ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202009_3(9).0005

Research on the Components and Dynamic Mechanism of the Logistics Industry-university-research Collaborative Innovation System under the Background of "Deep Integration of Informatization and Industrialization"

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Abstract

Industry-university-research cooperation is the breakthrough to establish an innovative country and the key to the innovative development of China's logistics industry. In order to promote the collaborative innovation development of China's logistics industry, this paper, based on the background of "deep integration of informatization and industrialization", links all the members involved in the innovation of logistics industry into a complex collaborative innovation system. By analyzing the main body, object, environment and other components of the innovation system, then analyzes the power transmission relationship between the system elements, and studies the dynamic mechanism of the system.

Keywords

Logistics industry; Collaborative innovation of industry-university-research; Deep integration of informatization and industrialization; Dynamic mechanism.

1. Introduction

The 18th National Congress of the Communist Party of China has made a series of strategic plans, such as adhering to the new industrialization and informatization road with Chinese characteristics, and promoting the deep integration of informatization and industrialization. The smooth development of social economy is inseparable from the support and guarantee of the logistics industry, so the integration of informatization and industrialization in logistics industry is conducive to promoting the industrial transformation and upgrading, and improving the innovation ability. In addition, the industry-university-research collaborative innovation is an important link in the effective operation of the national innovation system [1]. In order to improve the ability of independent innovation and accelerate the construction of an innovative country, the 19th National Congress of the Communist Party of China clearly proposed to strengthen the construction of national innovation system, and establish a technological innovation system with enterprises as the main body, market as the guide, and in-depth integration of industry-university-research. But for a long time, the efficiency of cooperation between Chinese universities and enterprises is low, and the phenomenon of "two skins" of science and technology and economy is obvious [2]. With the continuous expansion of China's foreign trade and the birth of various online trading platforms in recent years, China's logistics industry has ushered in unprecedented opportunities for development. However, due to the lack of logistics talents, the overall level of China's logistics industry is still low, and there is a big gap compared with developed countries. Therefore, deepening the cooperation of industry-university-research in logistics industry has become an effective way to solve the bottleneck of innovative talents in China's logistics industry. At present, a common problem that restricts the collaborative innovation of industry-university-research in China is the lack

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202009_3(9).0005

of systematic motivation[3], and the literature does not pay enough attention to the research on the motivation of industry-university-research [4]. In view of this, based on the background of China's "deep integration of informatization and industrialization ", this paper explores the factors that drive the collaborative innovation of China's logistics industry, and how these factors affect the mechanism of collaborative innovation of industry-university-research in China's logistics industry.

2. Components of the Logistics Industry-University-Research Collaborative Innovation System

The essence of collaborative innovation of industry-university-research is the technical innovation strategic alliance form, which is carried out by enterprises, universities, scientific research institutions, governments, intermediary institutions and financial institutions to realize major scientific and technological innovation [3]. Like other organizational systems, the innovation system based on the collaboration of industry-university-research has a high purpose and strong utility, and the composition structure of the innovation system determines the size of its function, that is, the degree to achieve the purpose and utility. The composition structure of the collaborative innovation system of industry-university-research refers to a stable structure formed by the interaction of the interrelated elements in the system. This section will analyze the components of collaborative innovation of industry-university-research in logistics industry from the three aspects of innovation system subject, object and environment.

2.1. Subjects of the Logistics Industry-University-Research Collaborative Innovation System

From the perspective of practice, the subject is an individual and a team actively engaged in social practitioners. This kind of subject should not only know how to produce according to the scale, but also know how to use the scale on the object. Along with the development of science and technology, combines various functions in one single innovation main body have been unable to adapt to the modern society, so the subjects of group or organization become the main part of innovation main body, they have their respective specific knowledge of each individual thinking ability, practice operation ability, and different background, social resources only through cooperation, to jointly complete the innovation activities[5]. The creativity, subjectivity and initiative of the innovation subject make it the primary element in the innovation system, which directly determines the combination of other elements and the formation of the innovation system. Generally, the definition of innovation subject can not be separated from the organization composed of people or many people. In fact, not all people or organizations are innovation subjects. Only people or organizations with innovation awareness, innovation ability and innovation activities can be called innovation subjects.

The subjects of collaborative innovation of industry-university-research in logistics industry refers to the innovative talents and their groups that participate in the collaborative innovation activities of logistics industry. In the collaborative innovation system of logistics industry, the subjects that plays a leading role is the logistics professional scientists, teachers, students and university managers in the University, which initially exist in the form of individuals. With the contact and communication with relevant researchers, a small scientific research team is gradually formed. When researchers continue to join, research content continues to deepen and research direction keeps subdividing, the research team develops into a large innovation group. In the collaborative innovation system, besides universities, there are also related innovation subjects such as logistics enterprises and scientific research institutes. They participate in collaborative innovation activities with universities, but they occupy a secondary position and play a secondary role in the logistics innovation system. Therefore, they are the secondary

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202009_3(9).0005

innovation subjects, specifically including entrepreneurs, employees engaged in innovation activities within the enterprise, as well as the enterprise they constitute and academic leaders, researchers and research institutes they form.

2.2. Objects of the Logistics Industry-University-Research Collaborative Innovation System

Among the constituent elements of innovation system, another element that corresponds to innovation subject is innovation object. If innovation subject plays a leading role in innovation activity, innovation object plays a passive role in innovation activity. The innovation object is the object that the innovation subject plays in the innovation activities. Specifically, it refers to the idea or method with new value and new utility that the innovation subject integrates and recombines the existing knowledge, technology, information and other resources to form the innovation results.

The object of industry-university-research collaborative innovation includes the necessary knowledge resources, information technology, equipment resources and various auxiliary resources to ensure the smooth progress of innovation. The essence of innovation is to use knowledge to create new knowledge, so the knowledge resource of logistics industry is the most important object of innovation system, and also the main guarantee of academic research frontier. Under the background of "deep integration of informatization and industrialization", the existing innovation activities of logistics industry largely rely on the intelligent mechanical equipment related to the research content, so the purchase of equipment also accounts for a lot of scientific research funds; at the same time, the innovation research also uses more relevant software to process the mathematical model and carry out quantitative analysis, which improves the work efficiency of logistics innovation activities and the scientific rigor of innovation results.

2.3. Environment of the Logistics Industry-University-Research Collaborative Innovation System

The collaborative innovation environment of industry-university-research in logistics industry is the basis for the survival and development of innovation subjects in the innovation system, the prerequisite for the formation and development of innovation system, and affects the construction process and quality of industry-university-research system. Because of the wide range of innovation environment, there are not only political environment, economic environment, social and cultural environment at the macro level, but also internal environment of innovation system at the micro level. The collaborative innovation environment of industry-university-research in logistics industry in this paper refers to the internal environment of innovation system, which influences innovation activities by influencing the role of innovation subject on innovation object, including the government's science and technology policy of logistics industry, the formed innovation culture atmosphere of logistics industry, and the relevant mechanism of the operation of innovation system of logistics industry.

The output of the collaborative innovation system of industry-university-research in logistics industry is closely related to the policies of universities, governments and regions. The government's science and technology policy is an important guarantee for the construction of the innovation system of logistics industry, which ensures the dynamic balance between the innovation system of logistics industry and the overall innovation system of the country. The innovative cultural atmosphere in logistics industry reflects the values of the innovation subjects in the innovation system, and guides the flow and concentration of innovative resources in the logistics industry through the construction of cultural facilities, the cultivation of personnel quality and the formation of organizational atmosphere. The relevant mechanism of logistics industry innovation system operation mainly refers to the relevant system in the

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202009_3(9).0005

process of collaborative innovation system of industry-university-research in logistics industry, which specifies the responsibilities, rights and obligations of innovation subjects, and divides the types and characteristics of innovation objects.

3. Dynamic Mechanism of the Logistics Industry-University-Research Collaborative Innovation System

The dynamic mechanism of industry-university-research collaborative innovation system refers to the dynamic source of collaborative innovation activities. As for the motive source of industry-university-research collaborative innovation, some scholars at home and abroad have studied it. Veugelers et al. [6]believe that the motivation of industry-university-research cooperation mainly comes from the "heterogeneity" of knowledge and ability between enterprises and universities, saving transaction costs and monopolizing knowledge and technology. Jing Xu et al. [7] analyzes the dynamic factors and resistance factors affecting the cooperation among enterprises, universities and research institutes, puts forward a sailing power mechanism model of industry-university-research Institute cooperation, and uses this model to deeply study the dynamic mechanism of industry-university-research institute cooperation in China. Based on the analysis of relevant dynamic problems by domestic and foreign scholars, this paper divides the dynamic factors of the logistics industry-university-Research collaborative innovation system into internal dynamic mechanism and external dynamic mechanism. Internal dynamic mechanism refers to the driving force of industry-university-research collaboration in the innovation system, mainly including cultural drive and benefit drive. The external dynamic mechanism refers to the external dynamic factors outside the innovation system that can promote the industry-university-research collaborative innovation, mainly including market driven and technology driven.

3.1. Cultural Drive

In the era of knowledge economy, culture plays an important role in the process of regional economic development. The importance of culture is reflected in its guidance and support for economic development as well as its promotion of innovation ability. Therefore, culture gives play to its incomparable vitality, charm and tension and becomes an important factor of social production. Collaborative innovation of industry-university-research is a complicated system engineering, it is not a simple "1+1+1=3" process, to really make the different interests pursuit, different backgrounds, different status of innovative elements to form a powerful force, first need to form a culture of every innovation main body can agree on a value basis, if the set up of a number of units or individuals lack the necessary cultural value integration mechanism, people's values and cultures clash, they may get half the result with twice the effort[8]. In the logistics industry-university-research collaborative innovation system, the innovation-driven role of culture is manifested in two aspects: one is to guide scientific research to discover and meet social needs; culture itself is a kind of soft power, representing the value orientation of social development. The second is to reflect the value demands of the university innovation system. The university is the highland for the production and dissemination of advanced culture, and the culture also reflects its strong cohesion and unique charm. This cultural demand closely links the university with logistics enterprises, scientific research institutes and other organizations to form a synergy of industry-university-research, and jointly realize innovation and transform it into social production to promote economic development.

3.2. Benefit Drive

The development process of social economy is essentially the pursuit and improvement process of value innovation. Under the condition of market economy, individuals or organizations are facing market-oriented competition. Therefore, the improvement and normalization of existing

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202009_3(9).0005

interests become the driving target of their continuous development. Under the condition of market economy, the interest mechanism is the fundamental power to promote the sustainable development of cooperation[9]. Without the driving force of interests, cooperation can not be deepened, nor can it last for a long time. The operation of the logistics industry-university-research collaborative innovation system can not be separated from the driving force of interests, which can quantify the transformation of innovation results into real productivity, so it has become the main internal driving force and premise for each innovation subject in the innovation system to participate in industry-university-research collaborative innovation. For universities, to participate in logistics industry-university-research cooperation, on the one hand, can improve their own popularity, obtain better students, attract high-level teachers, on the other hand, not only can students of logistics apply what they have learned in books to the actual field, but also can exchange information and establish communication relations with professional technicians, which can open up horizons, close to new logistics technology, lay a good foundation for students to choose and obtain employment. At the same time, it can make full use of teachers' scientific research ability to participate in logistics industry-university-research cooperation, improve teachers' academic level, so as to achieve the purpose of training students and teachers. For scientific research institutions, industry-university-research cooperation is conducive to cultivating the research and development ability of scientific research personnel, providing them with more opportunities to contact and learn with technical personnel of logistics enterprises and researchers of universities, so as to enhance the overall research and development ability of scientific research institutions and the ability to foresee technological development. In addition, as the main body of science and technology research and development, universities and scientific research institutes have two main sources of research and development funds: in the vertical aspect, they mainly come from the national or local government's science and technology project appropriation. Such science and technology project funding support is policy oriented, and the approval procedures and project approval requirements are relatively strict. Compared with the huge demand of many universities and research institutes, it is only a drop in the bucket. In horizontal aspect, it mainly obtains scientific research funds through cooperation with enterprises, that is to say, it obtains scientific research support funds income through joint research and development, principal-agent research and development, patent authorization, patent transfer and other ways. Under the condition that universities and research institutes obtain limited funds through vertical channels, they urgently need to cooperate with enterprises to meet their own research funding needs. For logistics enterprises, what they pursue is long-term and overall profit maximization. Industry-university-research cooperation can enable logistics enterprises to acquire complementary scientific knowledge and technology, form capacity synergy and combination advantages, and greatly reduce the cost of technology research and development. At the same time, if logistics enterprises apply for patents on core technologies successfully developed through cooperation and monopolize logistics services in related fields, then the market position can be consolidated and the competitiveness of logistics enterprises can be enhanced, thus bringing continuous profits to the enterprises. So in the logistics industry-university-research collaborative innovation system, internal interest as a means to ensure the continued cooperation between innovation subjects, promote the orderly work of collaborative innovation, effectively transform innovation results into real productivity and realize economic benefits, and the innovation subjects take their own needs from innovation results and innovation benefits to realize the benefit returns.

3.3. Market Driven

Under the background of "integration of informatization and industrialization", the development goal of manufacturing industry is no longer confined to the comprehensive information technology into business processes, research and development, design and

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202009_3(9).0005

manufacturing and other manufacturing activities, more important is realize the transformation of growth mode, industrial structure and resource allocation by means of the leaping development opportunity window opened by the integration of informatization and industrialization[10], so as to promotes the transformation of global manufacturing industry from "production manufacturing" to "service manufacturing". As a production-oriented service industry, the logistics industry has also been listed in the ten national industrial revitalization plans. However, compared with the international advanced level, China has not yet formed a system in terms of logistics informatization and intelligent long-term development strategy, and its overall planning capacity is low. Besides, the overall innovation of the logistics industry lags behind the active production and trading links, which hinders the innovative development of the modern logistics industry. [11]. Therefore, under the policy environment of "integration of informatization and industrialization", the integration of informatization and the logistics industry, as a modern service industry, is bound to become a development trend. In the logistics industry-university-research collaborative innovation system, further construct specialized and socialized modern logistics through the information means, not only can reduce the abrasion and transaction cost among various elements, enhance the industrial competitiveness, but also promote the development of logistics industry and increasingly become important foundational services industry in the national economic system. In addition, the transformation of scientific and technological innovation results into real productivity will ultimately serve the market demand through products or technology, which has become the main basis for guiding the operation of the logistics industry-university-research collaborative innovation system. Enterprises are the secondary main body of the the logistics industry-university-research collaborative innovation system. They directly face consumers to participate in the market competition. They have great advantages in analyzing market changes and grasping market demand, but they are in a relatively inferior position in scientific research and technological development. Therefore, they have a strong desire for collaborative innovation, hope to cooperate with universities and research institutes to make up for the lack of knowledge and technology. While universities and scientific research institutes have a large number of innovative talents and technical knowledge reserves, but it is difficult to understand the market changes, so they can not turn advanced technology into productivity to meet the market demand, and collaborative innovation with enterprises just solves this problem. Driven by market demand, the logistics industry-university-research collaborative innovation system can effectively integrate the superior resources of each innovation subject, so as to accurately grasp the development and change of market demand, and realize the breakthrough and innovation of product technology to realize the industrialization of knowledge and technology.

3.4. Technology Driven

With the rapid development of the industrial revolution and informatization, science and technology are constantly making breakthroughs in advanced technologies of new energy, biology, information, materials and other high-tech industries. Under the trend of universal, intelligent and green development, science and technology will fundamentally change people's lifestyle and market competition pattern[12]. At present, China's logistics industry in the face of national preemption characteristics of a new round of technological revolution and industrial revolution of the new situation, face the nation "to speed up the depth of a new generation of information technology and manufacturing integration as the main line, in order to promote the intelligent manufacturing as the main direction" strategy, face of the strategic task of developing into a great power in manufacturing from a pure big manufacturing country, an urgent need to build a support of deep integration of informatization and industrialization. In this context, the cycle of science and technology upgrading becomes shorter, so the market demand for cutting-edge science and technology drives the operation of the logistics industry-university-research collaborative innovation system. Especially in the era of knowledge

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202009_3(9).0005

economy, the society has higher requirements and deeper dependence on knowledge and technology. It is difficult for logistics enterprises to achieve sustainable development through a single technology, which requires diversified technology and continuous innovation to adapt to the changes of social market demand. Therefore, it is difficult for logistics enterprises to realize technology diversification only through internal independent research and development. They must use external resources to obtain technology diversity, so as to reduce their own research and development costs and improve innovation efficiency. The demand of enterprises for diversified technologies strengthens the driving force of cooperation between enterprises and technological innovation source-universities and scientific research institutes, thus promoting the realization of the logistics industry-university-research collaborative innovation.

4. Conclusions

The ultimate goal of collaborative innovation is to establish a long-term win-win cooperation mechanism among enterprises, universities and research institutes. Under the background of "deep integration of industrialization and modernization", this paper analyzes the innovation subject, innovation object and innovation environment of the logistics industry-university-research collaborative innovation system, and discusses the dynamic mechanism of the system from the internal and external power sources. It can be concluded that the realization of collaborative innovation in the logistics industry requires the in-depth cooperation between the industry, universities and research institutes to form a win-win pattern, so as to realize the sustainable collaborative innovation development of the logistics industry.

Acknowledgments

The research was supported by Social Sciences Foundation of Chongqing Municipality (No. 2016BS034); Educational science planning program of of Chongqing Municipality (No. 2017-GX-124); Curriculum reform and construction project in CTBU (No. 1792036).

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