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RESEARCH ON THE INFLUENCING FACTORS AND ACTION MECHANISM

OF SHENZHEN BIOPHARMACEUTICAL INDUSTRIALIZATION

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Abstract

The bioindustry is another emerging leading industry after the information industry. Human society has entered a new era of biological economy. The Chinese government formulated the "Eleventh Five-Year Plan" for the bioindustry for the first time in 2007, drawing a grand blueprint for the biological industry. In general, China's bioindustry is still in its infancy, and the basic research of industrial development lags far behind that of developed countries. After more than 10 years of development, China's bioindustry has made great progress, but the relevant achievements still fall short of expectations. In the biological industry, the biopharmaceutical industry is undoubtedly a bright pearl. But at present, the development speed of biopharmaceutical industrialization in China is also relatively slow. Except for Beijing, Shanghai and Shenzhen, the number of biopharmaceutical enterprises in other regions is small, and they often fight alone, lacking of echo and cooperation within the region, and it is difficult to achieve the macro goal of industrialization development. The biopharmaceutical industry has received a lot of attention in recent years and has even been regarded by some as the golden key to solving human diseases. At present, the country attaches great importance to the development of the biopharmaceutical industry and has issued a series of policies to assist and support the biopharmaceutical industry. However, there are still some problems in the development of biopharmaceutical industrialization, such as insufficient innovation, insignificant industrial effect and weak independent research and development capability. How to promote the industrialization of biopharmaceutical industry has also become a topic of common concern for academics and governments. Based on this thinking, this article will study the influencing factors of Shenzhen's biopharmaceutical industrialization, analyze which factors can have a significant

impact on the development of biopharmaceutical industrialization, and also analyze the specific action mechanism of these influencing factors. From the perspective of research methods, this paper relies on the Likert five-level evaluation scale to conduct a questionnaire survey on Shenzhen's biopharmaceutical industry and relevant government departments, and rely on data processing software such as SPSS to process and analyze the collected data information. This article hopes that through research, we can find a way to promote the development of Shenzhen's biopharmaceutical industrialization and provide some experience for the development of biopharmaceutical industrialization in other regions of China.

Keywords: Biopharmaceutical; Industrial development; Influencing factors; Action mechanism; Empirical analysis

INTRODUCTION

A draft of the human genetic blueprint was completed on June 27, 2000, and it was called the third milestone in the history of science and technology after the atomic bomb and the moon landing. Major breakthroughs in life sciences and biotechnology have triggered new technological revolutions in the fields of medicine, agriculture, industry, environment, and energy. The bioindustry is another emerging leading industry after the information industry (Zhang, 2016; Huo, Han & Ke, 2017; Shi, 2017; Long, Wei, Yin & Pan, 2017; Gao & Ou. 2019; Wen, 2019). Human society has entered a new era of biological economy.

In many countries, the bioindustry has been developed as a strategic industry. Countries have formulated strategic plans for the development of the bioindustry, issued special policies, established specialized agencies, accelerated the cultivation and attraction of talents, significantly increased investment in biotechnology research and industrialization, guided social resources into the bioindustry, promoted the concentrated development of the bioindustry in knowledge-intensive areas and strived to seize the commanding heights of international economic and technological competition in the 21st century (Shi, 2012; Yuan, Li, Tang & Wang, 2014; Hu, Luo & Dai, 2018; Peng, Zou, Zeng, Wang & Sun, 2018; Zhang, 2019). The United States has a clear understanding of the strategic position of the bioindustry. The Bush administration has established the biopharmaceutical industry as a "new growth point." The cost of biotechnology research and development has reached more than 38 billion U.S. dollars, second only to military science. The United States White House and the Congress both have dedicated biotechnology committees to track the development of biotechnology, study and formulate corresponding budgets, management regulations and tax policies. The Biotechnology Industry Organization of the United States has been working to coordinate the relationship between industry and government and to promote the development of biotechnology research, development and industry policies. Driven by it, the 1997 U.S. federal budget provided tax incentives for the biotechnology industry and research and development. Entering the 21st century, the United States has established and secured an intergenerational advantage in the biotechnology industry in the world. In this study, Shenzhen city is taken as the source of enterprise samples. As we all know, Shenzhen is an economically developed city in China and has obvious geographical advantages in terms of technology and economic strength. Many well-known biopharmaceutical companies in China are in Shenzhen, including Shenzhen Mindray Bio-Medical Electronics Co.Ltd. Shenzhen Puruikang Biotechnology Co., Ltd., and ERA Biotechnology (Shenzhen) Co.Ltd. In recent years, the Shenzhen Municipal Government has vigorously promoted the development of biotechnology. It can be said that Shenzhen is currently a model area for the development of biopharmaceutical industrialization in China, and relevant research on Shenzhen will help provide valuable experience for the development of biopharmaceutical industrialization in other cities in China.

Problem Statement

Birth, senility, illness and death are the normal state of human life. With the development of modern medicine, more and more diseases have been effectively controlled and even completely cured. However, in the face of some difficult diseases, traditional medical and physical methods have been difficult to play a role, so biopharmaceuticals have begun to become an important trend in the development of the current world pharmaceutical industry. Research and development of a pharmaceutical often requires huge investment costs, its amount can even be as high as more than 1 billion US dollars. Because of this, the call that promotes biopharmaceutical industrialization already got more and more people 's recognition and support. China's national and local governments are also vigorously promoting the development of this process, but the pace of the development of biopharmaceutical industrialization is still slightly slow, in the process of its industrialization is always accompanied by the following problems:

There are problems in the biopharmaceutical companies themselves, such as insufficient capital strength, insufficient R&D investment, unfavorable talent training, and outdated organizational forms. In addition, the development of related supporting industries and surrounding industries is closely related to the progress of biopharmaceutical industrialization.

Research questions

Question 1: What role does innovation play in the development of biopharmaceutical industrialization? Innovation is the soul of a country's development, and it is also an important driving forces for enterprises to take off. In the process of biopharmaceutical industrialization, it seems to be fully connected with innovation. In the development of biopharmaceutical industrialization, innovation is mainly reflected in two aspects: 1. external cluster innovation network; 2. internal synergy innovation

factors. Because most of the biopharmaceutical products circulating in our market are imitation products (imitation of mature products from abroad), the ability of independent innovation appears to be insufficient. Therefore, research on this issue is very necessary.

Question 2: Does the market competition factor affect the development of biopharmaceutical industrialization? Competition has been existing since the beginning of the birth of enterprises. With the gradual opening of China's market and the gradual transparency of market information, the degree of market competition of Chinese enterprises has almost reached an unprecedented level. In the process of such fierce competition, is the biopharmaceutical industrialization affected by market competition? If so, does this influence tend to be positive or negative?

Objectives of the research

This article takes the Shenzhen biopharmaceutical industry as the research goal, aims to explore the influencing factors of Shenzhen biopharmaceutical in the process of industrialization, and analyze the specific mechanism of these influencing factors. Therefore, in this study, the establishment of empirical analysis, to analyze the various influencing factor has become the key to this study. For this reason, the specific research objectives of this paper include: 1. With external cluster innovation network and internal synergy innovation factors as the specific research objects, the specific impact of innovation on Shenzhen biomedical industrialization is analyzed. Research goal 2: Taking the factors of market competition as research objects, explore the role played by market competition in the industrialization of biomedicine in Shenzhen.

LITERATURE REVIEW

Dependent Variable: Development of biopharmaceutical Industrialization

At present, the definition and delineation scope of the biotechnology industry in various countries and organizations are not uniform, and even different people's views are often widely divergent. This paper adopts the views of relevant scholars and defines the modern biotechnology industry as: Biotechnology is a comprehensive technology system, in which people taking the theory of modern life science as a base, using living organisms and their cellular, subcellular and molecular component, combining with the engineering, informatics, etc., conduct a research and manufacture products, or modify animals, plants, microorganisms, etc., and make it with the desired quality, properties, and then provide society with the means of goods and services. With the completion of the Human Genome Project, it is expected that by 2020, more new pharmaceuticals made using biotechnology will be available on the market. In the 21st century, the entire pharmaceutical industry is facing renewal using biotechnology. The development of biopharmaceutical industrialization means that

using biological pharmaceutical technology, relying on the related enterprises, form industrial agglomeration effect in the region, create an industrial park with the level of industrial competitiveness, form a batch of biopharmaceutical enterprises with certain strength and research capacity, constantly launch new scientific research products, and correlate and promote the common development of related industries at the same time (Xiaowei, Zhilin & Lingyu, 2009; Hou, Sun & Li, 2015; Cai & Jiang, 2017; Chen, Peng, He & Hu, 2018; Feng, 2018; Huang, Li, Ye, Wang & Wang, 2018).

Preliminary Research on the Development of Biopharmaceutical Industrialization

1. Research on industrial cluster and biopharmaceutical industry cluster

Scholars at home and abroad have done more research on industrial clusters. Foreign representatives include Marshall, Alfred Weber, Michael Porter, Krugman, and domestic representatives include Wang Jici and Wei Jiang. There are also various definitions of industrial cluster, and the concept of industrial cluster by Mike E. Potter (1998) is widely recognized at home and abroad. According to Mike Porter, an industrial cluster is a collection of geographically concentrated companies and institutions that are interconnected in a particular field. Industrial cluster include a group of interconnected industries and other entities that play an important role in competition. Industrial cluster offen extend down to sales channels and customers, and laterally to manufacturers of auxiliary products, as well as industrial companies related to technical skills or inputs. Industrial cluster include governments and other agencies that provide specialized training, education, information research, and technical support. Industrial clusters have attracted the attention of researchers from different disciplines and become a hot topic in foreign theoretical research. The main representatives and research directions include:

(1) In terms of the generation mechanism of the biopharmaceutical industry cluster, Cooke et al. (2003) researched and found that the high-tech, high-input, high-risk characteristics of the biopharmaceutical industry determine the need for biopharmaceutical enterprises to cluster; The meticulous division of labor in the biopharmaceutical industry, the spillover of technology and the denseness of investment funds further catalyze the concentration of enterprises in the industry. In terms of the generation mechanism of biopharmaceutical industry clusters, Cooke et al. (2003) found that the basic characteristics of biopharmaceutical industry, such as high technology, high investment and high risk, determine that biopharmaceutical enterprises need clusters. Huo yongliang et al. (2005) believed that there is a detailed division of labor in the biopharmaceutical industry, the spilt of technology and the density of investment funds further catalyze the agglomeration of enterprises in the industry. (2) In terms of the classification of biopharmaceutical industry clusters, Wu Xiaojuan et al. (2008) divided the US biotechnology clusters into three cluster models: traditional pharmaceutical centers, R&D-based corporate centers, and venture capital centers. (3) In terms of the composition of the biopharmaceutical industry cluster, Li zhineng et al. (2006) analyzed that there are four core characteristics of biological industry clusters in the United States. World-class research institutions are the premise, venture capital network is the key, new enterprises are the primary, and leading enterprises are the pillar. (4) In terms of research on industrial cluster and industrialization performance, Steven Casper (2015) concluded through empirical analysis that the companies established by scientists with industrialization experience have better business performance; Thomas Brenner (2016), through his research on German biopharmaceutical industry clusters, found that product innovation, process innovation and cooperative innovation between enterprises and suppliers or research institutions have a great difference in the impact of industrialization realization.

In conclusion, the research on clusters at home and abroad mainly focuses on the mechanism of industrial clusters, technological innovation, organizational innovation, social capital, and the relationship between economic growth and industrial clusters, and industrial policies based on industrial clusters (Shi, Li & Yinlu, 2012; Wang, 2013; Lin, Zheng & Li, 2013; Li, 2015; Zeng & Hu, 2015; Wang & Cheng, 2017; Li & Chen, 2018; Xu, 2018; Guo, Jin & Li, 2019; Tan, Wang & Guo, 2019; Zhang, Guo, Fan & Tang, 2019). The main research method is to summarize general laws and empirical studies by analyzing regional industrial cases (mainly concentrated in successful areas of developed countries). The main conclusion is that the growth of labor productivity in industrial clusters is endogenous and shows the characteristics of increasing returns to scale. For the regional economy, due to the intra-industry and inter-industry linkages, increasing returns to scale are not only reflected in enterprises, but also in the industry. Clusters enhance the competitiveness of regional industries and improve the innovation performance of enterprises. However, from the existing literature results, the research on bio-industrial clusters at home and abroad has a certain foundation, but it is not sufficient. From the perspective of enterprises, there is no literature on the influence of biopharmaceutical cluster on the industrialization along the path of biopharmaceutical industrialization.

Independent variable 1: Factors of innovation

Innovation refers to the use of existing thinking patterns to provide insights that are different from the conventional or ordinary people's thinking, which means that using the existing knowledge and material, in a specific environment, in line with the ideal needs or to meet social needs, and improve or create new things, methods, factors, paths, environment, and can obtain certain beneficial effects (Feng, Yin, Li & Ma, 2014; Dong & Huang, 2014; Cheng & Tian, 2017; Fan, 2017; Wang, 2019; Wang, Li, Zhou, Zhou & Li, 2019; Zeng, 2019). Innovation is a conceptual process characterized by new thinking, new inventions and new descriptions. It originated in Latin and has three meanings: first, renewal; second, create something new; third, change.

Innovation is the unique cognitive ability and practical ability of human beings, an advanced expression of human's subjective initiative, and an inexhaustible motive force to promote national progress and social development. If a nation wants to be at

the forefront of the times, it must not be without innovative thinking for a moment, and it cannot stop all kinds of innovation for a moment. Innovation plays an important role in research in economics, technology, sociology, and architecture.

Preliminary research on the relationship between innovation and the development of biopharmaceutical industrialization

From the current point of view, the factors of innovation have become one of the core factors of the development of biopharmaceutical industrialization. This is because the biopharmaceutical industry itself is a high-tech industrial cluster based on the research and development and application of biopharmaceutical technology. The research and development of biopharmaceutical technology itself is an innovative scientific research activity. The innovative results obtained by this activity are innovative products of biopharmaceuticals.

Research on cluster innovation networks at home and abroad has focused on the composition, operation mechanism, external environment, and role of innovation networks in industrial clusters. It mainly studies how to achieve innovation performance, and the research conclusions are mainly aimed at traditional industries (such as the Zhejiang regional cluster) or monopolized industry (such as the mobile communication industry), and there is little research on the biopharmaceutical industry. Overall, the structure, operation, and empirical research on cluster innovation networks are currently limited.

Judging from the current research results at home and abroad, no scholar has studied the impact of cluster innovation networks at different phases in the realization of biopharmaceutical industrialization. Due to the long realization period of industrialization of biopharmaceuticals, it takes more than 10 years from obtaining technical results to industrialization, and the different phases of the industrialization path are critical to the success of industrialization, so further research is necessary.

Scholars at home and abroad agree that innovation factor synergy has an important role in the innovation process of enterprises, but there is a gap in the definition of innovation synergy factors.

Independent variable 2: Capital factor

Capital is the principal and property used for investment to obtain profits, and is the general term for various socio-economic resources created by mankind to create material and spiritual wealth. Capital can be divided into institutional or social production relations capital, and its promotion or appreciation is realized by changes in social and political thinking (Long & Chen, 2013; Chi, 2013; Li & Wang, 2015; Yun, 2016; Tan, He, Chen & Liu, 2019).

In western economic theory, capital is part of the input (the means of production), and inputs include: labor, land, and capital. In this case, capital refers to the factors of production produced, which are durable goods. According to the current mainstream

macroeconomics perspective, capital can be divided into physical capital, human capital, natural resources, and technical knowledge. Among them, physical capital refers to the stock of equipment and buildings used to produce goods and services; Human capital is a term that economists use to refer to the knowledge and skills that workers acquire through education, training, and experience; natural resources refer to production inputs provided by nature; technical knowledge refers to an understanding of the best ways of producing goods and services.

Hypothesis

In order to carry out the research in this article, this article proposes the following hypotheses: Hypothesis H1: Innovation factors can promote the development of Shenzhen's biomedical industry, including external innovation and synergy innovation. Each kind of innovation can play a role in promoting the development of biomedicine industrialization, which can promote the development of research and development, improve the scientific research ability of pharmaceutical enterprises, and promote the development of industrialization towards the direction of innovation. Hypothesis H2: Market competition can promote the development of Shenzhen's biopharmaceutical industrialization. Market competition is to promote the optimization of the allocation of resources in the industry by means of mutual competition, so as to realize the integration of resources in the industry and promote the development of the industry. Hypothesis

METHODOLOGY

Research design

Based on the literature review, a set of influencing factors for biopharmaceutical industrialization was extracted, and a questionnaire was designed to investigate the representative general manager of Shenzhen biopharmaceutical company or the person in charge of the marketing, research and development, or government personnel. using empirical results to get the main factors affecting the realization of biopharmaceutical industrialization. By reviewing the literature on the influencing factors of biopharmaceutical industrialization. It can be found that scholars have different emphasis on the the factors that realize biopharmaceutical industrialization. Summarizing the existing literature and combining the results of expert interviews, the influencing factors can be summarized into national policies and regulations, external cluster innovation networks, national capital support, corporate R&D investment, risk financing and other capital factors, corporate research and development capabilities, internal synergy innovation factors, the management team, leading enterprise guidance, government industry guidance, production equipment and capabilities, sales network and capabilities, and fierce market competition and so on. Due to the three different phases of pre-clinical research, clinical research, coming

into the market and large-scale sales of biopharmaceutical industrialization, the effects of various influencing factors on biopharmaceutical industrialization will necessarily differ. Therefore, it is necessary to further analyze the role of factors in different phases.

Based on the above analysis, the purpose of this study is to investigate the factors affecting the biopharmaceutical industrialization, and to explore the relationship between these factors and the realization of the biopharmaceutical industrialization and the different roles of these factors in each phase through empirical research. The design of the empirical study takes the factors affecting the realization of the three phases of biopharmaceutical industrialization as the independent variable and the factors of the success of the industrialization as the dependent variable to construct a model of the effects of these factors on the realization path of biopharmaceutical industrialization, to investigate the mechanism of influencing factors in the three phases of biopharmaceutical industrialization. The research model is shown in Figure 3-1.



Figure 0-1 Schematic diagram of the research model

Number of people analyzed / sample / unit

The research purpose of this article is to explore the influencing factors of Shenzhen's biopharmaceutical industrialization. Therefore, it is an inevitable way to complete the research project by investigating related companies and personnel. From the perspective of industrialization development, the core of realizing industrialization is still the enterprises in the industry. Only when the enterprises form a certain scale and have good economic effects can they promote the formation and development of industrialization. Therefore, Shenzhen biopharmaceutical enterprises are the focus of this article's analysis. This article must issue questionnaires to the scientific research and management personnel in the enterprise, and then organize and analyze the data. In addition, as it involves government factors, relevant government officials responsible for the development of biopharmaceutical industrialization within the government will also be included in the research population. For the biopharmaceutical industry, to realize the good development of industrialization, support from the government is inevitable, which involves many issues such as the health department and local government policies.

Data Acquisition Process

This article intends to use questionnaires to investigate companies and government personnel. Considering that there are limited personnel to complete this project, the investigation can only be carried out according to time. This survey is mainly divided into three ways: (1) After applying to the relevant company and obtaining permission, within the allowed time, distribute the questionnaire in the company, and collect the questionnaire on the spot. (2) Entrust domestic questionnaire survey agencies to assist in completing questionnaire distribution and data collection in some enterprises and government agencies. (3) Because the author is engaged in the work related to medicine, so I can carry out the research on related personnel by myself through certain channels. This questionnaire is in anonymous form, distributed on the spot, and after filling in, the questionnaire is collected on the spot. Respondents will be explained that all data are only used for the research of this topic so as to ensure the authenticity and validity of the data.

Data analysis methods

The main data analysis methods in this paper include: (1) using Likert scale to preliminarily process related influencing factors and calculate their weights. (2) This paper intends to use data processing software such as SPSS and use regression analysis and correlation analysis to determine the relationship between each independent variable and the dependent variable, so as to verify the hypothesis proposed in this paper.

ANALYSIS

Summary of Respondents

During the distribution of this questionnaire, a total of 22 biopharmaceutical companies in Shenzhen were surveyed. At the same time, surveys were conducted with personnel of relevant government agencies such as Office of the People's Government of Shenzhen Municipality, Bureau of Health of Shenzhen Municipality, etc., via email and on-site A total of 500 questionnaires were sent out during the interview and 482 questionnaires were recovered. Among them, 5 questionnaires with missing information and invalidity were excluded, and 477 valid questionnaires were obtained. The effective recovery rate was 95.40%. Among all the questionnaires, the number of questionnaires distributed to business units was 450, accounting for 90% of all questionnaires, and the number of questionnaires distributed to government agencies was 50, accounting for 10% of the total number of questionnaires distributed.

Research Object 1: Innovation factor

Analysis

(1) Regression analysis of internal synergy innovation factors

The success factors of biopharmaceutical industrialization were selected as the dependent variables, and the internal synergy innovation factors were used as independent variables for multiple linear regression analysis, as shown in Table 3.7. Regression analysis results indicate that: technology and market synergy, resource guarantees successively entered the regression model, analysis of variance shows that the regression model is statistically significant (F = 15.474) and the total explanatory power of the model reaches 0.295 (adjusted R2 = 0.276).

 Table 4-1 Regression analysis results of internal synergy innovation factors on biopharmaceutical industrialization

Variable	В	SE.B	Beta	Т	Sig
(Constant)	1.529	0.394		3.884	0.000
TECHMARKET	0.304	0.096	0.356	3.152	0.002
RESOURCE	0.251	0.106	0.268	2.374	0.020
R2			0.295		
Adjusted R2			0.276		
F			15.474		

Sig.F

0.000

Resource guarantee is a factor that needs to be considered for synergy innovation of bio-enterprises, while technology and market synergy are the most important factors in the three phases of biopharmaceutical industrialization. According to foreign experience, the average R&D and development cost of a new biotechnology pharmaceutical needs 1 billion U.S. dollars, which cannot be completed without strong funding and other resources. In order to continue the EPO research, Amgen sold its overseas sales rights to Johnson&Johnson, and shared the technology with Japan's Kirin. These measures were to obtain funds to ensure that the EPO could proceed according to the research and development plan. In our country, a very important reason for the low conversion rate and industrialization rate of technological achievements is because resources cannot be sustainably guaranteed.

The synergy between technology and market is the most important factor in the three phases of biopharmaceutical industrialization, which is consistent with the conclusions of the literature. Sibiono GeneTech Co. Ltd., Shenzhen and Shenzhen Medgenn Co., Ltd. are both enterprises founded by returned talents after studying abroad. All of them are supported by the state, have obtained a kind of biological pharmaceutical with independent intellectual property rights, and the treatment field are oncotherapy. However, due to the cooperation between Medgenn and Jiangsu Simcere Pharmaceutical Group, a listed company with strong sales strength in China, to realize the connection between technology and market, Medgenn's ENDOSTAR has exceeded \$270 million in sales in two years since it came into the market, while the sales volume of Gendicine of Sabiono is still hovering around 50 million yuan five years after it came into the market.

(2) Regression analysis of regional innovation network factors

Multivariate linear regression analysis was performed by selecting the successful factors of biopharmaceutical industrialization as the dependent variables and using the preclinical capital factors as the independent variables, as shown in Table 4-2. Regression analysis results indicate that: the cooperation with scientific research institutes entered the regression model, analysis of variance shows that the regression model is statistically significant (F = 19.872) and the total explanatory power of the model reaches 0.273 (adjusted R2= 0.263). In the pre-clinical research phase cluster innovation network, cooperation between enterprises and research institutes and government agencies is the most important. The development of biotechnology originates from knowledge, not invention. Research institutes are the places where knowledge and talents are most concentrated. In China, they are also the subject of innovation. They can transfer knowledge and transfer research talents to enterprises. Therefore, in the preclinical phase, enterprises need to cooperate with or even integrate with research institutes. 90% of the 35 kinds of biological medicines that have been industrialized in China come from scientific research institutes.

В	SE.B	Beta	Т	Sig
2.432	0.235		10.355	0.000
0.309	0.058	0.522	5.300	0.000
		0.273		
		0.263		
		28.095		
		0.000		
	B 2.432 0.309	B SE.B 2.432 0.235 0.309 0.058	B SE.B Beta 2.432 0.235	B SE.B Beta T 2.432 0.235 10.355 0.309 0.058 0.522 5.300 0.273 0.263 28.095 0.000

Table 4-2 Regression analysis results of regional innovation network factors o	n
biopharmaceutical industrialization in the preclinical phase	

The success factors of biopharmaceutical industrialization were selected as the dependent variables, and the clinical phase capital factor as the independent variable were used as independent variables for multiple linear regression analysis, as shown in Table 3.11. The regression results indicate that the cooperation with the institution entered the regression model, and the analysis of variance showed that the model was significantly established (F = 19.446), and the total explanatory power of the model reached 0.206 (adjusted R2 = 0.195).

The regression results show that the cooperation between enterprises and CROs is the most important in the cluster innovation network in the clinical research phase. The key link for biotechnology to develop into pharmaceuticals is clinical research, and clinical research involves hospitals, doctors, patients, clinical trials, etc., which are unfamiliar fields for biological enterprises. According to industry experience, the clinical cost of pharmaceuticals accounts for 70% of the total research and development costs, ranging from 1-5 years. Sometimes if patients are widely distributed and case collection is difficult, maybe simple clinical research can not be carried on. CRO companies are professional outsourcing service companies. They have the resources of hospitals and doctors, and have the professional skills to communicate with patients. They are familiar with clinical research management and can save costs and shorten clinical time for biological companies.

 Table 4-3 Regression analysis results of regional innovation network factors in clinical phase on biopharmaceutical industrialization

Variable	В	SE.B	Beta	Т	Sig
(Constant)	3.082	0.138		22.265	0.000

0.196	0.044	0.454	4.410	0.000
		0.206		
		0.195		
		19.446		
		0.000		
	0.196	0.196 0.044	0.196 0.044 0.454 0.206 0.195 19.446 0.000	0.196 0.044 0.454 4.410 0.206 0.195 19.446 0.000 0.000 0.000

The success factors of biopharmaceutical industrialization were selected as the dependent variables, and capital factors in the phase of coming into the market were used as independent variables for multiple linear regression analysis, as shown in Table. Regression analysis results indicate that: the cooperation with leading enterprises entered the regression model, analysis of variance shows that the regression model is statistically significant (F = 29.733) and the total explanatory power of the model reaches 0.284 (adjusted R2 = 0.274).

Table 4-4 Regression results of regional innovation network factors on biopharmaceutical industrialization in the phase of coming into the market

Variable	В	SE.B	Beta	Т	Sig
(Constant)	2.736	0.174		15.678	0.000
c6	0.254	0.047	0.533	5.453	0.000
R2			0.284		
Adjusted R2			0.274		
F			29.733		
Sig.F			0.000		

The Regression analysis results show that the cooperation between enterprises and leading enterprises is the most important factor in the cluster innovation network in the phase of coming into the market and large-scale sales. The symbol of successful industrialization is to realize large-scale sales and realize the return of early investment in the short term. If the best product cannot be accepted by consumers, it will not be successful from an industrial perspective. However, the consumption of pharmaceuticals is different from general consumer products. The sales of pharmaceuticals are most affected by the intermediate link-professional doctors, who can even be considered as "consumers". Only through academic promotion and longterm communication can doctors' medication using habits be affected and changed. Therefore, it is irrational for biological enterprises to build their own network to realize sales in a short time, and leading enterprises with sales network and good doctor resources are their best partners.

Results

From the above research analysis, innovation has a close relationship with the development of Shenzhen's biopharmaceutical industrialization, and shows a clear positive effect. It can be said that innovation can actively promote the development of Shenzhen's biopharmaceutical industrialization.

From different phases, in the process of internal synergy innovation, due to the deepening of the cooperative relationship between enterprises and enterprises, companies can form a good complementarity and mutual assistance effect. This mutual complement and mutual assistance is reflected not only in the sharing of results, but also in the joint research and development process between enterprises. As we all know, for a high-tech industry such as biopharmaceuticals, it is difficult for a single company to make obvious results and the efficiency is slow. Therefore, synergy innovation within the industry is vital.

For external innovation, this innovation model profoundly affects all phases of biopharmaceutical industrialization, including three phases: experimental research and development, clinical and coming into the market. Its significance lies in optimizing the development environment and conditions of the enterprise, and bringing obvious promotion effects to product research and development, sales and corporate reputation improvement. To sum up, the conclusion can be drawn through the analysis: the hypothesis H1 proposed in this paper is valid.

Research Object 2: Capital factors

Analysis

(1) Analysis of the role of capital factors in the preclinical phase

The success factors of biopharmaceutical industrialization were selected as the dependent variables, and the preclinical capital factors were used as independent variables for multiple linear regression analysis, as shown in Table 4-6. Regression analysis results indicate that: the self-owned funds and government funding entered the regression model, analysis of variance shows that the regression model is statistically significant (F = 9.879) and the total explanatory power of the model reaches 0.211 (adjusted R2= 0.189).

Variable	В	SE.B	Beta	Т	Sig
(Constant)	2.445	0.284		8.597	0.000
a10	0.208	0.055	0.393	3.798	0.000
a11	0.129	0.062	0.216	2.084	0.041
R2			0.211		
Adjusted R2			0.189		
F			9.879		
Sig.F			0.000		

 Table 4-6 Regression analysis results of pre-clinical capital factors on biopharmaceutical industrialization

The regression analysis results show that the main components of capital in the preclinical research phase are own funds and government funding. This is different from the experience of foreign industries. In pre-clinical research, the typical model abroad is a scientist venture capitalist, while China relies more on its own funds and government funding, so many technicians with entrepreneurial desires cannot realize their dreams. From the perspective of innovation sources, there are obviously shortcomings in Shenzhen. Currently there are less than 15 new projects developed by Shenzhen biopharmaceutical companies, which also reflects the problem of insufficient capital investment in Shenzhen.

(2) Analysis of the role of capital factors in clinical phase

The success factors of biopharmaceutical industrialization were selected as the dependent variables, and the capital factors in the clinical phase were used as independent variables for multiple linear regression analysis, as shown in Table 4-7. Regression results show that self-owned funds, government funding, and venture capital have entered the regression model one by one. Analysis of variance shows that the model is significantly established (F = 10.245), and the total explanatory power of the model reaches 0.296 (adjusted R2 = 0.267).

Table 4-7 Regression analysis results of Capital Factors on biopharmaceutical industrialization in the clinical phase

Variable	В	SE.B	Beta	Т	Sig	

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(Constant	2.027	0.302		6.711	0.000
)					
b9	0.137	0.067	0.236	2.043	0.045
b10	0.153	0.063	0.243	2.409	0.019
b8	0.143	0.060	0.270	2.376	0.020
R2			0.296		
Adjusted			0.267		
R2					
F			10.245		
Sig.F			0.000		

The Regression analysis results show that the main components of capital in the clinical research phase are own funds, government funding, and venture capital, which are closer to the experience of foreign industries. It can be seen from the source that neither venture capital nor government funding can be a large sum of money, so the clinical research funds of Shenzhen biopharmaceutical companies are basically self-funded, however, foreign experience shows that the fund of pharmaceutical clinical research accounts for 70% of the total R&D fund, and the limited fund source seriously restricts the biological enterprises to carry out clinical research.

(3) Analysis of capital factors in the phase of coming into the market

Multivariate linear regression analysis was performed by selecting the successful factors of biopharmaceutical industrialization as the dependent variable, and using capital factors as the independent variables at the listing phase, as shown in Table 3.10. Regression analysis results show that industrial capital and venture capital successively entered the regression model. Analysis of variance shows that the regression model is statistically significant (F = 12.979), and the total explanatory power of the model reaches 0.260 (adjusted R2 = 0.240).

DISCUSSION AND CONCLUSION

The biological industry is another emerging leading industry after the information industry. The economy of human society has entered a new era of biological economy. Bill Gates predicted at the end of the last century that "the world's richest man will be born from the biotechnology industry in the next century." However, China's biopharmaceutical industry is still in the early phase of development, and its industrialization level is far from that of other countries. Therefore, it is of great theoretical and practical significance to study the path, influencing factors, action mechanism and practical application of biopharmaceutical industrialization.

Based on the research in this article, future research can be carried out in the following aspects: (1) Further study on the role of national policies and regulations on the path of biopharmaceutical industrialization and the establishment of a regulatory system. (2) The impact and mechanism of the IPO rush and capital market follow-up financing on the realization path of China's biopharmaceutical industrialization. (3) The influence of entrepreneurs on the realization path of biopharmaceutical industrialization and its action mechanism. (4) Research on the capital market structure suitable for China's biopharmaceutical industrialization. (5) Research and design of industrial policies suitable for China's biopharmaceutical industrialization. (6) Apply other research methods such as deductive reasoning to study the influencing factors and mechanism of biopharmaceutical industrialization. (7) Study the relationship between entrepreneurial incentives and industrialization performance in biopharmaceutical companies.

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