

The Analysis and Implementation Strategies on Operation Model of University-Enterprise Cooperative Innovation Network

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Abstract This paper divides University-enterprise cooperative innovation network system into three sub-systems: Innovation Core Subsystem (ICSS), Innovation Auxiliary Subsystem (IASS) and Innovation Environment Subsystem (IESS), and it constructs its Operation model from angle of the open innovation and the complex system theory, then presents the implementation strategies of effective operating of University-enterprise cooperative innovation network, in order to provide reference for related research of University-enterprise cooperation.

Key words University-enterprise cooperative innovation network; Open innovation; Operation model; Implementation strategies

1 Introduction

With the increasing competition in the market and accelerating pace of technological updating, enterprises, the Main-body of Technological Innovation, can not adapt to this trend because of the limitation of innovation resources. Enterprises should cooperate with other innovation resources, So Innovation network emerges. Scholars conducted the research from different angles to the innovation network. Freeman (1991) considered that innovation network is a basic system arrangement coping with system innovation, the main coupling mechanism of the network architecture is innovative and collaborative relationships among enterprises. And further divided the types of innovation networks into the Joint venture and the research company, cooperate the R&D agreement, the technological exchange agreement, the direct investment, the permit agreement, the sub package, the division of production and the supplier network, the research association, the government subsidization union research project and so on. Olaf Amdt (2000) regarded the innovation as a coordination community of each participant, and thought that the innovation function of network is bigger than the total innovation ability of each individual. Van and Waggeman (2000) thoroughly inquired into the classification of network, and subdivided innovation network into formal and informal network, furthermore, they emphasized the complexity of the innovation network. Sternberg (2000) discussed the influence of innovation network on the innovation environment, and further analyzed the promoting action of innovation network to the innovation. In China, the scholars also have done a lot of researches on innovation network, Chi Renyong etc(2005) have studied the formation mechanism of middle and small scale innovation network; Wei Jiang etc(2003) have studied the Small business colony and the basic connotation of innovation network and the structure and the knowledge overflow effect; Chen Xinyue etc(2002) have studied the joint mechanism of innovation network; Zhang Weifeng etc(2004) have studied the construction agent and the pattern of innovation network; He Yaqiong etc(2002) have researched the learning mechanism of the region innovation network; Liu Lanjian etc(2009) have researched technological innovation network from the angle of knowledge shift contact surface.

The research about University-enterprise cooperative innovation mainly concentrates on the main body function, influencing factor and policy suggestion of University-enterprise cooperative innovation system. As the research of E. Mansfield(1962) indicated that the outstanding universities can obtain massive government finances to maintain high grade research ability, and produce more innovation; It is very difficult for second-class universities to be highly effective innovation ones, even though they can obtain funds from the industrial fields. K. Laursen(2004) pointed out that the enterprise which uses the open-type R&D strategy and the high R&D investment takes the university as the innovation origin. According to the different foundation and the way of grinds gathers, the scholars Zhang Jun, Li Zhongyun(2005)divided the operational mechanism of grinds gathers into the credit foundation union, the contract union, the legal person union operational mechanism and industry and research integration operational mechanism, and thought that industry and research integration operational mechanism was the best one for the union of industry and research.

Generally speaking, the scholars researched the innovation network mainly from the network

concept, the network architecture, the construction agent, the joint mechanism, inter-organizational learning, and knowledge transfer etc. But to University-enterprise cooperative innovation, they mainly based on the microscopic inspection, such as university, enterprise etc main body or object angle of view. The research content also mainly concentrated in the cooperation agent, the pattern choice, the influencing factor and so on. There are not enough researches conducted from the angle of innovation network and based on the complicated system theory and the open style innovation theory to discuss the intermediate perspective stratification plane—the movement of University-enterprise cooperative innovation network based on the open style innovation. It is difficult for people to have a more complete clear understanding with University-enterprise cooperative innovation substantive rule.

Along with the establishment and consummation of market economy system, the reform of the science and technology system requested that University should face economic development, accelerate transformation and promotion of achievement, guide and support economy acceleration and healthy development by technical; but the economic restructuring requests the enterprise to depend upon the advance in technology and the technological innovation, and adapt the market competition, to pursue great economic efficiency as far as possible. Facing the development and reform of technical and economic system, the related benefit main bodies in University-enterprise cooperative innovation should share respective information to form a complete innovation chain. The research about the movement of University-enterprise cooperative innovation network from the complicated system theory and the open innovation theory will have important practical significance and value to explore the intrinsic law of development of University-enterprise cooperative innovation network and formulate feasible network development policy.

2 The Operation Model of University-enterprise Cooperative Innovation Network System

2.1 Factor analysis of university-enterprise cooperative innovation network system

Open innovation emphasize the importance of external sources of innovation, the external market and technical cooperation. Under the open innovation theory, the technological innovation will be no longer a simple linear process, but forms a complex feedback mechanism. It must carry on the innovation with in the interaction and the mutual influence of other organizations (customers, suppliers, competitors, non-related businesses, universities, research institutions, consulting firms, government, etc.)(Chen Jin, 2006).

Table 1 Factor Analysis of University-Enterprise Cooperative Innovation Network System

sub-systems	Factor	Innovation function
ICSS	Enterprise	New product, New technical Commercialization
	University	Research development, Knowledge creation
	Government	Innovation Guidance
IASS	Research Institutions	supplement of Innovation Resources
	Financial Institutions	Innovation Economic Force
	Intermediaries	Innovation bridges and Bonds
	Consumers	Judgment of Innovation Achievement
IESS	Social Culture Environment	Innovative spirit drive, Cultural Approval
	Policy Environment	Innovation Incentive
	Economy, Legal Environment	Financial Support and Legal Protection

In the theory of open innovation, the border of University-enterprise cooperation is permeable, the university and the enterprise cooperation can use the interior and exterior innovation thought and market way. The open innovation combines internal and external resources into the university-enterprise cooperation system, through the exterior channel the thought in university-enterprise cooperation also can be able to enter the market, and it has more extra values for the university and the enterprise. In brief, under the theory of open innovation, university-enterprise cooperative innovation network is a loose complex system which related to multiple levels, multiple organizations, multiple stages, number of elements. Therefore, it is very essential by utilizing the open innovation and the complex system theory to know and reveal the elements of University-enterprise cooperative innovation network.

Based on the study about University-Research Cooperation, and combined the theoretical basis of Innovation Networks, from the standpoint of open innovation and complex system theory, University-enterprise cooperative innovation network can be regarded as an open system composed by the core innovation subject, auxiliary principal subject and external environment. This system is such an

organization in which the R&D, achievement transformation and consulting services was achieved by mutual influence, restriction and promotion among the subjects and external environment universities and enterprises as core innovation subject, government, research institutions, financial institutions, intermediaries, consumers as secondary principal subject. According to this concept, this article divides University-enterprise cooperative innovation network system into three sub-systems: Innovation Core Sub—System (ICSS)、Innovation Auxiliary Sub—System (IASS)and Innovation Environmental Sub—Systems (IESS)(Table 1).

From Table 1 we can see that, ICSS includes the university and the enterprise, they have the most direct technological innovation ability, simultaneously, they also constitute the network core; IASS is the subsystem that provides ICSS with the service; IESS is an elements combination that provides the network organization with the environment mechanism and the system protection, it is the essential condition of the cooperation innovation system.

2.2 Operation model of university-enterprise cooperative innovation network system

According to the factor analysis of University-enterprise cooperative innovation network system, based on open innovation and complex system theory, Operation model of University-enterprise cooperative innovation network system was constructed. As shown in Figure 1.

From Figure 1 we can see that, the Operation model of University-enterprise cooperative innovation network was mainly composed by innovation core subsystem (ICSS), innovation auxiliary subsystem (IASS), the innovation environment subsystem (IESS) three sub-systems and the University-enterprise cooperative innovation network and the output effect. Concrete study will be shown later.

2.2.1 The subsystem of university-enterprise cooperative innovation network

What ICSS reflects is factor joint between the enterprise and university. First, the enterprise as the most active essential factor in the network movement forms the cooperation innovation platform with the university through cooperation innovation forms etc, and promotes knowledge and the technical commercialization, then has a series of cooperation innovation behavior. Next, the university through inputs the new knowledge, the new technology to the enterprise, which forms the knowledge and the technical proliferation and shift between the university and the enterprise, provides the innovation support for the enterprise.

What IASS reflects is the innovation auxiliary essential factor joint; it mainly includes government, scientific research institution, financial institution, facilitating agency, consumers and so on. On the one hand, the innovation auxiliary essential factor provides innovation main body system with the knowledge flow, the technical flow, the fund flow, human resources flow, information flow etc. innovation resources and the infrastructure, and provides resources support to the IASS for continually operation. On the other hand, the innovation auxiliary essential factor promotes knowledge and the technology diffuse to the IASS through providing the technology, the information consultant, the technical transfer, the innovation hatching, the financial support and so on, serving as bridge and pivotal role for cooperation innovation network effective movement.

What IESS reflects is the innovation environment essential factor joint. On the one hand, the advantageous social culture environment, the policy environment, the economy, the legal environment have provided good social atmosphere for the cooperation innovative activities, making various main bodies in the system to join in the cooperation innovative activities positively, getting very strong confidence to the cooperation innovation, increasing the possibility to use each internal resources to cooperate and realize multi-win. On the other hand, the comprehensive technical environment and the international economy environment have provided the power for the technological innovation. The perfection of regulations environment has provided the effective policy support for the cooperation main bodies. It's beneficial to the market order formation, and provides powerful safeguard for the cooperation innovation.

2.2.2 The operation model of University-enterprise cooperative innovation network

The operation model of University-enterprise cooperative innovation network is the core of entire University-enterprise cooperative innovation network movement model. It is composed by the trust mechanism, the study mechanism, the benefit assignment mechanism, the incentive mechanism, the coordinated mechanism. Building the trust mechanism may increase all aspects of communication and strengthen the trust , to achieve long-term cooperation; building the study mechanism may create one platform to study and communication for the network, and urge the organization to study creatively; building the benefit assignment mechanism may guarantee the effect of network movement, optimizing various networks members' benefits as far as possible; building the incentive mechanism may carry out

network members. Cooperation innovation between the University-enterprise cooperative innovation network members was established in the foundation of trusts and respects. The credit is playing the vital role in network, which is a “dynamic alliance”. Therefore, we must train and maintain the credit between the University-enterprise cooperative innovation network members, to make the network members fully understand that the cooperation innovation which take the credit as the premise can bring them with higher income than the former cooperation, and avoid innovation risk, thus improving own credit standing, realizing the fully sharing of the knowledge, information, technology and so on between network members as far as possible.

(2) Forming the study atmosphere between the University-enterprise cooperative innovation network members. Establishing the study mechanism of the University-enterprise cooperative innovation network can promote mutual study and raise the Knowledge-sharing rate, to enhance overall competitive power of the network. Such as setting up organizations which can provide consultation and solve questions, or organizations aimed at encourage voluntary study and so on, to promote knowledge sharing between the core enterprise and university gradually, to improve dynamic learning capability, sustained technical innovation capacity and the rapid response ability of the enterprises.

(3) To establish the effective coordination mechanism of the University-enterprise cooperative innovation network. The nodes of the University-enterprise cooperative innovation network have difference in cultural context, management idea, thinking mode and so on, so it's easy to have conflicting opinions in the cooperation innovation process. Therefore, network members should realize the importance of the full cooperation and exchange to get the goal. Building the coordination mechanism may ensure smooth co-operation.

(4) To strengthen the incentive of the University-enterprise cooperative innovation network members. From the network plane, the focal point in designing the incentive mechanism is how to stimulate the participations to contribute the superiority innovation resources, to fuse, cooperate, innovate better, and enhance the ability of University-enterprise cooperative innovation more quickly. Therefore, through effective stimulation, participants will maximize their enthusiasm, initiative and creativity, which is beneficial to cooperation innovative activities development.

(5) To establish fair and reasonable benefit of the University-enterprise cooperative innovation network. As independent economic entities, participants in network will maximize their own benefit. Whether the assignment mechanism between partners is reasonable immediately influence the operation efficiency and Stability of the University-enterprise cooperative innovation (K. Laursen, 2004). Enterprise pays attention on market value of the innovation product, pursuing low risk and the realization of the short-term economic interest; university pays attention on academic value, pursuing the promotion of the long-term comprehensive strength; government pays attention on social efficiency, pursuing economic growth and competitiveness promotion; financial organ pays attention on income, economic interest, the investment security and so on; the difference between individual benefit goals of the main bodies will cause the innovation performance for the University-enterprise cooperative innovation low. So establishing certain benefit assignment mechanism to safeguard network movement effect appears to be especially important (Zhang Jun, 2005).

4 Conclusions

The University-enterprise cooperative innovation network is a Multi-agent interaction complicated system. Based on the innovation network theory, this paper divides University-enterprise cooperative innovation network system into innovation core subsystem (ICSS), innovation auxiliary subsystem (IASS) and the innovation environment subsystem (IESS) three sub-systems and constructs its Operation model from the angle of the open innovation and the complex system theory. Through analysis of the University-enterprise cooperative innovation network Operation model, we can see that, whether the operational mechanism is reasonable and scientific is the key factor for successful cooperation in University-enterprise cooperation movement process. So we must design and follow the mechanism that conforms to the University-enterprise cooperation innovation effective movement, so as to promote the University-enterprise cooperation innovation to develop healthy, highly effectively, and constantly. The research conducted in this paper of the University-enterprise cooperative innovation network Operation model is just a preliminary exploration. Regarding to the University-enterprise cooperative innovation network, there are also many questions need further research: the unceasing roles evolvement of University-enterprise cooperative innovation network members in different periods of network movement; the influence of University-enterprise cooperative innovation network to

performance of enterprise innovation; the case study about detailed process of University-enterprise cooperative innovation network movement and development and so on.

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Reflection and Reconstruction of University Scientific Research Function

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Abstract The principle of “teaching combining with scientific research” posed by Wilhelm von Humboldt in HU Berlin can be regarded as the start of the scientific research function of university, the scientific research has different status and role in different time’s university. However, the reality of university research and Humboldt’s ideal fall into a difference world. Based on the analysis of scientific research’s value orientation, this paper argues that the value demand of the socio-economic environment and the value choice of the scientific research in university is the main reason for the alienation of research and education in today’s university, and universities should attach importance to the educational nature of scientific research. Besides, the scientific research of university should take nurturing creative talents as the first function, meanwhile, undertake the other two functions: developing knowledge and serving for the social progress and economic growth.

Key words University; Scientific research; Educational; Value orientation

1 Introduction

With science and technology having a stronger and stronger influence on the development of productive forces, university scientific research is playing a more and more important role in economic growth and social development. When the scientific research of modern university displays its function in knowledge innovation and social service, it is gradually deviated from Humboldt’s ideal of teaching combining with scientific research, even appears the conflict of teaching and research in some teachers’ individual behavior. Therefore, it’s both necessary and beneficial to review the research function of university.

In the study of university research function, the relationship between teaching and scientific research has been hot issues in higher education. Study abroad is quantitative-based, through quantifying the indicators like teaching effectiveness, research results, the time of teaching and research, published papers, teacher reward and so on to carry on statistical analysis; China is mainly from the aspects of qualitative to study the relationship between teaching and research, and that the two should be harmonized and coordinated development. For instance, there are researchers based on the viewpoint of teaching combining with scientific research, put forward that scientific research back feeding teaching work should be implemented in the current university and to establish appropriate security system (Li Changzu & Feng Wen, 2009).

Different from these studies, this article focuses on the relationship between scientific research and education, and from the analysis of scientific research’s value orientation to find the reason for the alienation of university research and personnel training, in order to reconstruct the educating function of university research.

2 The Formation and Development of University Scientific Research Function

2.1 Before the 19th century: scientific research is the subsidiary activities of teaching

After the 11th century, university appeared in the Middle Ages based on the city rise and public class development. The prototype of Medieval University is the scholar guild; its main goal is not teaching activities and personnel training. Scholars’ primary purpose is to study and disseminate the profound knowledge, they engaged in religious or philosophical research, which is separated from the social reality. In the second half of the 14th century, the Renaissance, which takes promoting the liberation of humanity as the core, started in Italy. This ideological and cultural movement has had a broad and far-reaching impact on development of literature, art and science. In this environment, university started to focus on nurturing “new human”, “it is the overriding goal of university education to nurture the person with full of human nature and cultural qualities, becoming ‘gentlemen’ and ‘ruler’ ” (Zhang Yingqiang, 2000), and most of academic research is transferred to university’s outside, the specialized organizations and agencies. Therefore, outside the university, Natural Science Research during this period presented unprecedented achievement, but in the university, the scientific research