to the construction of industry-university-research collaborative innovation system.

3. The collaborative innovation mode of in-depth integration of industry, university and research in the automobile industry based on the national-level testing service platform

The process of technological innovation in the automobile industry consists of product function analysis and design, product function realization (including the combination and optimization of function element solution and function solution, sample vehicle manufacturing and mass production manufacturing), product function realization degree test and detection, product function improvement and quality control, etc. Product function analysis and design, function realization and function improvement are usually led by the production enterprise. For the automotive industry, the test and detection of the degree of product function realization and the quality control link cannot be separated from the participation of the National Inspection Center. In particular, the detection of the relevant certification and approval projects must be carried out by a third-party national inspection agency. Institutions of higher learning and scientific research have the advantage of gathering interdisciplinary and interdisciplinary talents, give full play to their scientific and technological research resources, and strive to integrate and promote the deep integration of electronic technology, information technology and automobile manufacturing technology in the process of solving the functional elements of automobile products and their combination optimization and function improvement, so as to adapt to the trend of electric, intelligent and networked automobile products.

The National Automobile Quality Inspection Center (hereinafter referred to as the National Inspection Center), as a national-level third-party inspection service platform, has world-class inspection and testing equipment and testing technology capabilities, and has passed the qualification accreditation of the National Certification and Accreditation Administration and the CNAS laboratory accreditation. On the one hand, the National Inspection Center is mainly engaged in the inspection of regulations such as the announcement project of the Ministry of Industry and Information Technology, the 3C certification project of the Certification and Accreditation Administration, the emission inspection of the Ministry of Ecology and Environmental Protection, the fuel consumption inspection of the Ministry of Transport, and the government's supervision and random inspection. The National Inspection Center will strictly implement the provisions of relevant laws and regulations to ensure the fairness and confidentiality of the inspection business. Therefore, the National Inspection Center and the relevant enterprises of the automobile industry have an inevitable connection and reliable relationship. On the other hand, the National Inspection Center can provide test and detection services, data services and decision-making services for the technological progress and new product development of various manufacturing enterprises in the automobile industry, and provide test and detection services and data services for universities and research institutions to

carry out scientific and technological research by taking advantage of its inspection and detection equipment, detection technology capabilities and detection data.

Therefore, under the guidance of the competent government departments, with the national-level third-party testing service platform as the link and the automobile manufacturing enterprises as the main body, contact the automobile industry production enterprises, universities and research institutions; Give full play to the advantages of the close combination of automobile manufacturing enterprises and the market, strong product development and industrialization capabilities, and the urgent need for continuous technological innovation and continuous development of new products; Giving full play to the advantages of multi-disciplinary integration, knowledge and technology accumulation of universities and research institutions, which is conducive to scientific and technological research, especially the advantages of forward-looking basic research, key common technologies and cutting-edge leading technology research, as well as the advantages of talent training in universities and colleges; From the beginning of project cooperation, through entrusted research and collaborative research, gradually increase mutual trust, form a closer collaborative relationship, build a long-term cooperative industry-university-research collaborative innovation platform (center), promote the in-depth integration of industry-university-research, and promote the continuous self-improvement and development of the collaborative innovation system in the process of technological innovation, so as to improve the technological innovation ability of the automobile industry and benefit the in-depth integration of industry-university-research in the automobile industry, It plays a positive role in promoting the technological progress and industrial development of the automobile industry.

4. Cooperative innovation operation mechanism of automobile industry

According to the synergy theory, the automobile industry technology collaborative innovation system, as a management system, is a complex open system. It is an open system in a non-equilibrium state. In the process of material and energy exchange with the outside world, it gradually transforms from a non-equilibrium state to an open system in time, by playing an internal synergy, such as mutual cooperation and cooperation, mutual interference and restriction between different units Ordered structure in space and function [4]. The purpose of constructing the operation mechanism of collaborative innovation is to form an orderly structure of the main bodies (subsystems) participating in the collaborative innovation of industry, university and research in the automobile industry, to improve and develop themselves in the process of technological collaborative innovation, and to achieve synergy.

5. Analysis on the operation mechanism of industry-university-research collaborative innovation in automobile industry

According to the synergy theory, when any complex system is under the action of external energy or the aggregation state of matter reaches a certain critical value, the synergy will occur between subsystems. A good system operation mechanism can make the overall effect of the system greater than the superposition of the effects of various elements [5].

5.1. Power mechanism

The motivation mechanism is mainly to solve the problem of why collaborative innovation is carried out. The external driving force of collaborative innovation of industry, university and research institute is mainly driven by environmental factors (mainly laws, regulations, policies and other government guidance), market driving force and technological driving force. The internal driving force mainly includes the independent innovation consciousness, collaborative innovation spirit and incentive mechanism of collaborative innovation system of all collaborative innovation subjects. The internal and external dynamic factors of the collaborative innovation system interact and complement each other, and jointly promote the transformation of the industry-university-research collaborative innovation system from a non-equilibrium state into an orderly structure to achieve synergy.

In the new era, the construction of a powerful modern country requires the automobile industry to master the core technology to reach the world's advanced level as soon as possible. Since the 18th National Congress, the central government and local governments at all levels have vigorously promoted industry-university-research collaborative innovation from laws and regulations, policies, financial support and other aspects, creating a good external environment for industry-university-research collaborative innovation in the automobile industry.

In today's world, the requirements of clean, low-carbon and consumption demand upgrading are increasingly high on the safety and efficiency, comfort and economy, environmental protection and energy conservation of automobile products. The revolution of energy, interconnection and intelligence, and the deep integration of automobile and energy, transportation, and information communication make automobile electrification, networking, and intelligence become the development trend of the automobile industry. The research and development of automobile technology and products is increasingly difficult, All kinds of advanced design technology, manufacturing technology, quality assurance technology, etc. are needed in product development, which not only involves many disciplines, but also is mostly the product of multidisciplinary intersection. In particular, at present, China's automobile technology is still lagging behind the developed countries in the world. As a pillar industry, the mass-produced automobile industry is facing fierce international and domestic market competition. How to efficiently carry out product development is the top priority for enterprises. Making full use of social resources to jointly tackle key problems and speed up the technological progress and product development of enterprises will inevitably become the urgent primary task for the survival and development of enterprises in the automobile industry. On the other hand, as mentioned earlier, the National Inspection Center, colleges and universities, and research institutions have their own advantages and characteristics, and there is a large difference in technical expertise between them and enterprises related to the automobile industry. According to the theory of comparative advantage, the greater the difference in technical expertise between the parties to collaborative innovation, the stronger the motivation of

collaborative innovation. This constitutes the market driving force and technical driving force for the establishment of collaborative innovation between industry, university and research in the automobile industry.

It can be seen from this that the external environment drive, market drive and technology drive of collaborative innovation of automobile industry, university and research are objective and unquestionable. Under the guidance of the government and in accordance with the national laws, regulations and policies, the main bodies of industry-university-research collaborative innovation continue to strengthen the awareness of independent innovation and the spirit of collaborative innovation, build incentive mechanisms to meet the needs of collaborative innovation, make full use of the good external environment to fully develop the technical expertise and subjective initiative of the main bodies of industry-university-research collaborative innovation, and realize resource sharing and complementary advantages, The continuous improvement and development of the industry-university-research collaborative innovation system is bound to achieve synergy benefits greater than the superposition of the effects of a single entity.

5.2. Risk control mechanism of collaborative innovation

In the practice of technological collaborative innovation, due to the differences in the property rights structure, geographical location, industrial fields, corporate culture and management concepts of the subjects involved in collaborative innovation, as well as the information asymmetry among the innovation subjects, there may be risks in the process of collaborative innovation, such as fund raising, technical feasibility, trade secret disclosure, coordination and cooperation, technical cooperation, timeliness and regional adaptability of innovation results, etc, It is necessary to build a targeted risk control mechanism according to the technological collaborative innovation project.

In the process of technological collaborative innovation in the automobile industry, through careful study of national and regional development plans and industrial policies, the goal of collaborative innovation is in line with national and regional development plans and industrial policies; Through the investigation and research of the current situation and development trend of science and technology and market demand, and scientific and reasonable prediction, we can construct forward-looking and feasible innovation objectives when planning technology collaborative innovation projects. It can effectively avoid the risks of technical feasibility, timeliness of achievements and regional adaptability.

When constructing the technology collaborative innovation system, through full communication and negotiation between the collaborative entities, sign a contract on the basis of mutual trust and understanding to form a consensus, build a practical information communication and coordination mechanism, establish various forms of information sharing platform, and accurately, timely and unreservedly transmit and share the progress, experience and results of the collaborative innovation process between the innovation entities, The risk of coordination and cooperation, technical cooperation and fund raising can be effectively avoided by reasonably sharing the proportion of fund raising and formulating a feasible fund raising plan,

The risk of trade secret disclosure is mainly due to the moral risk caused by speculative awareness and the risk of disclosure caused by the imperfect confidentiality system. In the process of constructing the risk aversion mechanism of trade secret disclosure, on the one hand, we should formulate strict and feasible moral quality and quality assessment and selection procedures, select the members who directly participate in collaborative innovation, and formulate measures to strengthen their moral cultivation and confidentiality awareness education; On the other hand, in accordance with relevant national laws and regulations, confidentiality and its punishment regulations and supervision measures should be formulated to minimize the risk of disclosure.

5.3. Incentive mechanism

The incentive mechanism is mainly to enhance the collaborative innovation spirit and enthusiasm of the main bodies and members of the industry-university-research collaborative innovation to participate in collaborative innovation, ensure the smooth development of collaborative innovation, improve the level of collaborative innovation, and optimize the effectiveness of collaborative innovation.

Each subject of industry-university-research collaborative innovation has different demands for collaborative innovation results. As mentioned above, automobile manufacturers expect to independently own the intellectual property rights of collaborative innovation products. As a national-level third-party institution, the national-level testing service platform has certain public welfare services. In addition to the certain performance and benefits of the enterprise itself, it also focuses on the social benefits of promoting industrial development. Colleges and universities are faced with the need of self-development, such as creating "double first-class", professional evaluation and school running ability improvement, and expect to obtain achievements in intellectual property rights and funding for scientific research. Scientific research institutions with different systems have different demands for the benefits of collaborative innovation achievements, which need to be analyzed according to the institutional conditions of scientific research institutions. Therefore, in the process of collaborative innovation, we should give full consideration to the interests and needs of all collaborative innovation entities, protect the ownership and sharing rights of the innovation results of all collaborative innovation entities in the form of systems in accordance with national laws and regulations, scientifically and reasonably develop incentive mechanisms, promote the in-depth integration of industry, university and research, and ensure the smooth development of collaborative innovation.

For those who participate in collaborative innovation, they need to share the results of collaborative innovation in terms of economic benefits, government awards, professional title evaluation, etc. When formulating the incentive mechanism, a scientific, reasonable, fair and impartial assessment and evaluation system should be developed to evaluate the contributions of the participants in the collaborative innovation process realistically and objectively, so that they can obtain the due returns, so as to motivate the participants, promote them to exert their maximum potential, and ensure the best synergy.

6. Conclusion

Under the guidance of the competent government departments, it is feasible and advantageous to build the

industry-university-research collaborative innovation system of the automobile industry with the national-level third-party automobile testing service platform as the link. The establishment of a complete and effective collaborative innovation operation mechanism is the guarantee for the high yield of the collaborative innovation of the automobile industry. According to the needs of the industry-university-research collaborative innovation project and the different characteristics and needs of the participants in the industry-university-research collaborative innovation, the scientific and reasonable construction of the collaborative innovation operation mechanism, the timely and dynamic maintenance and operation of the collaborative innovation operation mechanism, and the full play of the resource advantages of the various industry-university-research collaborative innovation entities must be able to promote the sound development of the industry-university-research collaborative innovation and achieve the best overall effect.

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