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TRIPLE HELIX THEORY AS THE CONCEPTUAL PLATFORM FOR INNOVATIVE TALENT CULTIVATION IN DIGITAL ECONOMY

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Abstract. The university-industry-government triple helix theory originated from regional innovation practices, revealing the essence of continuous knowledge-based regional innovation and triggering the exploration of new models and mechanisms for regional growth in countries around the world. The triple helix theory provides a new paradigm for the collaborative development of innovation and entrepreneurship education by government, enterprises, universities and other subjects. Taking the triple helix theory as a tool, the article proposes that under the background of digital economy, a new path of deep integration of innovation and entrepreneurship education with professional education should be explored in multiple modes, such as conceptual integration, curriculum integration and cross-disciplinary integration. University students are the main human base of the innovation and entrepreneurship group. To build the innovation and entrepreneurship education system in universities and to optimize the structure of innovation and entrepreneurship education, it is necessary to innovate the entrepreneurship model in universities based on the needs of the digital era.

Keywords: triple helix theory, digital economy, talents, competencies, innovation

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ТЕОРИЯ ТРОЙНОЙ СПИРАЛИ КАК КОНЦЕПТУАЛЬНАЯ ПЛАТФОРМА ДЛЯ РАЗВИТИЯ ИННОВАЦИОННЫХ ТАЛАНТОВ В ЦИФРОВОЙ ЭКОНОМИКЕ

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Аннотация. Теория тройной спирали, характеризующая взаимодействие в системе «университет – промышленность – правительство», возникла из региональных инновационных практик, раскрывая суть непрерывных региональных инноваций, основанных на знаниях, и иницируя исследование новых моделей и механизмов регионального роста в странах по всему миру. Теория тройной спирали обеспечивает новую парадигму для совместного развития образования в области инноваций и предпринимательства со стороны правительства, предприятий, университетов и других субъектов. С использованием теории тройной спирали в качестве концептуального инструмента, в статье предлагается, чтобы в условиях цифровой экономики новый путь глубокой интеграции образования в области инноваций и предпринимательства с профессиональным образованием был изучен в нескольких режимах, таких как концептуальная интеграция, интеграция учебных программ и междисциплинарная интеграция. Студенты университетов являются основной кадровой

базой для инноваций и предпринимательства. Для построения системы образования в области инноваций и предпринимательства в университетах и оптимизации структуры образования в области инноваций и предпринимательства необходимо внедрить инновационную модель предпринимательства в университетах, основанную на потребностях цифровой эпохи.

Ключевые слова: теория тройной спирали, цифровая экономика, таланты, компетенции, инновации

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The transformation and development of the economy and society are more concerned with the selection, cultivation and reserve of talents. The core function of modern university responsibility is the cultivation of innovative talents, i.e. the cultivation of various types of professional and innovative talents urgently needed by the country and society. Nowadays, innovation and high-tech industries have become pillar industries. Economic development cannot be achieved at the cost of damaging the environment. Modern universities have not yet done enough systematic research on the training of innovative and entrepreneurial talents. This requires reforming the training model with new educational teaching concepts and adopting modern educational tools to cultivate talents with innovative spirit and entrepreneurial skills.

With the development of the knowledge-based economy, universities have gradually become the centre of innovation in society. In 1995, Etzkowitz and Leydesdorff co-authored "The Triple Helix-University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development" [1], using the concept of the "triple helix" as a model to explain innovation activities in the knowledge-based economy, reflecting the special relationship between innovation agents [2]. The triple helix theory refers to the fact that the three organizations, government-industry-university, work closely together and interact with each other in the innovation process, while each party maintains its own independent status [3]. In the triple helix innovation theory model, the government-industry-university actors maintain their independent identities and functions, while supporting the functions of the other actors. The three subjects interact, intersect, overlap and merge like "spiraling helixes" to create an endless array of interrelated patterns and organisational structures, thus driving the spiral of innovation activities [4]. The triple helix theory provides a new theoretical research paradigm for studying the university-industry-government relationship. As an important part of innovation theory research, its main idea is that universities, enterprises and governments collaborate and switch roles in innovation, so as to improve the efficiency of resource utilisation and collaborative innovation through the adequate sharing of resources among the three parties [5].

The 1996 Triple Helix International Conference established the interaction between government, universities and enterprises as a cluster branch of innovation systems theory, which gradually became a new paradigm for the study of innovation systems [6]. The effective cooperation between government, universities and enterprises has become a source of power for economic and social development [7]. Since its inception, the theory has been receiving attention from scholars around the world. Research has mainly focused on the construction of theoretical models [8], analysis of synergy mechanisms [9], case studies [10], and innovation and entrepreneurship education in universities [11].

The triple helix theory explores the interconnected and spiralling interaction between government, university and enterprise innovation agents around the goal of knowledge production and transformation. In this interaction, government, universities and enterprises are all important forces in the innovation system. The triple helix theory has three levels of meaning :

- government, universities and enterprises are both independent of and interact with each other in the formation of the spiral;
- the role functions of government, universities and enterprises are both integrated and possibly partially transformed within the spiral, i.e. the functions on each spiral are integrated with each other or even partially transformed;
- government, universities and enterprises interact through the three spiral chains to generate new overlapping organisational structures and networks, thus providing a new platform for creative government-industry-academia cooperation [12].

The first level illustrates that the government, universities and enterprises play their respective functions in the innovation system: the government, as the main body of public administration, provides support for government-industry-academia cooperation through the formulation of public policies; universities, as the main body of knowledge innovation, undertake the function of scientific and technological innovation and knowledge dissemination; enterprises, as the main body of the market, are the promoters of the marketization of scientific and technological innovation results. The second level means that with the development of the economy, universities, as the main body of knowledge creation, began to take up part of the function of transforming innovation results, creating new products, opening up markets and developing into new enterprises; enterprises, while carrying out marketing and industrialisation activities, also established relevant research institutions or centers to realise technological knowledge innovation, playing the role of university knowledge innovation. The government carries out the transformation of its functions, from policy support to investment in science and technology parks and industrial parks. The third layer refers to the continuous emergence of hybrid organisations such as university student science and technology parks in the process of mutual cooperation between the three. Therefore, the analysis of the triple helix relationship between the government, industry and university should clarify the role positioning between the three, so as to facilitate the analysis of the dynamic mechanism of the in-depth cooperation between the three. At the same time, in the process of interaction between the three, the innovation subjects are constantly changing according to different stages of development, and each of the three plays its own role independently, while at the same time complementing each other, showing a continuous upward development in the interaction and cooperation.

Although most countries follow a 'triple helix' approach to government-university-enterprise partnerships due to the different contexts, they have chosen different types of internal institutions and development paths.

The first type is the 'state interventionist model', which emphasises state-led government-industry-university partnerships (as shown in Figure 1). In the state interventionist model, the innovative behaviour of industry and universities is controlled and arranged by the government, and the scope for autonomy is relatively narrow. The allocation of science and technology resources is centrally distributed by the government administrative system.

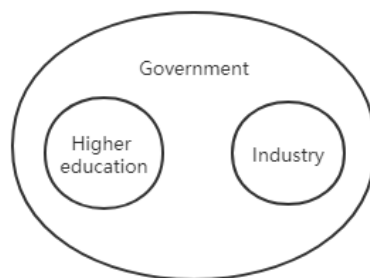


Fig. 1. Government-led model of triple helix theory

The second type of model is the 'liberal' model, in which the government, universities and enterprises operate independently and perform their own functions, but lack a good mechanism for interaction between them. In this model, there is a lack of sharing and effective integration of resources and information among the three innovation agents, resulting in an inefficient system as a whole.

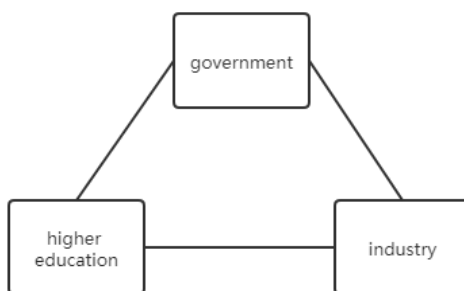


Fig. 2. Liberal model of triple helix theory

The third type of model is the triple helix overlap model (as shown in Figure 3), which refers to the fact that the three subjects play their own innovative roles while also undertaking some of the functions of other subjects, so that the roles and functions of the three subjects overlap with each other. For example, universities, while undertaking teaching and research functions, also promote the industrialisation and marketisation of research results, and to a certain extent play the role of entrepreneurs. In this model, the government provides services to support enterprises and universities by formulating and adjusting relevant policies and regulations or establishing science and technology parks to improve the environment.

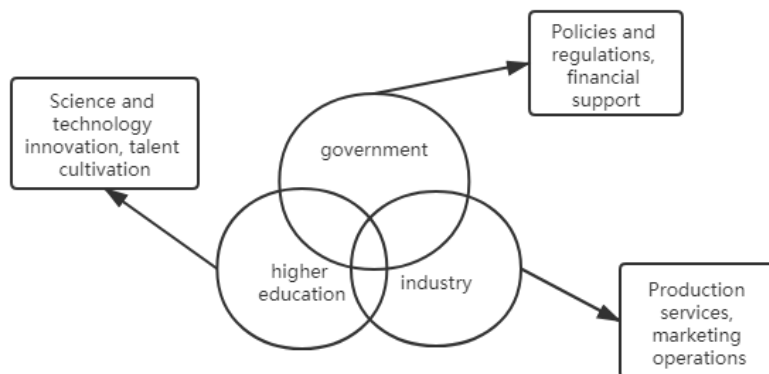


Fig. 3. Overlap model of triple helix theory

The regional triple helix is a reflection of the combined effect of the three models - university-pushed, corporate-led and government-pulled [13]. In different countries and regions, the ideal innovation should be a unification of these three models, each of which has its own conditions and strengths and weaknesses and can complement each other. The university-driven formation presupposes the presence of first-class research universities/institutes in the region and dedicated to the development of industry and society, with the advantage of helping to form autonomous regions of continuous innovation and the constant creation of new economic growth points, suitable for knowledge-intensive regions. The government-driven approach relies on the interaction between the government and academia, with the prerequisite that the government must be strong, able to fully mobilise innovation resources, and suitable for organising major national projects. The prerequisite for the large enterprise driven approach is that there is no shortage of large enterprises in the region that are leaders in their industries, which can use the industry cluster strategy to drive the progress and development of the region's advantageous industries as a whole, and is suitable for the development of resource-based and strategic industries that already have a foundation in the region.

The emergence and development of digital technology has injected new vitality into the innovation and entrepreneurship education ecosystem in universities. Digital technology not only breaks the limitations of time and space distance in the traditional educational environment, but the massive amount of data and information also expands the knowledge boundaries of talents and activates new ways of thinking. Digital technology not only facilitates the formation of sufficient resource interaction among subjects in the ecosystem [14], but also helps to break the dilemma of "data silos" among multiple subjects, establish a learning community created by digital resource construction, and promote the continuous improvement and optimization of the innovation and entrepreneurship education ecosystem.

Digital innovation and entrepreneurship is a new model of innovation and entrepreneurship proposed under the development of mobile communication, big data and Internet of Things technologies. In the traditional innovation and entrepreneurship model, various entrepreneurial problems of the industrial era were mainly targeted, while digital innovation and entrepreneurship has greatly enriched and expanded the content of entrepreneurial activities with the advantages of strong interaction, borderlessness and openness of the Internet. In digital innovation and entrepreneurship, entrepreneurs are using digital technology to communicate and exchange, with highly networked and virtualized characteristics. To build a sound innovation and entrepreneurship education ecosystem in the context of the digital economy, the government, universities and industry need to work together and make rational use of digital technology and digital platforms to form three complementary resources, coordinate with each other and develop together.

Based on the triple helix theory, this article explores the path and methods of building an innovation and entrepreneurship education ecosystem in universities from a digital perspective. The triple helix theory is the foundation, while talent cultivation is the core premise of innovation and entrepreneurship, and its path is to achieve the goal of full employment through higher education so as to achieve the impact of promoting regional economic development (as shown in figure 4) .

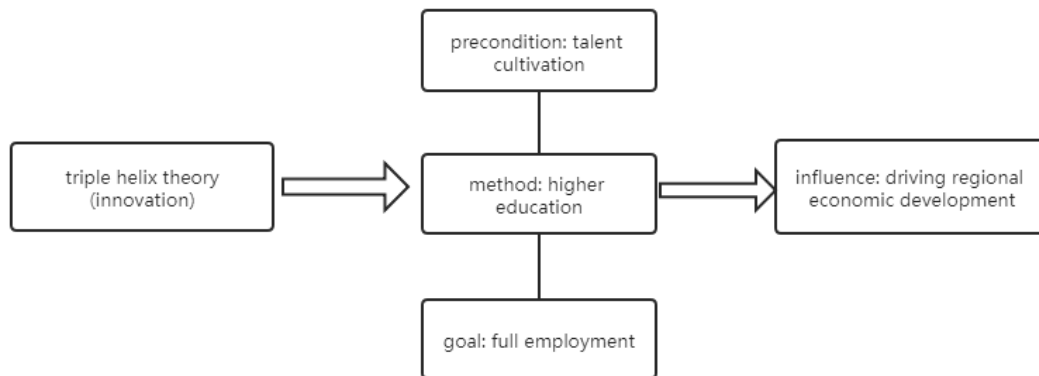


Fig. 4. Triple helix theory and talent cultivation

First, optimise the top-level design and strengthen the policy supply. The integration of innovation and entrepreneurship education with professional education, based on the triple helix theory, requires more comprehensive and targeted policy supply. The state should speed up the formulation of innovation and entrepreneurship education policies aimed at strengthening the tripartite collaboration between the government, universities and enterprises, highlight the main position and role of the government and enterprises in the practice of innovation and entrepreneurship education, and give more incentives to local government departments and enterprises for innovation and entrepreneurship education.

Second, strengthen the system and improve the management system. A sound policy system provides a good institutional environment for the development of innovation and entrepreneurship education. The government is an important regulator of the innovation and entrepreneurship ecosystem in colleges and universities. As an important spiral chain, the functions undertaken by the government, such as making policies and regulations and providing financial funds, are key factors affecting the effectiveness of innovation and entrepreneurship education in universities. As a government with public administration functions, it needs to provide financial support and improve intellectual property protection laws to better promote university-industry cooperation. The government should give universities more autonomy. Therefore, the government plays a coordinating role in the innovation and entrepreneurship education ecosystem through the formulation of policies and regulations and other public management tools. The government should further improve its policies in terms of top-level design to provide good policy resources and public services for collaborative innovation among government, universities and enterprises.

The role of the government in the innovation and entrepreneurship education ecosystem is not only to act as a policy in maker, but also to undertake the construction of a basic platform for sharing innovation and entrepreneurship resources. In the development of innovation and entrepreneurship education in colleges and universities, more emphasis is placed on cultivating the innovation and entrepreneurship awareness and ability of college students and on the nurturing function of innovation and entrepreneurship. Therefore, the government is not only a service provider of innovation and entrepreneurship in the innovation and entrepreneurship education ecosystem, but should also take the initiative to participate in the government-industry-university cooperation, establish a resource exchange platform for government-industry-university cooperation, realize the flow and sharing of information on innovation and entrepreneurship among the government, universities and enterprises, and actively guide the innovation and entrepreneurship achievements of universities and enterprises to serve local positive social development.

Curriculum is the basic carrier of professional education in universities, and it is also the basic element for the implementation of innovation and entrepreneurship education. To promote the integration of innovation and entrepreneurship education with professional education under the triple helix model, the integration of curriculum is an important support. The functional integration model of innovation and entrepreneurship education and professional education from the perspective of the triple helix is to take the integration of curriculum as the grip, aggregate the value orientation and educational resources of the government, universities and enterprises, and create a curriculum system in which innovation and entrepreneurship education and professional education are mutually permeable and deeply integrated, relying on the curriculum to promote. The government, universities and enterprises should jointly develop a curriculum integration system, in which education authorities can undertake the development of courses on national innovation and entrepreneurship policies, financial and taxation policies, laws and regulations and other entrepreneurial awareness and knowledge; universities can undertake the development of courses on innovation and entrepreneurship system theory and professional education; enterprises can undertake the development of practical courses directly related to innovation and entrepreneurship.

Structural integration refers to the integration of innovation and entrepreneurship education with professional education based on the triple helix theory and the inherent structural characteristics of the practice of innovation and entrepreneurship activities. The knowledge and skills required for innovative and entrepreneurial activities are not presented in the way that they are divided into disciplines and curricula within the education system, but rather in a way that crosses and interpenetrates multidisciplinary knowledge and skills. This requires a high degree of breadth and depth of professional knowledge and skills. The integration of innovation and entrepreneurship education with professional education should be based on the "triple helix" structure and take the path of inter-professional integration, based on the structural characteristics of the practice of innovation and entrepreneurship activities.

Innovation and entrepreneurship involves a wide range of knowledge, and the dimensions and levels of integration between innovation and entrepreneurship knowledge and professional knowledge are also very rich. Building a knowledge space platform means enriching innovation and entrepreneurship knowledge education with professional knowledge education through a wider coverage and knowledge capacity online space on top of on-campus courses and credit hours. The government, universities and enterprises can jointly build an internet knowledge space platform for innovation and entrepreneurship, and jointly develop courses and digital teaching resources that can be used by students for independent learning.

Universities play a major role in the development of innovative human resources, and their activities must be geared to the requirements of the digital age. The shortage in each country is not only for doctoral talents with high-end technologies, but also for digital application-oriented skills at the mid-range, i.e. digital talents. Innovation and entrepreneurship education in universities should be oriented towards new innovation and entrepreneurship models using big data, the internet, the real economy and artificial intelligence to nurture artisanal talent for the new era.

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