

Research on the Structure and Operation Mechanism of Industry-University-Research Cooperation Organizations in Liaoning Province

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Abstract: Industry-University-Research Cooperation is a Combination of Science and Technology, Education and Economy. It is Marked by Two National Science and Technology Conferences in 1995 and 2006. the Cooperation between Industry, Academia and Research Has Experienced Three Stages of Development: “Production, Study and Research”, “Integration of Production, Study and Research” Study and Research Are Closely Combined.” the Cooperation between Industry, University and Research Institutes in Liaoning Province Has Been Transformed from Spontaneous to Conscious, from the Cooperation of Early Single Projects to the Coexistence of Multiple Modes and the Sharing of Interests.

1. Introduction

With the development of science and technology and changes in market demand, the research and development process of products has been greatly shortened. How to effectively connect faults between the scientific community and the industrial sector and promote the rapid development of the economy is a question of thinking among the government, the scientific community and the industrial community. The industry-university-research cooperation, an effective model for promoting economic development abroad, has been developed in China from the initial exploration to supporting the national innovation system. In the effective cooperation between enterprises and research institutes, colleges and universities continue to deepen the reform of the teaching system, and carry out reforms in the management system, school-running model, training objectives, professional settings, and teaching content and methods.

2. Organizational Structure of Cooperation between Industry, University and Research Institutes in Liaoning Province

2.1 School-Enterprise Cooperation Committee Model

Early industry-university-research cooperation organization. (1) There is a sound organization. The school-enterprise cooperation committee has a clear convener, deputy convener, secretary-general, deputy secretary-general, and committee work office, with clear responsibilities. (2) There is a work charter. (3) Strict annual meeting system. Regular event annual meetings for emotional exchanges and technical communication. Based on technical cooperation, the two sides cooperate to build a school-enterprise research institute.

Case: In 2000, Dalian University of Technology took the lead in setting up a school-enterprise cooperation committee with 25 large and medium-sized enterprises in the province and 20 enterprises in Dalian, changing the previous single technology and project cooperation to form a group-oriented long-term group-based cooperation. The long-term mechanism for school-enterprise cooperation. In 2001, Northeastern University, under the guidance and support of the Liaoning Provincial Economic and Trade Commission, the Liaoning Provincial Department of Education, and the Liaoning Provincial Department of Science and Technology, established a Northeastern University-Enterprise Cooperation Committee in conjunction with 36 large enterprises in Liaoning Province. The cooperation committee conducts research on key scientific research projects such as

chemical, shipbuilding, petroleum, machinery, metallurgy, information consulting services, and personnel training according to the needs of the industrial development of the enterprise.

2.2 School-Enterprise Cooperation Research Institute Model

In the principle of mutual benefit, complementary advantages and common development, enterprise R&D institutions settled in the campus, established a “research special zone”, and utilized the internal resources of the university, the research funding of the enterprise, and the research and development direction to improve the technological competitiveness of the enterprise. Form a certain technology chain, talent chain, capital chain, policy chain and service chain.

Case: CNR Group, Shenyang Blower Group Co., Ltd. and Liaohe Petroleum Exploration Bureau, together with Dalian Jiaotong University and Dalian University of Technology, jointly established the “Railway Truck Heavy Duty Express Engineering Technology Research Institute” and “Drums-Dagong Research Institute, Liaoyou-Dagong Research Institute, etc. Baosteel Yidongda Materials Electromagnetic Process Laboratory has become the key laboratory of the Ministry of Education.

2.3 School-Run Industrial Cooperation Mode

Based on their own scientific research resources and scientific research advantages, colleges and universities set up science and technology enterprises, establish practical bases, realize the organic combination of production, education and research, and promote the transformation of scientific and technological achievements in the school into actual productivity.

Case: Rare High Technology Industry Company, Dalian Economic and Technological Development Zone, established by the University of Communications,

2.4 University Science Park Model

Relying on the university's intellectual resources, the university's technology business incubation will be carried out to accelerate the transformation of university high-tech achievements into productivity. Carry out scientific and technological research, service and innovation, and entrepreneurial talent training. It has become an innovative service platform for equipment manufacturing industry, an engineering software incubation platform for modern equipment manufacturing industry, an industrial design innovation service platform, an entrepreneurial financing platform, and the combination of engineering, industrialization and various capitals of scientific and technological achievements.

Case: There are 5 national university science parks in our province, namely Shenyang Industrial University, Liaoning University of Engineering and Technology, Liaoning University of Science and Technology, Dalian University of Technology and Northeastern University. Provincial University Science Park: Dalian Jiaotong University. These enterprises and industrial parks have produced huge economic and social benefits in the transformation and incubation of scientific and technological achievements.

2.5 Cooperation Model of Government, Industry, Research and Research

Local governments combine local industrial structure and innovation needs to build an information platform for industry-university-research cooperation, collect technical needs of enterprises (mainly small and medium-sized enterprises), and help enterprises find suitable technology supply units (colleges or research institutes). Form a cooperation model of government, industry, and research.

Case: Dalian Municipal Government approved Dalian Jiaotong University in 2006 to establish “Dalian City Transportation Equipment and Ancillary Products Technology R&D Center” and in 2006 approved the establishment of “Dalian Modern Rail Transit Engineering Research Center”. Liaoning Province approved the establishment of “Liaoning Province Modern Rail Transit Engineering Technology Research Center” in Dalian Jiaotong University in 2007.

2.6 Strategic Alliance Model

Relying on major and key projects, universities, research institutes and large enterprises form

alliances, complement each other, strengthen alliances, and form high-tech R&D centers, high-tech transfer centers and incubation bases in the form of strategic alliances with their interests as the link. Form a complete technology chain, talent chain, capital chain, policy chain and service chain. The strategic alliance integrates projects, talents, bases and industries into one, forming a complete “development- pilot-product-commodity” industry-university-research cooperation system.

Case: The National Technology Transfer Center of Dalian University of Technology was awarded a special fund of 5 million yuan by the National Development and Reform Commission to integrate university resources, incubating and transferring energy-saving, environmental protection and consumption reduction projects such as “removing carbon dioxide technology and equipment by adsorption distillation”, with significant benefits. Northeastern University has signed a comprehensive cooperation agreement with Baosteel, Shougang, Shagang, Anshan Iron and Steel and other metallurgical enterprises. It has participated in the copper industry industry-university-research cooperation alliance with 41 universities, research institutes and related enterprises in Tongling City, and achieved remarkable technology through cooperation. And economic benefits.

3. The Operation Mechanism of Cooperation between Industry, University and Research Institutes in Liaoning Province

3.1 Scientific Research Mechanism within the School

Colleges and universities in Liaoning Province have certain opinions on strengthening scientific research and industrial work; temporary planning scientific research projects and temporary management methods for fund management; teaching, scientific research, production and technical personnel engaged in production, teaching and research teaching, scientific research work management regulations; horizontal commissioned scientific research projects and funding Interim Measures for Administration; Interim Measures for the Approval of Scientific Research Work; Measures for the Management of Science and Technology Contracts, Measures for the Management of Scientific and Technological Achievements; Measures for Promoting the Transformation of Scientific and Technological Achievements.

3.2 Talent Training Mechanism

Break the talents' affiliation and establish a dual talent recruitment mechanism. The enterprise sends the technical backbone of the factory to the school to carry out project research. At the same time, the experts of the enterprise go to the school to teach, bring the technology of the enterprise and the culture of the enterprise to the university, and promote the cultivation of talents in the university. The school sent experts to work in the enterprise. For example, Dalian University of Technology, organize a group of scientific research personnel, completely withdraw from the teaching work of the school, full-time engaged in the technical development of cooperative enterprises. At the same time, the school's teachers can carry out research and development work part-time in the enterprise. Many schools have adjusted the structure of scientific research organizations to form research bases and teams. They have pooled the advantages of both scientific and technological personnel in enterprises and schools to solve the key technical problems of products and form a multidisciplinary joint research team.

3.3 Equipment Integration Mechanism

Clearly define the principle of “not for all, but for use” and fully integrate the equipment resources of both schools and enterprises. According to the needs of cooperation between the two parties, the company establishes research institutes and research bases in universities to provide research equipment for research and development and teaching. Universities provide the foundation and high-end equipment for the research of enterprises. The equipment complements the functions and functions, and reasonably avoids the contradiction of asset attribution.

3.4 Results Transformation Mechanism (Intellectual Property Rights)

Among the 28 colleges and universities, 9 universities have set up intellectual property

intermediary service organizations to serve the intellectual property work of the school. Dalian University of Technology issued the “Dalian University of Technology Intellectual Property Protection Regulations” and “Dalian University of Technology on Promoting Technology Transfer Implementation Rules”, etc., effectively combining the protection and utilization of intellectual property rights with science and technology management; building a management information platform, greatly improving Management level and efficiency, promoting the integration of intellectual property systems, resource integration and information sharing.

4. Analysis on the Structure and Operation Mechanism of the Cooperation of Industry, University and Research Institute in Liaoning Province

The cooperation between industry, university and research institutes in Liaoning Province has experienced several stages of rapid development. The universities have made fruitful contributions to the development of regional economy and industry economy in cooperation with enterprises. With the gradual maturity of China's market economy development, the cooperation between industry, university and research institutes in Liaoning Province has continuously overcome the problems in cooperation, and the cooperation between industry, university and research institutes in Liaoning Province has gradually matured.

4.1 The Purpose of the Behavior between the University and the Enterprise is Different

Institutions of higher learning are non-profit social organizations that aim to cultivate various talents and promote social progress in society. Their main tasks are knowledge contribution and talent cultivation. Enterprises are mainly engaged in the production of material products and profits that meet market demand. Therefore, the two are not always consistent, or even conflicting and antagonistic, in terms of major social responsibilities, basic values, and goals. How to coordinate the relationship between the two and form a virtuous cycle of stable cooperation, sustainable development and mutual promotion has become one of the important issues that need to be resolved in the process of industry-university-research cooperation.

4.2 The Management System of the Partners is Not Sound

The production, research and research cooperation parties are still divided into sections in the management system, and they are self-contained and independent. The competent departments are different, and the operating mechanism is different. As a result, at the handover point of the industry-university-research cooperation, all parties to the cooperation lack systematic and effective management. After the appraisal of scientific and technological achievements, the pilot, development, promotion, application, implementation of partners, communication information or matchmaking, etc., there is a lack of effective systems and mechanisms for the coordinated management of universities, research institutes and enterprises, resulting in a large number of scientific and technological achievements. The combination of the industry-university-research cooperation model lacks the guarantee of the management system. The interest distribution mechanism of industry-university-research cooperation is not perfect, and there is no mechanism for sharing interests and sharing risks.

4.3 Information Asymmetry, Intermediary Services Have Not Played a Role

There are information asymmetry between scientific research institutions and enterprises in scientific research and development, technology update, experimental equipment and equipment acquisition, and talent demand. They are closed to each other and lack communication intermediary and platform.

4.4 Science and Technology Funding Needs to Be Strengthened

Scientific research and technological transformation are important aspects of colleges and universities serving the society. The investment of scientific research funds reflects the support of a region's scientific research activities. There are certain gaps in the investment of different types of

colleges and universities in Liaoning provinces. There are 4 colleges and universities in Liaoning Province, of which 3 are “985” and “211” colleges. In 2008, the average expenditure of science and technology activities of these 4 universities was 441.86 million yuan, and the average expenditure of science and technology activities of 18 colleges and universities transferred to the province was average. It is 48.182 million yuan, a difference of 9.2 times. The average funding for humanities and sciences activities was 9.271 million yuan, and the average amount of humanities and science and technology activities in 18 provincial-level colleges was 2.504 million yuan, a difference of 3.7 times. At the same time, in 2008, the proportion of scientific research funds in Liaoning Province accounted for 38.1% of the total income of education funds, and the proportion of scientific research funds in provincial colleges and universities accounted for 11.6% of the total income of education funds. Therefore, the research funding of provincial transfer schools was increased. The investment to promote the technological development of these institutions.

4.5 Industry-University-Research Cooperation Mechanism

Industry-university-research cooperation involves different entities such as enterprises, universities, research institutes and governments, and involves various interests between different systems. At present, the cooperation mechanism of production, education and research in universities in our province is at an early stage. The risk sharing mechanism of cooperation is one of the key issues in the cooperation between industry, universities and research institutes. The cooperation between industry, university and research institutes in our province has not established a risk sharing responsibility mechanism suitable for cooperation between industry, universities and research institutes, and there is no hierarchical and phased risk liability mechanism. At the same time, the performance evaluation mechanism of industry-university-research cooperation failed to accurately reflect the input of industry, university and research institutes and objectively evaluate the performance of industry, academia and research institutes in scientific research, technological innovation, business management, market development and other aspects.

5. Strategies for the Development of Industry-University-Research Cooperation in Universities in Liaoning Province

5.1 Establish the Interests and Risk Mechanisms of Industry-University-Research Cooperation

Due to the high-efficiency and high-risk characteristics of the transformation of scientific and technological achievements, the two parties adopt the method of benefit distribution such as technology shareholding and shareholding system to reduce the risk of scientific research investment; the research and development of universities and research institutes enable enterprises to bear the expenses of research and development as soon as possible. Identify the risks of R&D. Formulate a set of comprehensive intellectual property management regulations or management measures to ensure the mutual interests of both parties. Establish a system of sharing benefits and risks, achieve hierarchical and phased risk responsibilities, and reduce risks, so that both parties can maintain long-term cooperative relationships.

5.2 Establish a Division of Labor Coordination Mechanism for Industry, University and Research Cooperation

The advantages of the industry, academia and research institutes are different, and the focus of cooperation is different. With its market insight and responsiveness, the company captures the changing demand information of the market in a timely manner, improves the pertinence of cooperative R&D, and realizes the economic value of scientific research results. Universities use their own scientific research conditions and the advantages of mastering the frontier information of scientific research to shorten the time of technological innovation and technology research and development, and lay the foundation for enterprises to achieve technological innovation. A clear division of labor improves the operational efficiency of industry-university-research cooperation.

The coordination mechanism of the two parties is to improve the operational efficiency of both parties and establish an organization to promote communication and coordination. Second, establish rules and regulations to promote cooperation between the two parties, including information exchange between the two sides. The third is to establish relevant policies and regulations, and regulate the operation of alliances through performance and discipline to mobilize the enthusiasm of alliance members.

5.3 Establish an Intermediary Service Platform

Strengthen the construction of the intermediary system, improve the service function, integrate the province's intermediary service system, set up industry associations, and provide information, consulting, evaluation, finance, insurance and other services for the transformation of scientific and technological achievements.

5.4 Establish and Improve the Financing Mechanism for Industry-University-Research Cooperation

The shortage of funds is one of the key factors restricting the cooperation between industry, university and research institutes in universities. Therefore, it is necessary to form multi-faceted, multi-level and multi-channel financing methods to promote the development of industry-university-research cooperation. First, establish and improve the venture capital mechanism. Secondly, it seeks diversified investment entities, broadens the sources of funds, and gradually forms an investment system that is guided by government investment, with corporate investment as the mainstay, bank loans as support, social fundraising and foreign investment. Third, actively seek government support for risk investment. Fourth, universities set up special funds for industry-university-research cooperation to absorb the investment of funds from all levels of society, so that the industry-university-research cooperation project has a stable source of funds.

5.5 Integrate Scientific and Technological Resources and Build a Public Technology Service Platform

The science and technology public service platform is an open and efficient service system and guarantee system for scientific and technological innovation. Universities and research institutes cooperate with enterprises to break through the situation of resource decentralization and monopoly by integrating scientific and technological resources and building virtual public technology service platforms. Platform management operation mechanism and incentive mechanism, jointly carry out industrial core technology, key common technology research and transformation of scientific and technological achievements, and form a group of high-tech products with independent intellectual property rights.

5.6 Establish a Cooperation Mechanism for Industry, University and Research Institutes in Liaoning Province

(1) The province and the government jointly build and enhance the scientific and technological innovation ability of the transfer institutions

Industry transfer schools have been closely integrated with regional economic development in the development of more than ten years and are the propulsion agents of regional economic development. In the new development period, we will give full play to the advantages of the provinces and the Communist Party to enhance the technological innovation capabilities of the institutions that are transferred to the industry. Relevant ministries and commissions and industries are oriented to transfer institutions, set up special funds for science and technology development and industry-specific facilities investment funds to promote these universities to continue to play an important role in the scientific and technological progress of the industry.

(2) Establishing a new cooperative relationship between industry enterprises and transfer schools

The original industry supports the establishment of multi-level and diversified cooperation between industry, university and research institutes through the orientation of technical policies and preferential policies. In addition to project traction, joint research, and technical consultation, we

will form an industry-university-research alliance with complementary advantages, benefit sharing, interdependence, and close integration, so that these schools will continue to enhance their talent training, scientific research, and society in the service industry. The ability to serve ultimately enhances its comprehensive school strength.

References

- [1] Bo Jianguo. (2016). Problems and Countermeasures of China's Domestic Research and Research Legislation[J].Journal of Adult Education College of Hebei University, no.18(1), pp. 96-100.
- [2] Shi Guizhou, Yu Xia. (2016). Collaborative Innovation of Industry, University and Research Institute Based on "Internet +"[J]. Modern Education Management, no. (1), pp. 7-12.
- [3] Sun Fuquan, Wang Weiguang, Chen Baoming. (2008). Cooperation Innovation of Industry, University and Research Institute: Model Mechanism and Policy Research [M]. Beijing, China Agricultural Science and Technology Press .
- [4] Li Yuna, Lin Li, et al. (2011). Legal discussion on the organizational form of industrial technology innovation strategic alliance [J]. Science and Technology Progress and Countermeasures, no. (24), pp. 131-134.
- [5] Peng Bin, Yuan Xiaojuan. Cooperation between industry, university and research institutes in foreign universities.