

DYNAMIC MECHANISM OF INDEPENDENT INNOVATION OF BIOLOGICAL INDUSTRIAL CLUSTER AND ITS EMPIRICAL STUDY

Mecanismo dinâmico da inovação independente em um cluster industrial biológico e seu estudo empírico

Wu Na

School of Business, Wuhan Huaxia University of Technology, Wuhan, P.R. China, 430223

E-mail: haha0629@126.com

Abstract: Independent innovation is the main source of cluster economic growth, and it is also the driving force of cluster development. Through the relevant literature, this paper analyzes connotation and motivation of the independent innovation biological industry cluster, and constructs the dynamic mechanism model on this basis. A case study of biolake in Wuhan, this paper analyzes its status quoined pendent innovation, and puts forward the corresponding countermeasures in view of the obstacle factors restricting the power of independent innovation, and the aim is to provide theoretical and practical guidance value for the sustainable development of the biological industry cluster.

Key words: Biological industry cluster; Independent innovation; Dynamic mechanism; Wuhan biolake

Resumo: A inovação independente é a principal fonte e força motiz de crescimento econômico do cluster. Através da literatura relevante, este artigo analisa a conotação e a motivação do cluster da indústria biológica de inovação independente e constrói um modelo do mecanismo dinâmico nesta base. Utilizando um estudo de caso do parque industrial biolake em Wuhan, este artigo analisa seu status de inovação pendente e apresenta as correspondentes contramedidas tendo em vista os fatores de obstáculos que restringem o poder da inovação independente com o objetivo de fornecer valor orientativo teórico e prático para o desenvolvimento sustentável do cluster da indústria biológica.

Palavras-chave: Cluster de Indústria Biológica; Inovação Independente; Mecanismo Dinâmico; Parque Industrial biolake Wuhan

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INTRODUCTION

The development of biological industry has been unprecedented attention all over the world, many countries in the area of technology, talent, capital intensive, has formed a relatively complete biomedical industry cluster, China will vigorously develop modern biotechnology as an important national strategy. According to incomplete statistics, China's bio-industrial park above the provincial level to reach more than 400 at present, the bio-industry will become a pillar industry of the national economy by 2020.

Some scholars have carried out a wealth of research on the dynamic of cluster innovation, representative views are shown as follow: Thomas Brenner (2001) used to set up a mathematical model to explore the dynamic factors for the evolution of the cluster, He believed that the memory of the cluster in seven power of innovation: cooperation between enterprises, enterprises rely on each other, the local capital market, human capital accumulation, informal communication, public opinion and local policy. Swann et al. (2002) through the example analysis method, the dynamic mechanism of cluster innovation depicted as including the interaction of dominant enterprises, new enterprises to enter, enterprise incubation increase and climate, infrastructure, and cultural capital of positive feedback system. Liu Hengjiang and Chen Jixiang (2005) described the dynamic mechanism of cluster innovation from two aspects: the excitation power and endogenous power. Motivation mechanism mainly referred to the clusters where the external environment on the cluster control and planning role, such as related policy and regulations, regional brand awareness, competitive environment; in addition to these external factors, there were some influencing factors from inside the cluster, such as complementary to the innovation of the network, the division of labor, for knowledge contribution degree, which was the impact of the fundamental factors of cluster innovation. Gao Daocai et al. (2007) argued that the independent innovation dynamic system was composed of external power, peripheral motion and driving force of three subsystems, which outer driving force was the foundation, around power was the guarantee, inner driving force was the soul of innovation activities, at the same time, they restrict and promote each other, jointly promote individuals actively engaged in innovative activities.

Previous studies showed that the independent innovation activities may not be determined by the chance of a single factor, it is determined by the interaction of various factors, such as society, economy, science and technology, culture and policy. This paper argues that the independent innovation activity of the biological industry cluster is affected by the external factors and internal factors, its independent innovation dynamic factors are composed of source dynamic factors and environmental dynamic factors.

ANALYSES ON DYNAMIC MECHANISM OF INDEPENDENT INNOVATION OF BIOLOGICAL INDUSTRY CLUSTER

Source dynamic factors

Source dynamic factors, mainly refers to the existence of the biological industry cluster, which produce core power to biological industry cluster independent innovation, including the independent innovation ability of the enterprise in the biological industry cluster, the benefit pursuit of enterprise or innovation organization in the biological industry cluster, the incentive of innovation agents to generate

innovative behavior, and the power of cluster subject collaborative innovation. It directly influences formation and quality of the independent innovation of biological industrial cluster.

Environmental dynamic factors

Environmental dynamic factors, refers to the biological industry cluster as a result of external factors on its own initiative to promote the role of innovation, including the pulling power of market demand, the driving force of technology, the pressure of market competition, the government’s support, the influence of other environment, For example, the macroeconomic environment, cluster regional innovation resources, social and cultural environment, talent market conditions, financial market conditions, property rights, legal system environment and market economic system, etc.. Through the interaction between the biological industry clusters, they have some influence on the formation, operation and duration of the biological industry clusters.

Dynamic mechanism of independent innovation of biological industry cluster

The dynamic factors and the environmental dynamic factors interact and influence each other; they have a huge driving force for the formation of the independent innovation of biological industry cluster, as shown in figure 1.

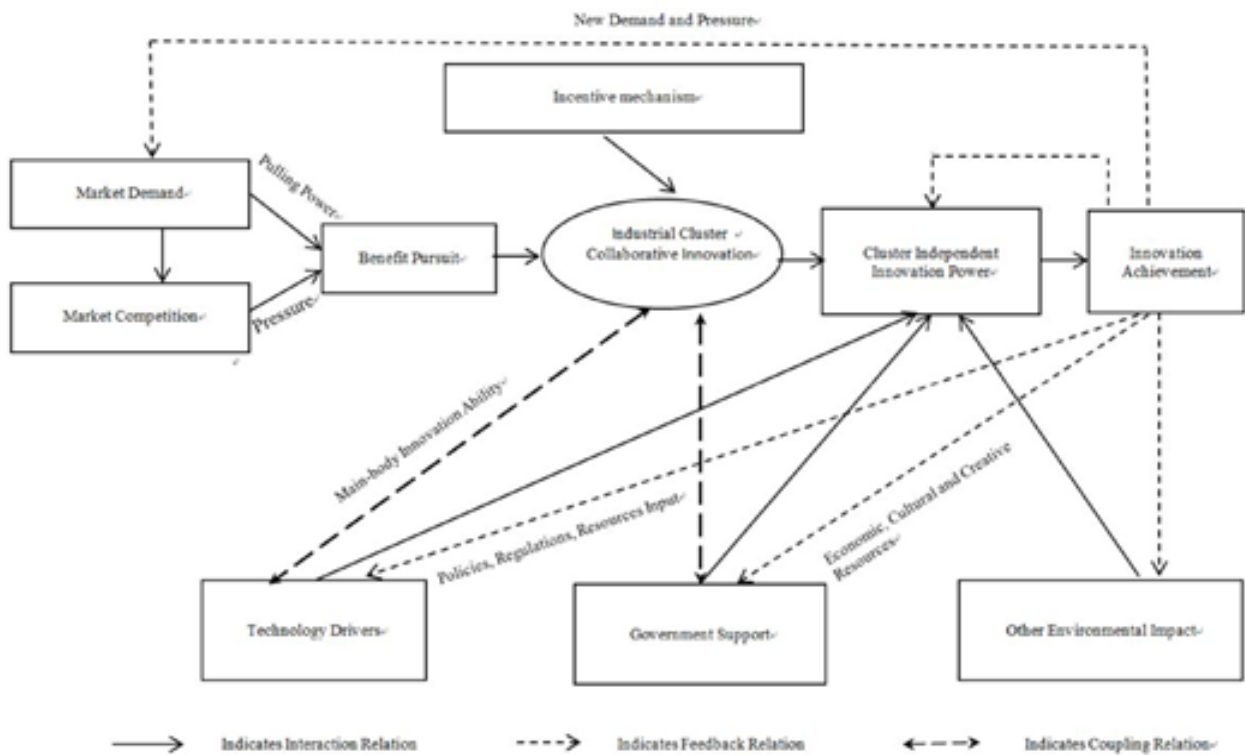


Figure 1. Biological Industry Cluster Independent Innovation Dynamic Mechanism

The pulling power of market demand and market competition pressure force the biological industry cluster to maximize the pursuit of benefit, the benefit pursuit of enterprise or innovation organization in the biological industry cluster directly or indirectly drives enterprise and innovation institution to engage in independent innovation activities. The enterprise innovation ability in the biological industry cluster is the material basis to ensure the realization of the innovation activity, scientific and technological progress is conducive to improving the ability of independent innovation of the cluster, forcing the main body of the cluster to increase R&D investment, develop new technologies and new products to meet market demand, so as to enhance the market competitiveness. However, the improvement of independent innovation ability of biological industrial cluster can promote the progress of the whole society and science and technology. The government's policies and regulations can effectively protect the biological industry cluster to complete the independent innovation activities, and the independent innovation of the biological industry cluster has promoted the improvement of the government's policies and regulations and the increase of tax revenue. Incentive mechanism can stimulate the innovation main body consciousness engaged in independent innovation, collaborative innovation of the main body of in the biological industry cluster enables the innovation resources and elements in the cluster to converge effectively, and promote the flow of talents, technology, information, capital and other factors of innovation in the main body, so that the process of independent innovation is more successful. The success of the independent innovation activities of the biological industry cluster has the promotion effect on the market, technology, government and environment, which in turn stimulates new innovation motivation, thus forming a continuous cycle, makes independent innovation activities continued to proceed.

STATUS QUOINED PENDENT INNOVATION IN WUHAN BIOLAKE

Approved by the National Development and Reform Committee (NDRC), Wuhan Biolake is a national industrial base combining biological products research, production and logistics. Having been established for over 8 years, Biolake has gathered 6 companies from world top 500 such as Pfizer, 11 listed companies such as National Medicine Group and other over 900 biological companies. The number of scientific and technological activities has broken through 40000; the scale of industrial production grows by an average of 40% per year and industry revenue has exceeded 80 billion RMB at the end of 2015. At present, compared with the other 107 domestic biological parks, Biolake ranks second relying on its comprehensive strength.

Having introduced 168 international high-end talent teams and 10 academician projects, Biolake has gained financial support up to 180 million RMB with 16 people selected to "National 1000 Talents Program" and 11 people selected to "Hubei Provincial 100 Talents Program". The number of enterprises' patent application reaches 428, among which 186 are approved and 60 are converted into achievements. Wuhan Heathen Biotechnology Company and Hamilton Biological Company have successfully landed at "new three boards"; a number of independent development products such as recombinant human serum albumin, nano-drugs, diagnostic reagents, EPA and DHA with high purity, cell disruption system, pesticides, food testing box have successfully come into the market.

OBSTACLES OF THE INDEPENDENT INNOVATION OF BIOLAKE

Although Biolake has achieved a lot during over eight-year development, some problems still exist in the motive aspect of the independent innovation, which is likely to cause a lack of stamina if not paid much attention to.

Insufficient collaborative innovation capability

The establishment of the Wuhan Institute of Biotechnology provides a platform for the cooperation of enterprises in Biolake and other innovative ones. Yet the industry-university-research collaborative innovative network in the biological industrial cluster has not formed completely, and the jointed innovative atmosphere is not active. There are 85 ordinary universities in Wuhan, among which are 7 “211 Project” universities, ranking the forefront of the country. Although the universities and enterprises have established an industry-university-research cooperation mode to build innovation laboratory, jointly develop technology innovation and develop new projects, the ability of market docking of the scientific research achievements is still not strong.

Lack of attractiveness to talents

Gathering a large number of colleges and universities, Hubei does not lack talents. According to statistics, there are over 300 thousand graduates, but among which only 1% Ph.D students, 4% master students and 11% undergraduates stay in Hubei every year. Meanwhile, universities disjoint market and industry development on cultivating. There are few new-rising subjects, few high-level research and development talents who can master the key technology and have the ability of independent innovation, and even fewer compound leaders with research and development background and operation capability, which cause an insufficient development of Biolake.

Lack of cooperation and coalition of leading enterprises

The leading enterprises have a great impact and appeal, a certain demonstration effect and guiding function on other peer enterprises in the same industry. Taking a comprehensive view of the successful development experiences of the industrial cluster in the USA, there is at least one leading enterprise that enjoys a high reputation. Such as Genentech and Chiron in Silicon Valley, Biogen in Boston, and Affymetrix in Biotechnology Bay, San Francisco.

Currently, Biolake has gathered the world's biggest pharmaceutical enterprise---Pfizer; Asia's greatest and world's third greatest genome research organization---Shenzhen BGI; the best subcontractor in Asia preclinical new drug's research and development and the world's best small molecule compound new drug's research and development enterprise---Wuxi AppTec; the best enterprise in Chinese pharmaceutical logistics industry---Sinopharm Group Company Limited; the biggest Chinese private vaccine enterprise---Changsheng Biotechnology; the leading enterprises of pharmaceutical industry in China---China National Seed Group, Grand Pharmaceutical(China), Longping High-Tech Agriculture and Wuhan Human Well Hi-tech Industry Company Limited etc. But those famous transnational enterprises contact more with their parent company instead of making technical exchanges with local enterprises in the industrial cluster. Therefore, the participation of transnational bio-enterprises doesn't bring the diffusion of the core technology.

STRATEGIES TO PROMOTE INDEPENDENT INNOVATION IN BIOLAKE

Establishing the innovation union and creating a collaborative innovation network with enterprises dominating and industry-university-research combining

By making the most of technology and talent in universities and scientific research institutes in Hubei Province, the collaborative innovation strategic alliance in Biolake is built, through which the multiform cooperative innovation between independent innovations is achieved. The intellectual property alliance, organization and technology alliance, industrial cooperation are established on major technology projects. Grasping the trend of industrial forefront in time and developing communication and industry-university-research cooperation in international dimensions promote the cooperation between enterprises or scientific institutions in the cluster and enterprises with strong research strength in the world. By following, studying, re-innovating and other ways to improve the independent innovation capability, the international competitiveness of Biolake industrial cluster will be enhanced.

Perfecting regulation system to create favorable policy environment

As a supporter of independent innovation activities, Wuhan municipal government should do a good job of service and create favorable policy environment. Firstly, the government should reach the grass-roots level, do well in the research work, investigate and analyze the developing situation of enterprises, the status quo of independent innovation and the existing problem in the industrial cluster in Biolake. On the basis of this, effective and pointed policies can be put forward pertinently, which includes financial budget, tax policy, special fund, application of major projects, public service platform and so on. Secondly, the government should adjust and reform the policies and measures in new drugs' approval, in market management, in financial credit, in tax deduction and exemption, in facilities, in talent introduction, etc., and further optimize the independent innovation environment in Biolake. Thirdly, the government should intensify the protection of intellectual property in the biology industrial cluster. Besides, to build a good independent innovation atmosphere in Biolake, the government should formulate and perfect the laws for the intellectual property, and increase the intensity to punish whoever violates the intellectual property of others.

Promote talent gathering to form the talent pool

To become a "magnetic field" where domestic and foreign excellent talents yearn and gather, Biolake should not only attract talents but also to retain them. In order to achieve this, Biolake should continue regarding "3551" Talent Project and Yellow Crane Talent Program as carriers to intensify high-level talents introduction and bring in the leading talent teams with projects and achievements. A number of outstanding scientists and research teams, as well as technology and products with international influence in biological industry will come into being by assembling high-level talents and supporting specifically. Besides, Hubei Provincial Government should intensify the construction of biological classes in universities and strengthen the cultivation of the professional technical talents and compound talents. According to the market demand, colleges need to adjust professional structures and talent training program, and set new-rising majors concerning biotechnology, so that universities can cooperate with enterprises to establish employment practice bases.

CONCLUSIONS

Although Wuhan Biolake has made remarkable achievements, there are still some obstacles to the driving force of independent innovation. The collaborative innovation capability of independent innovation subject, the government support, talent depressions formed, the collaboration between the leading enterprise aspects has carried on the detailed analysis, and on this basis, this paper puts forward some effective countermeasures.

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