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A Study of the Ecological Community Model of Independent Innovation of Biomedical Industry in China

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Abstract: *This paper first analyzes the status quo of and problems with independent innovation of biomedical industry in China and uses ecological theory to analyze the ecological community characteristics and models of the independent innovation system of biomedical industry, holding that balanced ecological community model can promote the development of biomedical industry.*

Keywords: *Biomedical Industry; Independent Innovation; Ecological Community*

1. Introduction

China's biotechnology research began in the mid-1970s, and the biomedical industry has undergone nearly 30 years of development. With the strong support of national policies, major breakthroughs have been made in some areas, but on the whole, they have not formed their own competitive advantages, especially with a lack of independent innovation capabilities. In recent years, the theoretical community has paid attention to the ecological characteristics of innovation behavior and innovation community evolution. The existing research results show that the science and technology innovation community is a social "ecological community" based on industrial linkages and characterized by geographical proximity and composed of interactive and interdependent innovation organizations. It has behavioral characteristics similar to biomes. Therefore, scholars should pay attention to how to deeply understand the ecological community model of independent innovation in the bio-pharmaceutical industry and promote the development of China's bio-pharmaceutical industry.

2. Status Quo of and Problems with Independent Innovation of Biomedical Industry in China

In October 2015, Tu Yu became the first Chinese scientist to win the Nobel Prize in Science for discovering artemisinin, which can effectively reduce the mortality rate of malaria patients. This marks a huge increase in the field of innovation and international influence of China's biomedical industry. China has a large number of talented scientists and strong drug and vaccine research and development capabilities, and will continue to address global health and human health challenges by accelerating drug discovery and innovation. From 1998 to 2013, the average growth rate of industrial output value of China's pharmaceutical manufacturing industry exceeded 16%, but there are still some problems in the field of independent innovation, which are shown in the following aspects.

First, the basic research of China's technology-based enterprises and research institutes is carried out independently. The two have not formed a close cooperative relationship, leading to repeated research, waste of resources, and lack of knowledge sharing; Second, the company independently undertakes investment in basic research, clinical trials, examination and approval, and marketing. The demand for funds and talents is huge, and the investment risks assumed are also high. This has led to insufficient willingness and motivation for innovative drug research and development in China; Third, China's biomedical industry is seriously lacking a platform for sharing public basic resources. Enterprises have to independently complete basic research, clinical trials, approval applications and marketing.

3. Ecological Community Characteristics of Independent Innovation System in the Biomedical Industry

The biomedical industry in a broad sense refers to an industry that combines modern biotechnology

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with the research, development, and production of various forms of new drugs, as well as the combination of diagnosis, prevention, and treatment of various diseases. The independent innovation system of the biomedical industry is a comprehensive innovation group. It requires close cooperation and coordination between units and departments such as biomedical research and development institutions, new drug screening and evaluation centers, biomedical students, production enterprises, investment and financing institutions, technology service intermediaries and science and technology management departments. From the perspective of ecology, the independent innovation system of the biomedical industry is an ecological community. In this ecological community, each ecological factor has different life characteristics, and there are various complex organic connections between the population, between the population and the population, and between the organism and the environment. The development and evolution of the independent innovation ecological community in the biomedical industry is a comprehensive process of the above various factors under certain environmental conditions. This ecological community is mainly characterized by:

The first is the symbiotic nature of the mutual integration and interdependence between the biotechnology industry and the pharmaceutical industry. Since biotechnology requires a large amount of R&D investment, the traditional pharmaceutical industry also needs innovative products, and bio-enterprises and pharmaceutical companies are united. This has promoted cooperation between pharmaceutical companies and biotechnology companies, changing the organizational structure of the two traditional industries and generating new industrial advantages.

Second, the symbiosis between biopharmaceutical companies is mainly to upgrade the organizational structure of the biomedical industry through mergers and acquisitions between biopharmaceutical companies, and to form an ecological balance between large companies and small and medium-sized companies: Strong companies invest in small and medium-sized enterprises, purchase their technology, and thus acquire new technology; small and medium-sized enterprises absorb foreign capital, and at the same time obtain market through professional division of labor within the industry.

Third, the ecological community of independent innovation in the biomedical industry presents typical environmental dependence characteristics. As a representative of the high-tech industry, the bio-pharmaceutical industry not only has the characteristics of industrial agglomeration, but also the region where the bio-pharmaceutical industry gathers has a special natural environment characteristic, which is the university dependence characteristics of the bio-pharmaceutical industry. For example, the four biopharmaceutical communities in the United States depend on the research base of local universities and research institutions. The ecological environment close to university research can provide patented products and technologies for biopharmaceutical companies on the one hand; on the other hand, it also provides a talent reserve for the development of biomedical industry. Even the founders of many biomedical companies are university professors or researchers. At the same time, the development of the industry also counteracts the ecological factors of the environment, breaking the traditional environmental theory and reconstructing the ecological balance of the biomedical industry.

4. Analysis of Ecological Community Model of Independent Innovation in Biomedical Industry

In the ecological theory, if any ecological community needs to have the ability of sustainable development, it must have a complete circulation system centered on the nutrition chain and the food chain, and can smoothly realize the exchange of matter and energy in each link. The nutrient chain and food chain of the ecological community are determined by the species in the community and the biological characteristics of each species, and are closely related to environmental changes. The various adjustment mechanisms affecting the development of ecological communities are essentially to maintain a certain dynamic balance of the above-mentioned circulation system. The evolution of biological species is manifested by the long-term effects of the above regulatory mechanisms, and some of the suitability changes exhibited by the biological characteristics of the species itself, which will be inherited and inherited by the genes throughout the species. The ecological model of independent innovation in the biomedical industry includes the following aspects.

The first is the research institution and enterprise community, which is the main part of the ecological community. They are distributed in the upper, middle and lower reaches of the industrial chain according to the role and status of producers, consumers and de-composers, and carry out the flow of knowledge, information, materials, capital and talents according to the operation rules of the ecological chain and food chain. The relationship between enterprises and enterprises, research institutions and research institutions, enterprises and research institutions is complex, networked, interdependent and mutually reinforcing. There are two types of core enterprises, mainly small enterprises, supplemented by the type of system operation mode, but also the same status of resource

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exchange, market regulation to achieve value chain value-added collaborative symbiotic operation mode.

The second is to support the community of services, which is the basis for the survival and development of the industry. In the service population, through the injection of bank funds, investment company support, industrial park service center provides a variety of services, so that the industrial chain can be formed and maintained, the entire industrial ecological community model can develop healthily.

The third is the innovation environment. Biomedicine has its particularity, namely high investment, high profit, high risk and long cycle. According to the survey, the development of new drugs usually takes at least four to five years. Therefore, a good innovation environment is particularly important for the growth of enterprises and the cultivation of innovative capabilities. The innovation environment includes government policies, market environment, geographical advantages, convenient transportation, comfortable environment, good culture, and recreational facilities designed for researchers. These are all important factors in attracting foreign investment and talents and facilitating the sustainable development of enterprises.

5. Conclusion

In order to effectively solve the problem of weak self-innovation ability in China's bio-pharmaceutical industry, this paper conducts in-depth thinking and model exploration from the perspective of ecology. It can be known from the analysis of the ecological community characteristics and patterns of the biomedical industry that: The rapid development of China's biomedical industry is not only due to its ability to industrialize scientific research results, but also to rationally adjust the ecological community model to grasp the balance of the biomedical industry ecosystem.

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