

A Review of Collaborative Innovation among University, Industry, and Government from the Perspective of Coupling

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Abstract: University is not only the primary unit of training talents but also an essential part of the national innovation system. This paper will research the university industry-academia-research collaboration literature review, through further statement and explanation of the industry-academia-research collaboration model. Consider the coupling relationship between the three major innovations of universities, industries, and governments, enhance the contribution of university science and technology innovation application ability and service society development. To promote the construction of regional science and technology cooperation platform and the coordinated development of multilateral technology systems.

1. Introduction

University is not only the primary unit of training talents but also an essential part of the national innovation system. The conversion rate of scientific research achievements in Colleges and universities is an important index to evaluate the application ability of scientific and technological innovation and the contribution rate of serving social development [1]. Currently, the relationship among the innovation subjects of universities, industries, and governments is changing from the original loose cooperation related to the deep collaborative innovation relationship, this phenomenon will pose a severe challenge to the traditional school running concept and operation mechanism of the university [2]. Moreover, the coupling degree of collaborative innovation determines the overall efficiency of the innovation ecosystem, which has attracted the attention of all countries and regions in the world. However, at present, there is still a common dilemma of the low conversion rate of scientific research achievements in the cooperation between government, industry, and university [3].

2. Development overview

At present, the primary cooperation method is inside the university members, this is the primary cooperation method among the university, enterprise, and government, it shows internal cooperation is relatively close, but the interdisciplinary collaboration is relatively weak [4]. There is a relatively independent and interactive essence among universities, industries, and governments, with relatively fixed generation principle, static performance, and dynamic evolution characteristics, and there are an interaction and operation mechanism among universities, industries, and governments characterized by the flow of personnel, information, and products [5].

The international academic community believes that universities are becoming more and more critical, Henry Etzkowitz indicates that entrepreneurial university plays an increasingly important role in the development of the knowledge economy, which is manifested in providing “knowledge space”, “Consensus Space” and “innovation space”. It is pointed out that the critical role of the university is how to expand its core functions from teaching and scientific research to economic and

social development [6].

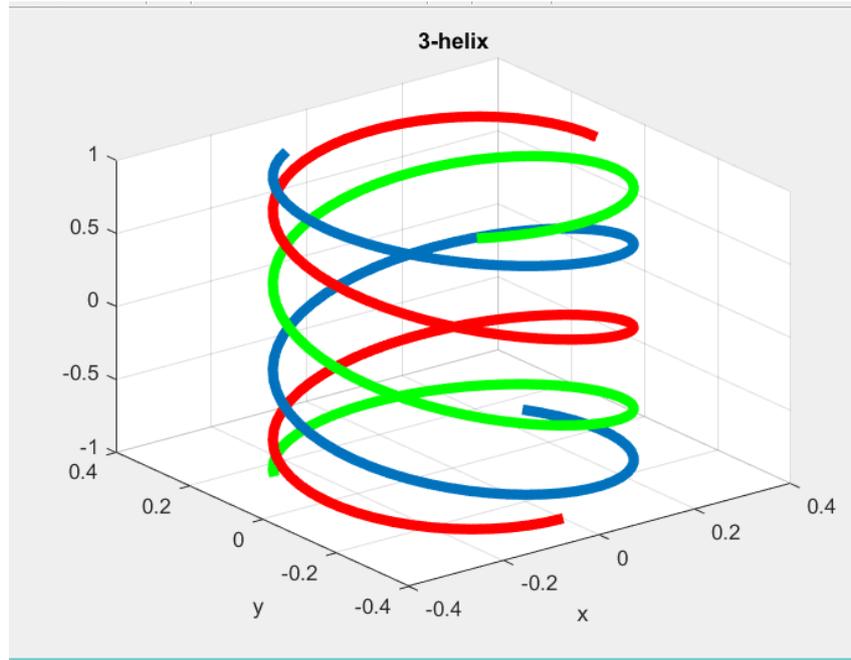


Figure 1 Henry Etzkowitz “Triple Helix” Model

In different stages of knowledge production and transformation, innovation subjects such as university, industry, and the government is connected, forming a triple helix model of mutual influence and spiral rise [7]. The pinnacle strategy, a technology development strategy to make Stanford out of the crisis and realize the transformation, defines the relationship between the university, government, and enterprise under the development of two-dimensional science and technology of academic and economic [8].

In China, the orientation of university has gradually developed from a research university to an entrepreneurial (or “applied”) university. The university has grown from a secondary supporting institution to a leading primary institution. As a carrier of knowledge innovation and entrepreneurship, the innovation system and technology transfer mode of university derived enterprises are more and more concerned by scholars. The university, government, and enterprises are linked by the requirements of industry and market, which can form a cross-coupling relationship. Through the demonstration of the “three-helix” model, we can provide ideas for the country's current scientific and technological innovation mode.

The mode of industry-university research cooperation of application-oriented university requires the interaction mechanism of the government, university, and enterprise and the advantages of training talents. The critical role of scientific and technological innovation in colleges and universities in regional economic development is becoming more and more prominent. But at the same time, there are still many problems in the transformation of achievements, which need to be continuously promoted through innovation system construction, scientific and technological personnel training, diversified industrial Incubation Platform Construction, and other innovative ways.

3. Model features

(1)Balanced Competition and Cooperation

Under the guidance of scientific and technological innovation, among the various cooperation modes of politics, industry, and learning, the subjects form a balanced competitive relationship of “depend on and independent”, “benefit-sharing, brand sharing, and institution-building”. In the relatively independent operation process, the three parties of production, learning, and research have cross-influence and achieve linkage rise, showing three-helix characteristics (such as mutual restriction, dependence, symbiosis, mutual cause and effect, etc.), and the three parties in the model

should eventually integrate into the structural relationship to promote the realization of their respective goals. At the same time, no matter how individuals run, cross, and overlap, they can not evolve into or replace another independent part [9], so it is imperative to balance competition and cooperation.

(2) Derivation and Linkage

The talent training mechanism of the linkage among universities, governments, and enterprises has the characteristics of goal consistency, primary body interaction, space-time continuity, and benefit amplification. At the same time, it includes strategic coordination, resource coordination, and system coordination. The realization of the talent training mechanism of tripartite linkage can be started from the aspects of organizational leadership, resource sharing, incentive and restriction, assessment and evaluation, corporate culture, etc [10]. Through the case study of Chinese university derivative enterprises, it is found that the strength and value of university scientific research are the necessary conditions for the generation of derivative enterprises, and the influence of the government in the knowledge innovation system also directly affects the development of derivative enterprises [11].

Therefore, the operation characteristics of the collaborative innovation model of production, learning, and research are a mutual restriction, dependence, symbiosis, and independence. The goals of the three models are consistent. Through derivative linkage, more significant social and economic benefits can be produced.

4. Research method

(1) Case Study

Some scholars have made in-depth study on the cooperation of government, industry, and learning in the research institutes of S University and P City, and discussed the useful cooperation mode of government, industry, and learning, which reflects the most ideal orientation of the main body in the development of science and technology innovation, and the “balanced cooperation” is the most effective cooperation state, that is, the three parties in the mode play a role in the cooperation process with their resources and functions [12]. The construction experience of some entrepreneurial universities in the United States and Australia is worth learning and can be used to promote the construction of entrepreneurial universities in China [13]. In order to measure the degree of network and structure of university-industry-government collaborative innovation, scholars made a comparative analysis of 10 countries such as the United States, Japan, and China. The results show that the self-organization ability of the United States, Japan, and the United Kingdom is active, while that of China is poor due to the weak cooperation between universities and industries [14].

(2) Quantitative Research

Scholars have put forward a variety of quantitative research methods, such as the complex three chain spiral innovation system network model based on the composite adaptive system theory, which can use the swarm simulation platform to simulate the operation of the innovation system, to find the optimal innovation organization mode [15]. It is a new method for the evaluation of scientific and technological innovation ability of colleges and universities to build a multi-dimensional initial index system and optimize the extraction of decision rules by using rough set theory [16]. The panel data model is established to test the long-term equilibrium relationship and short-term fluctuation relationship between R & D input and the university's scientific and technological innovation output, then regional differences between R & D input's impact on the university's scientific and technological innovation output can be analyzed [17]. Data envelopment analysis (DEA) method can be used to measure the efficiency of scientific and technological innovation in colleges and universities. On the premise of considering the factors of geographical space, this paper uses the knowledge production function to construct a model to analyze the influencing factors of the efficiency of scientific and technological innovation in Colleges and universities in China. It shows that the level of information, government behavior and the number of research and development institutions have a significant role in promoting the efficiency of

scientific and technological innovation in colleges and universities, and the level of regional economic development, but the number of R & D projects has a negative effect [18].

(3)Index of Construction

In recent years, colleges and universities can evaluate their scientific and technological innovation ability by building an evaluation index system of their scientific and technological innovation ability. In 2015, some scholars suggested that colleges and universities should set up contractual scientific research assistant posts in the form of scientific research funds allocation to release their potential scientific and technological innovation ability [19]. From the current situation, it has been realized. Besides, from the aspects of resource input, research achievements, achievements transformation, and technology exchange, the evaluation index system of the university's scientific and technological innovation ability can be constructed. It can be found that resource input and research achievements output are the key factors affecting university's scientific and technological innovation ability [20].

5. Effect evaluation

The rise of application-oriented universities plays an essential role in the transformation of high-tech achievements, the improvement of independent innovation ability and core competitiveness, and the promotion of regional economic development [21].

First of all, to carry out substantive collaborative innovation between universities, governments and industries is the path of transformation to entrepreneurial (application-oriented) universities, and to promote the sound operation of the innovation ecosystem, the model of industry-university research has the effects of dependence, cooperation, spillover, synergy and win-win [22] [23].

Secondly, according to the cooperation among universities, enterprises, and governments, the “three-dimensional central coordination theory” centered on market demand can mobilize the enthusiasm of participants and promote the overall development of the social economy [24].

Thirdly, the cooperation between universities and local stakeholders is a key factor for the successful development of the regional entrepreneurship ecosystem, and the future orientation of network and win-win may become a key factor for accelerating cooperation [25].

Finally, the “university-industry-government” should focus on the interactive relationship, the government-industry-university research cooperation model, and other advanced models, such as “building research and development entities”, to meet the needs of industrial technology innovation and strive for government cooperation and investment [26].

6. Conclusion

To sum up, three central units with different resources, including university, enterprise, and government, cooperate, this can form a relatively independent and interactive innovation mode. In this process operation, the primary position of the university, enterprise, and the government is like the continuing alteration of the propeller. So the organization form has a stable spatial combination pattern and mode, and the dynamic mechanism can reflect each other's demand resonance and interest inlay. An analysis of the actual cooperation between universities and industry and the role of the government in this process involves the use of various assessment methods to assess the overall effectiveness of the university's scientific and technological innovation capabilities and the three-helix collaborative innovation mechanism. In terms of the use of the model, it is mainly to be able to transform the scientific research results better, so that the research and development results of universities can be transformed into enterprises to achieve practical application so that enterprises can improve their independent innovation ability and core competitiveness. At the same time, under the coordinated control of the government, the development of the whole society is more flexible and comprehensive.

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