

# Selection of Modes of Cooperation among Industries, Universities and Research Institutes

Chunhua Feng, Mengchun Ding & Baojun Sun

School of Economics and Management, Changchun University of Science and Technology

Changchun 130022, China

E-mail: fengchunhua918@sina.com

## Abstract

Innovation of cooperation among industries, universities and research institutes has played an extremely important role in the process of economic development, so countries throughout the world all attach great importance to study on models of cooperation among industries, universities and research institutes. At the present time of economic globalization, informationization and networking, traditional modes of cooperation among industries, universities and research institutes no longer adapt to requirements of development of the new situation and modes of cooperation among industries, universities and research institutes also call for continuous reform. We should select effective modes of cooperation among industries, universities and research institutes and make more contributions to the economic development.

**Keywords:** Industries, Universities and research institutes, Mode of cooperation, Selection

Cooperation among industries, universities and research institutes means the process of integration and innovation of the three parties of local universities, scientific research sections and enterprises under macro-control of the government. The government has further confirmed the status of independent innovation in national strategies in the future, and cooperation among industries, universities and research institutes is the key to promote independent innovation. Close cooperation among universities, enterprises and scientific research institutes can facilitate commercialization of original achievements in scientific research and accelerate construction of the competence of independent innovation.

## 1. Connotation of cooperation among industries, universities and research institutes

Cooperation among industries, universities and research institutes means the entire process in which the three technical innovation subjects of universities, research institutes and enterprises enable scientific research achievements to live through the difficult period of industrial achievement based on the principle of "assuming together risks, sharing interests, complementing mutual advantages and cooperative development" and further complete the commercialization of research findings in order to realize respective economic goals. As for explanation of the connotation of "cooperation among industries, universities and research institutes", we can mainly summarize the following several ones:

- 1). From its literal comprehension, "industry" refers to the industrial field, "university" refers to academic circle and "research" refers to scientific field. Cooperation among industries, universities and research institutes means coalition, collaboration and combination of the three aspects to integrate industries, universities and research institutes into one whole.
- 2). Cooperation among industries, universities and research institutes means that the three parties of enterprises, universities and research institutes and two of them unite and take several measures to cooperate in development of scientific research achievements, product production, product sales and after-sale service, etc, to realize certain value goal. In cooperation, the parties involved tap their own advantages and obtain a synergistic effect.
- 3). Cooperation among industries, universities and research institutes is led by enterprises, takes research and development of universities and research institutes as the starting point and realizes innovation in terms of technology through practice by enterprises in the market. Cooperation among industries, universities and research institutes is collaboration and integration of different systems of division of labor of scientific research, production and universities in resources.

## **2. Basic concept and essence of mode of cooperation among industries, universities and research institutes**

### *2.1 Model of cooperation among industries, universities and research institutes*

Cooperation among industries, universities and research institutes refers to the optimal allocation of such resources as assets, personnel, equipment and technology, etc, and rational distribution of interests by all subjects of cooperation to realize their own value goal under a certain institutional environment.

### *2.2 Functions of the mode of cooperation among industries, universities and research institutes*

Functions of the mode of cooperation among industries, universities and research institutes include basic research function, application research function and development research function. Basic research function refers to the function of converting scientific technology into productivity, which is directly related with strength, feature and direction of conversion from scientific technology into productivity. Application research function refers to the function to convert theoretical achievement into practical and applicable technology, namely, technical invention. Development research function, namely, industrial innovation, is the most important aspect to convert scientific technology into productivity.

### *2.3 Category of the mode of cooperation among industries, universities and research institutes*

(1) Mode of cooperation among industries, universities and research institutes in which the subject is universities (research institutes) initiating enterprises themselves

For instance, Founder Group, Tsinghua Tongfang and Unisplendour, etc, are enterprises initiated by research institutes or universities themselves, so these enterprises occupy particular advantages in the aspect of industries, universities and research.

(2) Mode of cooperation among industries, universities and research institutes with the subject of university science parks

University Science Park is a sort of form to promote national innovation that was carried out at the end of the Twentieth Century and is professional platform enterprise for cooperation among industries, universities and research institutes, such as, Beijing University Science Park and Tsinghua Science Park.

(3) Mode of cooperation among industries, universities and research institutes with the subject of social enterprises

This is a sort of model of cooperation in which enterprises are the subject and in the process of converting scientific achievements into productivity, enterprises play a crucial role.

## **3. Analysis of restraining factors in modes of cooperation among industries, universities and research institutes**

### *3.1 Parties of cooperation among industries, universities and research institutes possess different amount of information, which affects selection of the mode of cooperation among industries, universities and research institutes.*

In the process of cooperation among industries, universities and research institutes, any party who possesses more information is more advantageous. In order to obtain the maximum interests, the party who possesses the most amount of information may conceal information or provide fake information for its cooperative parties. Since parties of cooperation differ greatly from each other in the amount of information possessed, the parties of cooperation among industries, universities and research institutes have different status of information, and then they will vary in selection of the mode of cooperation.

### *3.2 Different economic properties of all subjects of cooperation affect selection of the mode of cooperation among industries, universities and research institutes.*

Economic property of the subjects of cooperation among industries, universities and research institutes determines the goal of cooperation. In the process of cooperation among industries, universities and research institutes, each party wishes to realize its own interest through cooperation. Different properties of all subjects of cooperation determine inconformity of interests they pursue. Universities are not profit organizations, and in the process of cooperation among industries, universities and research institutes, they wish to further cultivate talents through cooperation and improve quality of talent cultivation. Thus, in selection of the mode of cooperation, universities pay more attention to their own characteristics and fulfillment of the goal of maximization of social interests. In contrast, enterprises are typical profit organizations, so they pay more attention to interests brought by cooperation in their selection of cooperation mode. In the time of pursuing economic interests, research institutes also wish to make full use of positive industrial conditions of enterprises to research scientific

achievements with higher level through cooperation.

*3.3 Existence of cooperative risks restrains selection of the mode of cooperation among industries, universities and research institutes.*

(1) Uncertainty of technical innovation causes high risk of technical innovation and thus determines that the process of cooperation among industries, universities and research institutes is one full of risks.

(2) Variation of cooperative organizations brings about the risk of negative synergistic effect to cooperation. Since parties of cooperation have cultural variations and property variations, etc, they can not give full play to the synergistic effect and thus brings great obstacle to success of cooperation among industries, universities and research institutes.

#### **4. Selection of the mode of cooperation among industries, universities and research institutes**

##### *4.1 Joint mode with the subject of enterprises*

Joint mode means that universities, enterprises and research institutes directly realize cooperation of organizations of the subjects of cooperation among industries, universities and research institutes through contract or treaty, etc. In joint mode, enterprises are the subject and are the most frequently used mode in current cooperation among industries, universities and research institutes in China, accounting for more than a half in the total number of cooperation. The specific forms include the following:

(1) Cooperative development or commissioned development. Enterprises invest capital and manpower and put forward technical cooperation requirements according to demands of the market and production, whereas universities and research institutes offer technology. Parties involved in cooperation participate together and enter the development process of a certain sector or the entire stage. Cooperative development or commissioned development is still a sort of cooperative means generally adopted by US in cooperation among industries, universities and research institutes, while it is also an extremely important means in China for parties involved in cooperation among industries, universities and research institutes to innovate in reform practice. The Characteristics of cooperative development or commissioned development are as follows: difficult technology, paralleled development, combination of technical driving and market driving and impossibility to independently finish a project for a single party.

(2) Technical transfer. Technical transfer means that universities and research institutes purchase their technical achievements to enterprises through transaction in technology and enterprises can directly go for production, in which parties involved in cooperation share interests and assume risks together. The obvious characteristics of technical transfer are technology-driven type and relay development type, in which enterprises involve in the process of development according to different stages of development. During the early period, universities and research institutes make investment to finish reliability of technical principle and then enterprises continue to make the pilot plant test, production and market development. For instance, Dalian University of Technology invented the technology of "carbon molecular sieve" and transferred this technology to Zhejiang Changxing Chemical Plant. The key technical index of this product surpasses products imported of the same type and its cooperation among industries, universities and research institutes has gained success.

(3) Cooperation in fostering talents, which refers to cooperation of enterprises with universities in talent cultivation to obtain human resources required by technical innovation. It mainly includes four patterns: firstly, in-job professional talents entrusted by enterprises to cultivate by local universities. In order to satisfy demands of economic and social development, all local colleges and universities have their own professional certificate class and class of education with record of formal schooling. For example, Changchun University of Science and Technology signed an agreement of entrusted cultivation with Dongguang Group and has assigned more than two hundred skilled workers for further study in the last three years. Secondly, to set up graduate student cultivation base. In order to resolve demand of every walk of life on talents at higher level, some departments in charge cooperate with one or several universities to set up talent cultivation bases. For instance, Office of Education and Office of Science in Jilin and provincially-owned universities jointly cultivated master graduates for several years and received favorable appraisal from all units. Thirdly, to set up post-doctoral working stations. Units who set up post-doctoral working stations and enterprises jointly recruit and cultivate post-doctoral research talents, which, on one hand, brings up talents, and on the other hand, brings considerable economic profits to enterprises. Fourthly, universities and enterprises cooperate to train applicable talents for specific posts. According to demand, enterprises entrust universities to cultivate professional talents. For example, they entrust universities to recruit students through a unified entrance exam for talents in industries of forestry, agriculture, livestock and mine, etc.

#### 4.2 Co-construction mode

Co-construction mode refers to a new joint entity established by universities, enterprises and research institutes, in which all cooperative parties share technology, information, capital and human resources to make allocation of resources achieve optimization and make all cooperative parties profit from the mode. Co-construction mode is the most productive pattern of cooperation among industries, universities and research institutes, mainly including the following aspects:

(1) To co-construct research institutions, engineering centers and research institutes. The first sort is college co-constructed by colleges and universities or research institutions and enterprises, in which cooperative parties hold long term development for relatively complicated technology so as to enable enterprises to keep competitive advantage for ever in terms of technology. The second sort is that, the nation or industrial sections make investment together with enterprises and provide advanced technical storage in universities and research institutes to promote integration and technology supporting conversion of scientific achievements. For example, Tongji University and Zhejiang Geely Holding Group Co., Ltd. Co-constructed “Geely-Tongji Automotive Engineering Research Institute” and Peking University and Founder Group cooperated and established Peking University Founder Technology College, etc. The third sort is that, industries, universities and research institutes jointly establish corporate technical center and make use of existing resources to set up high level research institutions. For instance, Haier Group made investment to co-construct the National Engineering Research Center for Engineering Plastics with Institute of Chemistry of Chinese Academy of Sciences.

(2) Co-construction of high and new technical enterprises. Universities and research institutes apply their own technical talent advantages and enterprises utilize their own capital, equipment, market and production advantages to together initiate high and new technical entities. Usually, this kind of entities includes two patterns: joint operation and technology investment. Characteristics of this sort of mode is that, all cooperative parties can realize their maximum advantage complement, with strong risk resistance capacity and integrating research, development, production, sale and service into one.

(3) Co-construction of science park, which is a mode of enormous complex with combination of universities, research institutes and enterprises and in which all cooperative parties set up university science parks in cities in which universities are relatively concentrated and industry is relatively developed and within certain geographic range. In 1950s, US Stanford University and Silicon Valley founded the first university science park in the world, namely, Stanford-Silicon Mode. The first science park in China is “Beijing Zhongguancun Science and Technology Park” centered with Peking University and Tsinghua University.

#### 4.3 Cooperative mode of independent industrialization in colleges and universities

Cooperative mode of independent industrialization in colleges and universities means that, colleges and universities combine closely the four stages of technical innovation on the basis of their own scientific research and conduct technical development, production trial and marketing. The primary forms are as follows: colleges and universities attract capital to set up research institutes and initiate school-run enterprises, especially high and new technology enterprises. Characteristics of this sort of mode are that, colleges and universities integrate education, scientific research and industry into one whole and take high-tech products as the lead, which has important leading role in the industry.

#### 4.4 Cooperative mode of independent industrialization in scientific institutes

Research institutes integrate industries, universities and research into a whole and independently conduct scientific research, development, production trial and marketing. The major forms include scientific research units converted to scientific enterprises, high-tech technical enterprises groups and research institutes of scientific, industrial and trading. The main characteristics of this cooperative mode are that, it leaves out intermediate links, saves times and can better and faster transfer scientific achievements into products.

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