Accounting and Corporate Management (2021) 3: 42-54
Clausius Scientific Press, Canada
DOI: 10.23977/acccm.2021.030107
ISSN 2523-5788

Bio-Pharmaceutical Industry R & D Performance Study in China

Jian Yu

College of Business Administration, Jiangxi University of Finance and Economics, Nanchang, P.R.C.

Keywords: Bio pharmaceutical, R & D investment, Emerging industries

Abstract: Bio pharmaceutical industry is a resource-conserving and environment-friendly industry, which is still a new industry in the world. In the process of the development of bio pharmaceutical industry in China, the advantage is the raw material procurement and marketing, the disadvantage is research and development. There are four problems in the research and development of biological medicine industry in China: The shortage of funds, the lack of compound talents, the single source of funds, and the slow development of scientific research. The two models show that the research and development of biological medicine industry in China will have a lagging effect on the development of China's pharmaceutical industry. Four suggestions are put forward: to improve the policy of biological medicine industry, to build a platform for enterprises, to improve the capital market and to train high quality talents.

1. Introduction

Biological medicine industry is one of the high technology industries in the world. It has brought huge economic benefits to the national economy, but also brought huge social benefits to the people and the society [1]. During 30 years of development in China, the structure of bio pharmaceutical industry is getting improved, as well as the industry scale. The data shows that bio pharmaceutical industry is developing very fast in China [2]. And our government also attaches great importance to the development of the industry. In 2010, the pharmaceutical industry has become one of the seven new strategic industries, the industry is increasingly becoming an important part of national economy [3].

At present, there are four main research areas in the field of biomedical research, which are organization structure, technological innovation, innovation ability and innovation mode and government supervision. In terms of the structure of the organization, Bianchi, M (2011) [4], Calero, C. (2007) [5], Moschini, G. (2006) made a profound study [6]. For example, Bianchi, M. (2011) mainly described in the paper that the problem is how to learn organizational model and put into practice to make drug discovery and development process in different stages of intertwined in the open innovation. In terms of technology innovation, Moschini, G (2001) and Orsenigo, L. (2001) believe that the development of new drugs rely on more basic theory [7], so as to generate a deeper level of explanation, so that people can understand the body's internal material. In terms of innovation ability and innovation model, Okada, Y. (2004) studied the production capacity of

Japan, G, D Sandhya (2012) studied the scientific research ability of India, M., P. Steven (2010) is the study of how to improve the ability of scientific research and innovation [8].

But the domestic research on the biological medicine industry is concentrated in three aspects: the biological medicine industry agglomeration, the biomedical industry park construction, the biological medicine industry development present situation and the countermeasure. The research on the biological medicine industry cluster, the results of the scholars of our country is remarkable. Huang Wei and Chen Yuwen (2012) using the method of literature research and comparative study, pointed out the problems of China's bio pharmaceutical industry cluster, and then got the conclusion that China's bio pharmaceutical industry should strengthen policy support. In the empirical aspect, Yu Liying (2009) calculated the standard location quotient, H index, Gini coefficient, EG index and other indicators to explain the biological medicine industry cluster innovation effect, development trend and economic effect. The research on the construction of the bio pharmaceutical industry park is divided into macro and micro. Wang Dongmei (2009) think of the bio pharmaceutical industry park as an effective hedge mechanism and competitive weapon, so in the park, we should set up a public library, new drug registration service center, and share research institutes, technology information. Zhu Xinghua (2010) think that the industrial environment pollution and resource depletion make us increasing the recycling economy and ecological and economic support to enhance the ecological and economic benefits in the bio pharmaceutical industry park. On the micro level, the choice of the enterprises in the industrial park of the bio pharmaceutical industry between the development mode and the choice of innovation mode are very important, which is related to the success or failure of the park. Jiang Zhaohua, Li Xin (2011) explain the development mode of biological medicine industry under the perspective of the whole industry chain. Zhang Xiaoping (2009) analysed the development of biological medicine industry in Shanghai City, and tongjin (2011) analysed the development of biological medicine industry in Chengdu. Yin Junxiang, Li Ruiguo (2010) analysed the development of the biological industry in Japan, the Japanese government focus on top-level design and other measures to encourage the development of the industry, which is worth learning and reference [3].

2. The Status Quo of R & amp; D in Biological Medicine Industry in China

2.1. Status Quo of the Development of China's Bio Pharmaceutical Industry

In recent years, the development of bio pharmaceutical industry in the world has accelerated, the major developed countries have made the deployment of the development of bio pharmaceutical industry. China's government has been promoteing the development of biological medicine industry for more than 30 years, although later than some developed countries, but the development speed is very fast, China's biotechnology research and development, industrial development and market applications have a certain foundation.

(1) Biomedical industry developes quickly with the expansion of industry size and investment scale.

China's bio pharmaceutical industry has developed rapidly, especially in recent years, China's government attaches great importance to the development of bio pharmaceutical industry and the introduction of a series of policies to encourage the development, which has accelerated the development of bio pharmaceutical industry. In 2000, bio pharmaceutical manufacturing enterprise engaged in 271, by 2008, enterprises count all the way up to 746, an increase of nearly 3 times. China's bio pharmaceutical industry's main business revenue also grew rapidly, the 2000 bio pharmaceutical industry's main business income was 11.228 billion, by 2008, the income rose to 71.033 billion. The amount of scientific and technological activities of the bio pharmaceutical

industry has greatly increased, from 3.7 billion in 2000 to 11.8 billion in 2008, an increase of more than 3 times.

(2) Varieties of bio pharmaceutical products increase as well as research and development capabilities.

Biological drugs are mainly divided into prevention, treatment and diagnosis, which is based on the treatment. Since 1989, China has developed a recombinant human interferon A-1b, since 2008, China has 59 approved the listing of biological medicine, and other 70 species in clinical research, there are 63 kinds of biomedical research in the laboratory, although these drugs are generic, but also tells of the improvement of China's bio pharmaceutical technology, while China's growing biological drugs also provide a guarantee for the health of the people. After 30 years of development, China's bio pharmaceutical industry has improved, the number of scientific and technological institutions has been steadily increasing. The scientific and technological institutions of the 713 people from 1995 to 2375 in 2008 [9].

(3) The development of biological medicine industry trends to cluster.

The formation of bio pharmaceutical industry park is the continuous development and competition of bio pharmaceutical industry. Bio pharmaceutical industry park can optimize the allocation of resources, so that enterprises in the park achieve scale operation, reform the park's competitive mechanism and innovation mechanism, so that the economic benefits of enterprises achieve the maximum. As of 2009, China's biological medicine industry base reachses 35, the industrial base with a high degree of agglomeration, industrial chain is relatively complete, and the scale is gradually expanding, the economic benefits are also significantly improved. Compared to the well-known national industrial park in Shanghai Zhangjiang High Tech Park, Beijing Zhongguancun Life Science Park and Yizhuang trough, Beijing Daxing bio engineering and medicine industry base [10]. Now Beijing Zhongguancun Science and technology park has entered more than 40 research institutions and enterprises, Yizhuang trough gathered more than 80 pharmaceutical enterprises, industry scale expanding rapidly. Shanghai Zhangjiang High Tech Park is also home to the famous 10 bio pharmaceutical enterprises at home and abroad.

2.2. The Status Quo of R & amp; D in China's Bio Pharmaceutical Industry

From Table 1 can be seen, from 1995 to 2008, China's bio pharmaceutical industry related indicators of research and development trends to grow. 1995 to 2005 overall grow slowly, overall growth accelerated after 2005. Among them, the scientific and technological activities of the 3400 people in 2005 to 6051 people in 2008, almost doubled in just 3 years. The number of invention patents from 1 in 1995 to 293 in 2008, it can be said 1995-2008 years, China's bio pharmaceutical industry has a number of patents has experienced from scratch, from a number of processes. Scientific and technological activities of the fund raised by 51.03 million to nearly 11.8 billion yuan, which not only shows that China's economic strength, but also shows that the Chinese government attaches great importance to scientific research and encouragement, and our ability to enhance the scientific research. From the table and figure can be found, new product development expenses and new product sales revenue has a certain positive correlation, the more spending, the more income. As can be seen from the growth of indicators, China's bio pharmaceutical industry in the government's leadership has made huge development, for economic growth and social development has made a great contribution.

Table 2 can be drawn from the Table 3, Table 3 shows that the number of patents ratio owned by the biomedical industry has increased from 1995, steady in 1996, 1997, 1998, in 1999 reached peak, accounting for 15.95%, and then decreased, after 2004 began to grow steadily. Number of scientific and technological institutions has been relatively stable, the highest in 2000 accounted for 8.58%,

accounting for the increase in since 2005, it keeps steady increasing. Science and technology activities accounted for more stable, the lowest ratio of 5.68% to 9.38%, which shows that the country should pay more attention to the cultivation of high technical personnel. R & D active staff equivalent to the total amount of volatility is not much, but before 2001 the proportion is higher, after 2002 a different degree of decline occurs, on the one hand explains the lack of R & D personnel, on the other hand also shows that the use of machinery and equipment. Combination of Table 3 and Table 2 shows that the amount of scientific and technological activities to raise funds, new product development expenses accounted for, the new product sales revenue accounted for almost the same as the change from 1995-2008 years, in 1997 reached a peak. From the comparison of biological medicine industry and pharmaceutical manufacturing industry indicators, although our government strongly support and encourage the development of bio pharmaceutical industry, but the biological medicine industry in the pharmaceutical manufacturing industry in the proportion is not much, that China's bio pharmaceutical industry R & D innovation ability to be improved, the knowledge level of scientific and technological personnel also need to be improved [11].

Table 1: The basic situation of the development of R & amp; D in the biological medicine industry in China.

	Funding for science and technology activities (million)	New product development funds (million)	New product sales revenue (million)	The invention patent number (part)	Number of scientific and technological institutions	Technical personnel (person)	R & D active staff is equivalent to full time equivalent (person year)
1995	5103	2792	18916	1	22	1423	786
1996	5780	2895	9168	3	10	2545	1173
1997	20168	13259	168475	3	13	3615	1034
1998	13945	4412	43101	6	18	1896	1058
1999	20915	11224	56045	37	29	2307	1194
2000	36925	15925	95979	24	43	3048	1406
2001	41011	14217	154711	--	34	2902	1665
2002	41206	17745	192810	43	37	3298	1401
2003	37831	15947	215287	26	16	2533	1147
2004	30102	15178	180182	31	40	3811	1235
2005	41469	28373	171308	49	31	3400	1534
2006	57120	33345	221846	119	38	4087	1706
2007	90387	51628	476100	276	52	5427	2769
2008	117984	85150	719740	293	55	6051	2717

Table 2: Comparison of the development of biological medicine industry and pharmaceutical manufacturing industry.

	Funding for science and technology activities (million)		New product development funds (million)		New product sales revenue (million)		The invention patent number (part)		Number of scientific and technological institutions		Technical personnel (person)		R & D active staff is equivalent to full time equivalent (person year)	
Time	Pharmaceutical manufacturing industry	Bio pharmaceutical industry	Pharmaceutical manufacturing industry	Bio pharmaceutical industry	Pharmaceutical manufacturing industry	Bio pharmaceutical industry	Pharmaceutical manufacturing industry	Bio pharmaceutical industry	Pharmaceutical manufacturing industry	Bio pharmaceutical industry	Pharmaceutical manufacturing industry	Bio pharmaceutical industry	Pharmaceutical manufacturing industry	Bio pharmaceutical industry
1995	108195	5103	46368	2792	615318	18916	183	1	564	22	25059	1423	9528	786
1996	126545	5780	65558	2895	687111	9168	113	3	528	10	35405	2545	10936	1173
1997	149654	20168	76865	13259	932232	168475	134	3	510	13	38530	3615	11303	1034
1998	204542	13945	76481	4412	1039185	43101	224	6	524	18	38594	1896	10860	1058
1999	222216	20915	99603	11224	1194476	56045	232	37	587	29	36068	2307	13015	1194
2000	375120	36925	147855	15925	1702574	95979	414	24	501	43	37833	3048	12136	1406
2001	408753	41011	140961	14217	2021148	154711	308	-	488	34	40009	2902	15229	1665
2002	559666	41206	189533	17745	2488566	192810	484	43	500	37	53055	3298	18220	1401
2003	640458	37831	228629	15947	3037923	215287	459	26	476	16	44561	2533	17518	1147
2004	700985	30102	264970	15178	3887153	180182	902	31	587	40	46594	3811	13931	1235
2005	841752	41469	447725	28373	4693608	171308	1134	49	581	31	51832	3400	19584	1534
2006	1013040	57120	557576	33345	5699191	221846	1965	119	641	38	64278	4087	25391	1706
2007	1273908	90387	739435	51628	7126886	476100	2482	276	708	52	73408	5427	30778	2769
2008	1406853	117984	871914	85150	9489106	719740	3170	293	746	55	90820	6051	40192	2717

Table 3: Indicators ratio of biological pharmaceutical industry and pharmaceutical manufacturing.

	Funding for science and technology activities (million)	New product development funds (million)	New product sales revenue (million)	The invention patent number (part)	Number of scientific and technological institutions	Technical personnel (person)	R & D active staff is equivalent to full time equivalent (person year)
1995	0.05	0.06	0.03	0.01	0.04	0.06	0.08
1996	0.05	0.04	0.01	0.03	0.02	0.07	0.11
1997	0.13	0.17	0.18	0.02	0.03	0.09	0.09
1998	0.07	0.06	0.04	0.03	0.03	0.05	0.10
1999	0.09	0.11	0.05	0.16	0.05	0.06	0.09
2000	0.10	0.11	0.06	0.06	0.09	0.08	0.12
2001	0.10	0.10	0.08	-	0.07	0.07	0.11
2002	0.07	0.09	0.08	0.09	0.07	0.06	0.08
2003	0.06	0.07	0.07	0.06	0.03	0.06	0.07
2004	0.04	0.06	0.05	0.03	0.07	0.08	0.09
2005	0.05	0.06	0.04	0.04	0.05	0.07	0.08
2006	0.06	0.06	0.04	0.06	0.06	0.06	0.07
2007	0.07	0.07	0.07	0.11	0.07	0.07	0.09
2008	0.08	0.10	0.08	0.09	0.07	0.07	0.07

From Table 4, we can see that the relevant indicators of the technical transformation of the bio pharmaceutical industry in China from the 1995-2008, and the technology obtaining are showing varying degrees of fluctuations, but the overall trend is increased [11]. Technical reform expenditure is the most spending of a few indicators, the largest increase in the growth rate with the minimum expenditure in 1996, for 4.77 million, the highest in 2008 spending, for 348.34 millon. comparing the spending of technology introduction and the purchase of domestic technology, in 1995-1997, the purchase of domestic technology spending more, in 1998-2002 years, technology introduction of spending more money. After 2003, the total expenditure is about 20 million, the purchase of domestic technology is more than some of the spending, which shows that China's enterprises carry out bio pharmaceutical technology research, enhance R & D innovation. The above four indicators says that the development of China's bio pharmaceutical industry is still very large, it should increase the intensity of technological investment.

Table 4: Technological transformation and Technological Acquisition of biological pharmaceutical industry in China.

	Technical reform expenditure (yuan)	Technology introduction of expenditure (yuan)	Expenditure on digestion and absorption (million)	Spending on domestic technology (million)
1995	6272	94	1164	134
1996	477	190	123	2188
1997	7441	40	1164	97
1998	4618	358	771	278
1999	7217	2559	771	1048
2000	4751	7353	2102	3691
2001	19023	1410	5428	1150
2002	24396	5696	3278	5504
2003	28837	1338	330	3290
2004	15647	1614	-	1334
2005	14754	151	55	897
2006	14730	1667	586	1250
2007	15756	707	1265	1864
2008	34834	3389	1768	1657

2.3. Problems in the Development of Biological Medicine Industry in China

(1) R & D investment is insufficient, the independent innovation ability need to be improved. The research and development of bio pharmaceutical products is very expensive. The development funds of enterprises in developed countries accounted for more than 20% of sales revenue, while the research and development expenses of our country's enterprises accounted for a little higher than 1%.The research and development of biological medicine in our country is seriously insufficient, which greatly restricts the development of China's bio pharmaceutical industry, has become the bottleneck of China's enterprises to improve competitiveness and independent innovation capacity. China's bio pharmaceutical companies are lack of independent innovation ability, for most of biological drugs are generic, and of no intellectual property. There are two reasons: on the one hand the enterprise's ideological consciousness is relatively backward, in the process of new drug research and development, they often involuntary imitate, lack of innovation. On the other hand, the enterprise emphasis on the reform and improvement of the exited product, is not willing to develop new products, resulting in low efficiency of the market to invest in innovation .

(2) Lack of compound innovative talents. The research and development of biological drugs should depend on the overall strength of many subjects. Management of biological medicine enterprises not only need to have a scientific talent, but also need to have an economic mind. China is extremely short of this talents. China's bio pharmaceutical companies do not attach great importance to this problem, there is no human resource development measures to be implemented, the incentive mechanism and incentive mechanism is not fully improved, which leads to the outflow of talent. So how to train and retain talent has become a problem to be solved.

(3) The financial integration of research and development is not reasonable. In the start-up stage,

the source of capital should be the risk capital, but because of our country's capital market is not perfect, the main source of the funds of the bio pharmaceutical companies is its own funds, bank loans and government funds. Compared with the bio pharmaceutical enterprise R & D funds, bank loans are negligible, and our country's banks pay more attention to the safety and liquidity of the funds, the high risk and the long term project business enterprise can difficultly apply to the loan. Government funds for bio pharmaceutical industry plays a pivotal role, but this part of the funds are mainly invested in basic research and key projects, putted into the business of little money. So the support of venture capital is very important for the development and growth of Chinese biological medicine enterprises.

3. The Research on the R&D Performance of the Bio Pharmaceutical Industry in China

3.1. Hypothesis

The R&D need investment funds and the labor. The input of funds is the amount of scientific and technological activities, and the input of labor is the number of scientific and technological person. On the output, the output data of the bio pharmaceutical industry mainly has the industrial output value, total profit, the main business income and the invention patent.

Generally speaking, the enterprise spend a long time to carry on the R & D activity. at first, they carry on the theoretical verification, then set up the project, and the fund, after a long time, they develop a new product, the new technology, but also to experience the long time to carry on the clinical trial, finally only then the market. Therefore, the enterprise's R & D cycle is long, and it can be concluded that the R & D investment has a lagged effect on the performance of the enterprise.

According to the above description, the following two hypotheses can be drawn:

H1: It is positive correlation between the R & D input and output value of biological medicine industry.

H2: The research and development of the bio pharmaceutical industry has a lagged effect on the output value.

3.2. Variable Selection and Model Setting

The basic model of the above assumptions selected is the Cobb Douglas production function. The basic form of Cobb Douglas production function is $Q = AK^{\alpha}L^{\beta}R^{\gamma}\mu$. The Q refer to yields, A refers to the technical level of the whole society or industry. K refers to the amount of capital invested, α is the capital output of the elastic coefficient. L is the input of labor, the output elasticity coefficient of the labor force. R presents the R & D funds and γ refers to R & D output of the elastic coefficient. μis a random disturbance, and less than 1.

The selected indicators are as follows: Q is the total production value, K is the original value of fixed assets, L is the number of persons who engaged in scientific and technological activities, R is R & D expenditures. The logarithmic transformation of the Cobb Douglas production function, can be obtained in linear form function:

$$\ln Q = \ln A + \alpha \ln K + \beta \ln L + \gamma \ln \mu \tag{1}$$

According to the model 1:

$$\ln Q_i = \ln A_i + \alpha \ln K_i + \beta \ln L_i + \gamma \ln R_i + \ln \mu_i \quad \text{while i=1, 2, 3} \tag{2}$$

According to the model 2:

$$\ln Q_{i+1} = \ln A_{i+1} + \alpha \ln K_{i+1} + \beta \ln L_{i+1} + \gamma \ln R_i + \ln \mu_i \quad \text{while i=1, 2, 3} \tag{3}$$

$$\ln Q_{i+2} = \ln A_{i+2} + \alpha \ln K_{i+2} + \beta \ln L_{i+2} + \gamma \ln R_i + \ln \mu_i \quad \text{while i=1, 2, 3} \qquad (4)$$

$$\ln Q_{i+3} = \ln A_{i+3} + \alpha \ln K_{i+3} + \beta \ln L_{i+3} + \gamma \ln R_i + \ln \mu_i \quad \text{while i=1, 2, 3} \qquad (5)$$

Q_i refers to the total output value of the biological pharmaceutical industry in the year i, K_i presents the value of fixed assets. L_i is the number of person who engaged in scientific and technological. R_i refers to the R & D internal expenses. Among them, the model (1) is used to explain the relationship between R & D input and output, Model (2), model (3) and model (4) used to explain the lag effect of R & D investment on the output.

3.3. Regression Analysis

(1) Regression analysis of the model 1

Table 5: Regression results of the model 1.

Variable	Regression coefficient	The value of T	Prob. value
C	-5.2814	-2.8935	0.0178
lnK	1.0160	1.9785	0.0792
lnL	0.7022	1.8052	0.1045
lnR	-0.1835	-0.3891	0.7062
R^2	0.9321	Adjusted R^2	0.9095
F	41.2132	Prob.(F)	0.000014

From Table 5, we can see that the coefficient of LnR = -0.183525, t=-0.389143, and the R^2 = 0.932147. The adjusted R^2 is 0.909529, F is 41.21322. Through the regression analysis, we can draw the conclusion: there exits negative correlation between the internal expenses and the output value of the R & D funds, but this negative correlation is not significant, however the results show that the research and development investment has a negative impact on the development of the pharmaceutical industry.

(2) Regression analysis of model 2

Table 6: Regression results of R & D funding and the production of bio pharmaceutical industry.

Variable	Regression coefficient	The value of T	Prob. value
C	-4.3742	-5.053436	0.001
lnK	0.6826	2.175113	0.0613
lnL	0.5143	1.748967	0.1184
lnR	-0.2202	0.995882	0.3485
R^2	0.9439	Adjusted R^2	0.9229
F	44.8402	Prob. (F)	0.000024

Table 6 shows the regression analysis results of regression model (2). From the table, we can see that the coefficient of R & D expenditure lagging a year is 0.22022, and the T value is 0.995882, which shows that the annual cost of R & D is positively correlated with the total value of the year. From the coefficient can be seen, by the year of the R & D funds internal expenses negative factor

into a year of R & D funds internal expenses positive coefficient, which shows that the lag one year of R & D funds internal expenses for the development of the bio pharmaceutical industry has played an active role. Next, the P value of the R & D is 0.3485, the P value is not very ideal, but the R^2 value of the regression model is 0.922818, which shows that the fitting of the model is good. So it can be concluded that the correlation between the R & D expenditure on the output of the bio pharmaceutical industry is lagging, and the results of regression analysis are consistent with the hypothesis.

Table 7: Regression results of R & amp; D funding and bio pharmaceutical industry output in two years.

Variable	Regression coefficient	The value of T	Prob. value
C	-4.8244	-7.4490	0.0001
lnK	1.1599	3.1641	0.0158
lnL	-0.1740	-0.3480	0.738
lnR	-0.2404	1.5893	0.156
R^2	0.9603	Adjusted R^2	0.9432
F	56.3921	Prob. (F)	0.000029

Table 7 lists the regression model (3), from the table we can be aware of the R & D funds internal expenses of two years-lagged which is 0.240411, its t value is 1.589334, it can be seen that the bio pharmaceutical industry two-year-lagged between the R & D funds internal spending and output are positively related, and this coefficient is slightly larger than one-year-lagged, but this relationship is more significant t. And from the table we can see that the adjusted R^2 value is 0.943239, which shows that the model has a good fit and strong interpretation.

Table 8: Regression results of R & amp; D funding and bio pharmaceutical industry output of three-years-lagged.

Variable	Regression coefficient	The value of T	Prob. value
C	-5.7428	-11.0274	0
lnK	1.4866	6.2469	0.0008
lnL	-0.4651	-1.3753	0.2182
lnR	0.2460	2.7278	0.0343
R^2	0.9802	Adjusted R^2	0.9703
F	98.9787	Prob. (F)	0.000017

Table 8 shows the impact of the R & D on the output of the three-years-lagged. From the table, we can see that the coefficient of the R & D expenditure of three-years-lagged is 0.246046, the T value is 2.727836, the data shows that the biological medicine industry of three-year-lagged has a positive correlation with the total output value of the year, and this relationship is not very good. And the coefficient of the three-year-lagged of R & D funds internal spending coefficient is only slightly larger than the coefficient of the two-year-lagged, and then look at the model adjusted R^2 0.970291, F is 98.9787, although the fitting is very good, but F is too high, not through F test.

4. Conclusions and Recommendations

4.1. Conclusions

(1) R & D investment in the biomedical industry is clearly insufficient. Bio pharmaceutical industry is a high-tech industry, which is one of the characteristics of high investment, in the developed countries, a business profit of 5% will be used for research and development, and our country is less than 1%, far less than the international level, but the trend of R & D investment in our country is increasing year by year.

(2) The R & D funding for biological medicine in our country was not significantly related to the output of the year. We can get this conclusion from the regression analysis results of the model, which are the following: first, the level of R & D investment is generally low, the two is the research and development investment has lagged effect on the output of the biological medicine industry. Three is a lot of the patent technology from foreign countries. This conclusion gives us the inspiration that we should build a good infrastructure and apparatus, and prepare for the future research and development.

(3) R & D investment in the biological medicine industry output has a significant lag effect, the lag period is generally two years, that is to say, R & D funds invested two years will produce benefits. Such a result will make the enterprises face the difficult situation in the short term, so we should establish a sound capital market, which can make the enterprise free into capital market, optimize the allocation of resources, and establish a sound risk capital mechanism, which is the fundamental way to solve the shortage of enterprise funds.

4.2. Countermeasures and Suggestions on the Development of China's Bio Pharmaceutical Industry

(1) Improve the capital market, and increase the investment in bio pharmaceutical industry R & D funds

Bio pharmaceutical industry is a new industry, with high investment characteristics, to promote the rapid development of bio pharmaceutical industry, it is necessary to increase investment in research and development, and if one wants to attract a lot of money to invest in bio pharmaceutical industry he will have to improve the capital market. At present, the research and development of bio pharmaceutical industry in China mainly comes from the government funds, which is far from the research funds needed. So we should establish a diversified financing channels as soon as possible. Sources of R & amp; D funds should include both government funds, social capital, and even foreign capital [8]. At the same time, it should also actively establish the risk capital mechanism, which is the key to solve the shortage of funds.

(2) Actively build technology platform to accelerate the process of Industry-Academia-Research

The purpose to build a technology platform is to revitalize the existing scientific and technological resources, so that resources and equipment can be shared, and then the cost reduce. This technology platform should fully cover the basic research, application research and test development, and establish a technical support platform with technical advice, demonstration, technology research and development, and other functions, so as to promote the sustainable development of bio pharmaceutical industry. At the same time, to speed up the process of IAR must strengthen the relationship of university and scientific research institutions to form a model in which the business needs is guidance, research institutions and colleges and universities do the research and development, but also encourage scientific research institutes, bio pharmaceutical companies and Multi-National Corporation to carry out research and development activities to enhance international standards. Finally, actively promote the construction of professional services

related to the bio pharmaceutical industry, specific measures are to establish the authority of the agency, including patent applications, information consulting, trademark registration, new drug reporting, professional training, so as to make the upstream and downstream closely linked, shorten the time of each phase of research.

(3) Develop policies to promote the development of bio pharmaceutical industry, and create a good policy environment

Although China's bio pharmaceutical industry has achieved a great success, but the industrial development is still in its infancy, the government should strengthen the guidance, formulate special policies, give support from the industrial training, intellectual property, tax and other aspects. In the cultivation of the market, the main problem is the small size of the enterprise, the government should formulate policies to guide and encourage large enterprises and small and medium enterprises mergers and acquisitions and joint reorganization. This can optimize the allocation of resources to achieve large-scale operations, but also to focus on R & D resources advantages, to create revenue. In taxation, China's government has a lot of tax incentives for the technological innovation of enterprises, the financial annual funding is also increasing year by year, but this is not the fundamental way to solve the shortage of resources, to improve the ability of independent innovation. Therefore, the government should take into account all aspects of the policy in the formulation of fiscal and taxation policy, based on the market, the enterprise, the appropriate formulation of preferential policies and incentives. In the intellectual property rights, the government should formulate the corresponding legal provisions to increase the protection of intellectual property rights. Although our country's biological drugs often imitate the foreign, but still need innovation.

(4) Cultivate high - tech and high - quality talents

Now the competition of the national strength is the competition of talents, the one who have the most talents master the technology. The one who mastered the technology master the lifeblood of economic development, so the training of high quality comprehensive talent has become an urgent and important strategic task. In order to achieve this goal, on the one hand, the country should set off the potential, high quality talents to first-class laboratory, but also to strengthen the quality and technical education, keep labor assets for the rapid development of China's bio pharmaceutical industry. On the other hand, we should create a good policy environment and working environment to actively attract domestic and foreign outstanding talents.

References

[1] Wan, F. (2012). Measurement of industrial agglomeration: innovation based on the empirical research on biological medicine industry in China. (05).

[2] Ye, L. and Feng, G.Z. (2011). Empirical analysis of R & amp; D input and output in China's pharmaceutical industry. modern commercial industry, (19).

[3] Niosi, J., Hanel, P. and Reid, S. (2012). The international diffusion of biotechnology: the arrival of developing countries. Journal of Evolutionary Economics, (4).

[4] Bianchi, M., Cavaliere, A., Chiaroni, D., Frattini, F. and Chiesa, V. (2010). Organisational modes for Open Innovation in the bio-pharmaceutical industry: An exploratory analysis. Technovation, (1).

[5] Calero, C., Leeuwen, T.N. and Tijssen, R.J.W. (2007). Research cooperation within the bio-pharmaceutical industry: Network analyses of co-publications within and between firms. Scientometrics, (1).

*[6] Moschini, G. (2006). Pharmaceuticals and Industrial Traits in Genetically Modified Crops: Coexistence with Conventional Agriculture. A*merican *Journal of Agricultural Economics, 88(5).*

[7] Bianchi, T.S, Allison, M.A. (2009). Large-river delta-front estuaries as natural "recorders" of global environmental change. Proceedings of the National Academy of Sciences, 106(20), 8085-8092.

[8] Lynn, K. and Mytelka. (2006). Pathways and Policies to (Bio) Pharmaceutical Innovation Systems in Developing Countries. Industry & Innovation, (4).

[9] Linda, A.H. and Sharmistha, B.S. (2006). An analysis of firm-level innovation strategies in the US biotechnology industry. Technovation, (1).
[10] Kneller, R. (2003). Autarkic drug discovery in Japanese pharmaceutical companies: insights into national differences in industrial innovation. Research Policy, (10).
[11] Orsenigo, L., Pammolli, F. and Riccaboni, M. (2001). Technological change and network dynamics. Research Policy, (3).