Research on the Development Status and Problems of Scientific and Technological Small and Medium-Sized Enterprises

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Abstract. This paper is aimed at figuring out the elements which a technology-based small and medium-sized enterprise should have in order to further growth. Based on the deconstruction of the development of this kind of enterprise, the paper summarizes the current development problems of domestic technology-based small and medium-sized enterprises. The development of science and technology small and medium-sized enterprises in China is mainly faced with the problems of limited number and regional imbalance. In some undeveloped regions, the local governments are relatively more willing to invest their restricted capital to infrastructure construction and do not pay enough emphasis on innovation activities. Taking TianJin Chase Sun Pharmaceutical as an example, this paper investigates the management mechanism and financial information to study the development factors of Chase Sun Pharmaceutical, using SWOT analysis and financial indicators analysis. CSP has converted from an enterprise on the verge of bankruptcy to a “Little Giant” enterprise that has strong research and development abilities. The case analysis reflects the development hindrance factors such as achievement transformation level, financing difficulties, and management defects, and further puts forward countermeasures and suggestions. Through this analysis, more specific information and experience on the development of science and technology in small and medium-sized enterprises in China is expected to be verified.

Keywords: Small and medium-sized technology-based enterprises; Technological innovation; SWOT analysis; Achievement transformation; Corporate finance.

1. Introduction

Small and medium-sized scientific and technological enterprises are special enterprises with "high risk, high investment and high growth". In the early stage of entrepreneurship, they are more likely to encounter various difficulties and bottlenecks to hinder their development. At present, the national science and technology-based small and medium-sized enterprises are still relatively weak, and the development among various regions is uneven. In particular, there are many adverse factors in terms of capital, policy, resource allocation, innovative talents, and financing, which affect the high-quality development of small and medium-sized science and technology enterprises.

In recent years, a variety of research methods have been formed in the research field of science and technology-based small and medium-sized enterprises. On this basis, the researchers put forward a variety of driving factors, involving macro (government subsidies, financing support, etc.) and micro (enterprise personnel structure, equity incentive system, enterprise innovation efficiency, etc.), and put forward a variety of countermeasures for the development of science and technology-based small and medium-sized enterprises.

In terms of the evaluation model, the catastrophe series method, selected scientific and reasonable comprehensive indicators have been adopted to establish the evaluation model, and carried out the

research on the growth of science and technology-based small and medium-sized enterprises in Shaanxi Province. This research provides a reference for the adjustment and government policy support of Science and technology-based small and medium-sized enterprises in the process of development. The technological innovation of scientific and technological small and medium-sized enterprises was taken as the mainline, dividing the factors affecting the choice of technological innovation mode of scientific and technological small and medium-sized enterprises into two key factors: explicit and implicit. On this basis, the selection and evaluation model of technological innovation mode of scientific and technological small and medium-sized enterprises is constructed by using analytic hierarchy process fuzzy comprehensive evaluation method. The evaluation model is conducive to better identifying the existing problems and finding the restrictive factors.

From the perspective of various constraints, there exist the factors restricting the development of science and technology enterprises including high-end talent management systems, multi-channel financing systems, service intermediary systems, marketing resources, organizational structure, and human resource management systems. A variety of factors interact with each other and act in synergy on the profitability and innovative manufacturing capacity of science and technology-based small and medium-sized enterprises. The shortage of technology R & D talents and R & D leaders restricts the development of science and technology-based small and medium-sized enterprises, and the scale and technical level are the main financing constraints emphasizing the role of talents and the means to attract talents. Also, building a more efficient service-oriented government is a necessary path to promote the development of science and technology-based small and medium-sized enterprises. The equity incentive system and salary and welfare incentive system have the most obvious impact on improving the technological innovation ability of enterprises, followed by training, development, and environmental incentive system, and achievement incentive system has the least impact. Two types of innovation capabilities of enterprises (internal innovation potential and open collaborative innovation capability) were focused on, and internal and external dual integration activities of science and technology-based small and medium-sized enterprises are the basis for improving competitiveness. Countermeasures from the perspective of the United Front were put forward. First, the United Front Department should actively guide. Second, the United Front Department should do a good job in financing services for science and technology enterprises. Vigorously developing relationship loans and actively trying Internet equity crowdfunding financing is of help, which can improve the credit guarantee system and the financing service system of intellectual property rights and enterprise management rights, so as to alleviate the financing difficulties of science and technology-based small and medium-sized enterprises.

While studying the development difficulties of science and technology-based small and medium-sized enterprises, the academic community has conducted in-depth research on the segmentation of restrictive factors through various models. Based on the DEA model, it is found that the overall financing efficiency, scientific research investment efficiency, and scientific research achievement efficiency of the pharmaceutical and biological products industry are higher than those of the information technology and electronic industries, but the investment in the scientific research stage is quite redundant. Resources have not yet reached optimal allocation. An empirical study was conducted on the intermediary effect of technological innovation investment between government subsidies and enterprise growth by using the intermediary effect model, and found that the current government subsidies have a significant positive impact on R & D investment and enterprise growth, and R & D investment and technical personnel investment have a significant positive impact on enterprise growth. Stochastic frontier analysis was used to build an SFA model in the form of beyond logarithmic production function, and found that government R & D investment has a slightly negative effect on enterprise technical knowledge output, but enterprise R & D capital investment is more conducive to the improvement of technological innovation efficiency of scientific and technological small and medium-sized enterprises than R & D personnel investment.

At present, the research object of most articles is from the national level, and there is little literature to analyze and study specific problems combined with specific cases. This paper will

supplement the research on the development of scientific and technological small and medium-sized enterprises through the case analysis of Chase Sun pharmaceutical, and put forward relevant suggestions.

The main results are as follows. The number of national science and technology-based small and medium-sized enterprises is large and developing rapidly, mainly distributed in the manufacturing industry. The government attaches great importance to innovation, with high investment intensity, strong innovation ability, and high efficiency. However, regional development is unbalanced and resources are mainly concentrated in the East. Small and medium-sized enterprises in other regions need to strengthen investment and construction. Through the SWOT analysis of Chase Sun pharmaceutical, it is found that the corporation has an advanced scientific research foundation and perfect equipment. On the basis of government support and the combination of industry, university and research, the research and development level is high and the market development prospect is good. Nevertheless, the source of profit is limited, and the profit margin of businesses other than traditional Chinese medicine granules is low. In addition, in the field of innovative drugs, due to fierce competition, Chase Sun pharmaceutical has no absolute advantage. In the financial analysis of Chase Sun pharmaceutical, it is found that Chase Sun pharmaceutical has strong short-term solvency, but the enterprise's financial strategy is too conservative, which is not conducive to expanding production. The operating capacity and profitability are lower than the industry average. Under the positive trend of the overall development of the industry, Chase Sun pharmaceutical has great development potential through the strategic expansion of the dual headquarters model.

2. Background of the science and technology-based small and medium-sized enterprises

In this section, we are going to investigate the characteristics of small and medium-sized enterprises(SMEs) in the science and technology industry.

2.1 Small and medium-sized enterprises are growing fast in number and are mostly concentrated in the east

Small and medium-sized enterprises grow rapidly, with science and technology-based small and middle enterprises in China reaching 328,000 in 2021. According to the statistics of the Torch Center of the Ministry of Science and Technology(MIIT), the number of registered technology-based enterprises has reached 595100. In terms of regional distribution, Jiangsu Province has the most. In the area of enhancing the innovation capacity of minor enterprises, MIIT has promoted the development of minor enterprises with "specialization and special innovation" and cultivated several "little giant" enterprises focusing on their main business, with strong innovation capability, high market share and focus on niche markets. On August 21, 2021, MIIT announced the third batch of 2,930 "little giant" enterprises with special characteristics. As of now, the number of "little giant" enterprises in China has reached 4762. From the perspective of geographical distribution, the third batch of the number of little giant enterprises in the East, Central, and West gradually decreases, accounting for 61%, 25%, and 14% respectively, which is consistent with the regional distribution pattern of manufacturing enterprises in China. It shows the imbalanced development of SMEs.



Figure 1: Statistics on the number of enterprises selected as "little giants" in each batch
Source: National Bureau of Statistics

From the distribution of subdivided industries, it shows the characteristics that: more than 60% belong to the industrial "four bases" field——Core basic parts and components, key basic materials, advanced basic technology, and industrial technology, more than 70% have been cultivating the industry for more than 10 years, more than 80% are in the first place in the market segment of the province, 90% are concentrated in the manufacturing field, with small accessories containing high technology, small enterprises to highly supported yet small industry into a big cause and other characteristics. It plays an important role in the advance of the industrial foundation and modernization of the industrial chain.

On January 13, 2022, the Ministry of Science and Technology (MOST) issued a notice proposing to create a better environment to support R&D activities of science and technology-based SMEs, hoping to add 200,000 science and technology-based SMEs by the end of the 14th Five-Year Plan. At the same time, MOST proposed to add 50,000 science and technology-based SMEs with the "four subjects" standard, which requires that science and technology enterprises have key core technology products, the proportion of science and technology personnel is more than 60%, the scientific and technological achievements represented by more than 5 high-value intellectual property rights, and the intensity of R&D investment is higher than 6%. During the 14th Five-Year Plan period, governments at all levels will promote the implementation of supporting policies in the fields of science and technology, taxation, finance, etc. with a focus on supporting the R&D of science and technology-based SMEs. It is conceivable that in the coming period, the number growth and R&D vitality of science and technology-based minor enterprise will be in a more positive policy environment.

2.2 High intensity of R&D (research & development) investment

At present, China's economic construction has entered the stage of high-quality development from high-speed growth, and the demand for scientific and technological innovation has become increasingly urgent. Since 2016, China's R&D expenditure has maintained a high growth rate and its proportion in GDP continues to rise.

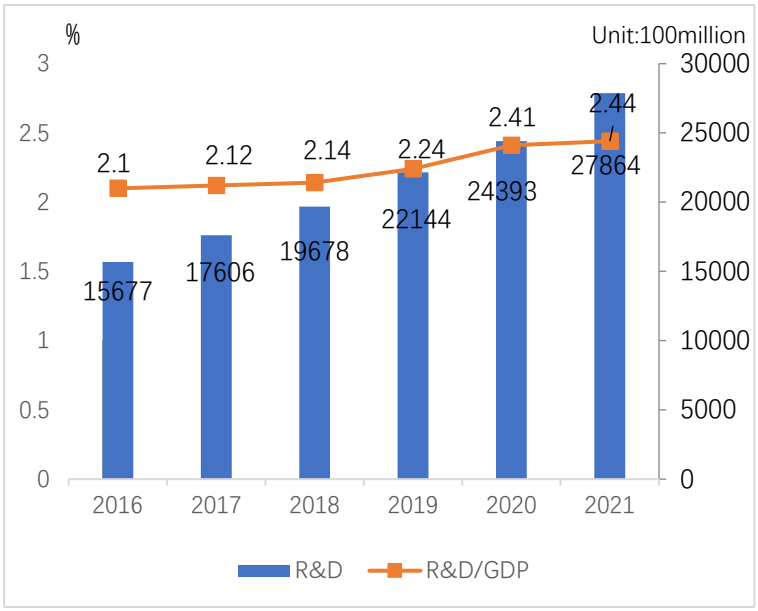


Figure 2: National R&D investment

Source: National Bureau of Statistics

The year-on-year rise in total R&D expenditure and proportion clearly shows that the central and local financial support for basic research is very solid, focusing on guiding enterprises, universities, and various social forces to increase investment in basic research, which ensures the precise support for key technologies and core areas, and the growth of science and technology-based SMEs has created a continuously expanding business environment.

By activity subject, in 2020, China's various types of enterprise research and experimental development (R&D) expenditure was 186.38 billion yuan, increasing 10.4% over the previous year. The proportion of expenditure of enterprises, government-owned research institutions, and higher education institutions is 76.6%, 14.0%, and 7.7% respectively, which means that enterprises play a dominant role in innovation. In 2019, the proportion of above-regulation industrial enterprises with R&D activities in China reached 34.2%. The investment in science and technology innovation has led to the gradual emergence of innovation capability and innovation effectiveness of Chinese enterprises. By region, Beijing, Shanghai, Jiangsu, Zhejiang, Shandong, Hubei, Guangdong, and Sichuan have a total funding investment of more than 100 billion yuan. In the intensity of their scientific research investment, the gap between the eastern coastal region and the western inland region continues to widen. While the large economic provinces rely on their strong economic strength to increase scientific research investment and help industrial transformation, the less developed regions can only invest more funds in basic construction projects such as livelihood security and infrastructure construction.

2.3 Higher revenue profit

China's innovative industry clusters have the following characteristics: the market is the basic force driving their formation; SMEs are their basic subjects; manufacturing is their main industry; developed coastal areas are their main distribution areas. In developed regions such as Beijing, Jiangsu, and Guangdong revenue and profits account for a high national total.

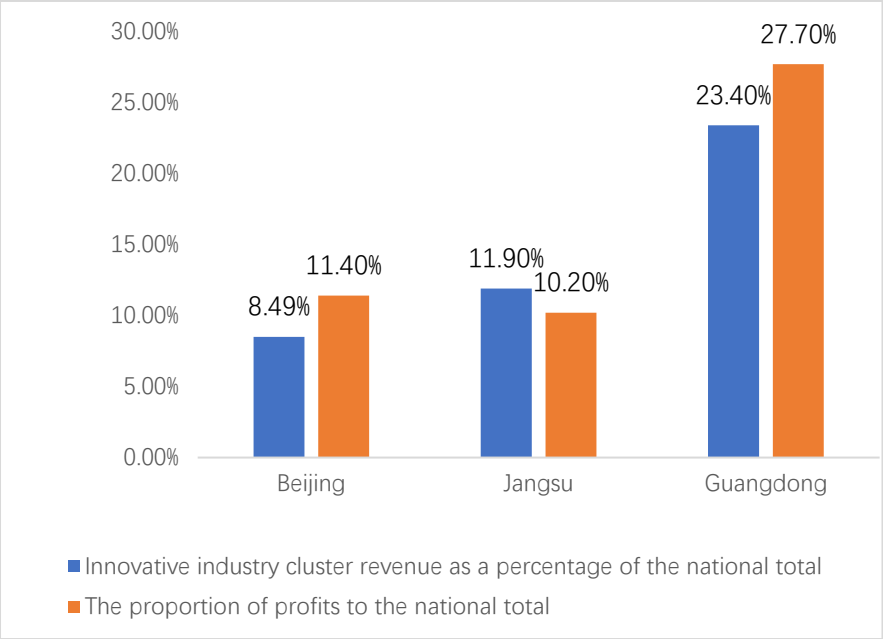


Figure 3: Main distribution of innovative industry clusters

Source: National Bureau of Statistics

The original driving force of innovative industry clusters, mainly technology-based SMEs, is the return of intelligence or capital. The formation of industrial clusters will promote technology spillover, forcing leading enterprises to continuously increase their investment and R&D activities, so that science and technology development will enter the conscience cycle and be further enhanced.

2.4 High percentage of patents granted in coastal areas

Since 2015, the proportion of the number of invention patents granted by domestic enterprises in the current year has been maintained at over 60%. By the end of 2020, the cumulative number of invention patents granted by domestic enterprises was 171,025, accounting for a further increase to 58.8% of the cumulative number of invention patents granted in China, and the position of enterprises in domestic science and technology innovation further increased.

In 2020, the top three provinces and cities in China in terms of patent grant volume were Guangdong, Jiangsu, and Zhejiang, with the numbers of 709,000, 499,000, and 391,000 respectively, occupying 45.5% of the total number of patent licensing. Guangdong, Jiangsu, and Zhejiang provinces are at the forefront of economic development in China. After the reform and opening up, the private economy has developed rapidly and the number of manufacturing enterprises is also very large, which shows a consistent trend with the change in the number of patents authorization.

3. Case study

3.1 SWOT analysis of enterprise development

The so-called SWOT analysis, which is based on the situation analysis under the internal and external competitive environment and competitive conditions, is to list the main internal strengths, weaknesses, external opportunities, and threats closely related to the research object through investigation and arrange them in the form of a matrix, and then match and analyze various factors with each other with the idea of systematic analysis, A series of corresponding conclusions are drawn, and the conclusions are usually decision-making. Using this method, we can make a comprehensive, systematic, and accurate research on the situation of the research object, so as to formulate the corresponding development strategy, plan, and countermeasures according to the research results. According to the complete concept of enterprise competitive strategy, a strategy should be an organic

relationship between what an enterprise can do (that is, the strengths and weaknesses of the organization) and what it can do (that is, the opportunities and threats of the environment.

Chase Sun pharmaceutical (CSP) has established a technology transformation center in Tianjin, covering an area of 25,000 square meters, including 3,200 square meters of synthesis production workshop and 7,200 square meters of preparation production workshop. Each production line has passed GMP certification. It has the ability to exert small, middle, and scale-up experiments against various synthetic drugs and dosage forms. Besides, the technology transformation center also provides technical services for domestic and foreign scientific research institutions including universities and other enterprises. Moreover, CSP has constructed a close relationship and cooperation with the government. It jointly held "Tumor Immunotherapy Drug Innovation Platform" with the Institute of Material Medical, Chinese Academy of Medical Sciences in 2015 and its R&D projects have received 6 special support from governments at all levels.

In addition to the traditional Chinese medicine granule business, the profits generated by other businesses of CSP are very limited. From 2017 to 2019, the net profit of CSP was 571, 498, and 528 million yuan respectively after excluding the impact of goodwill impairment. The profits generated by other businesses of the company in the same period were 56.04, 12.59, and 49.41 million yuan, accounting for less than 10% of the company's net profit, while the corresponding income accounted for nearly 50%.

In the field of the bulk drug, the global API market size reached 168 billion US dollars in 2020, and is expected to grow at a CAGR of 6.4% from 2021 to 2031, reaching 332.4 billion US dollars by 2031. In this field, CSP's Yinorui and Prospect pharmaceutical's overseas market competitive advantage is increasingly strong. In the field of pharmaceutical excipients, the global market size was 87.3 billion dollars in 2020, and is expected to reach 128.9 billion dollars in 2027. In this field, CSP’s Prospect pharmaceutical research foundation is solid. A number of categories have completed international technology standards, and now, it has achieved close cooperation with many domestic and foreign enterprises. In the international market of raw materials, CSP is occupying an important position.

The research and development of innovative drugs is accidental. The additive effect of the leader is not obvious and small enterprises may also succeed through innovative research and development, so in fact, the valuation of innovative drugs has been relatively vague. Furthermore, Big-ticket drugs enjoy only more than 10 years of patent protection, and some of them face even greater difficulty.

3.2 Enterprise financial analysis

CSP has strong short-term solvency. Solvency can be reflected by two indicators, the current ratio, and the asset-liability ratio. Generally speaking, when the current ratio equals to 2, it is healthy for the enterprise to develop in the long term. Since 2018, the current ratio of CSP has gradually declined, indicating that idle funds have reduced and funds have been used more efficiently. When it comes to the asset-liability ratio, it should be neither too high nor too low. If the ratio is too high, greater financial risks emerge, bringing insufficient cash flow which fails the enterprise to pay debts in time and leads to bankruptcy of the enterprise. At the same time, the high asset-liability ratio will further increase financing costs. The excellent value of the asset-liability ratio of the pharmaceutical industry in 2020 is 48.6%, and that of CSP is only 27.4%, indicating that the financial strategy of the enterprise is too conservative and can not make good use of financial leverage to expand production.

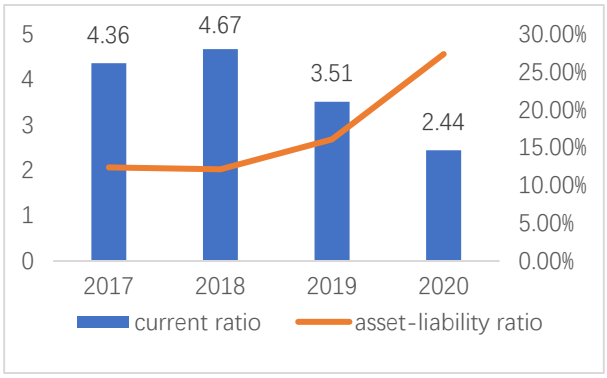


Figure 4: Current Ratio and Asset-Liability Ratio of CSP from 2017 to 2020

Source: CSP's Annual Report

CSP's operating capacity is not good as expected despite the progress in recent years. Operating capacity can be reflected by the total asset turnover rate. From 2017 to 2020, the total asset turnover rate has increased year by year and the total asset turnover speed has become faster which means that the sales ability has improved and the asset utilization efficiency has become higher. However, it is still lower than the average rate of the pharmaceutical industry in 2020 which is 0.9. It's time for CSP to think about how to strengthen its operational capabilities.

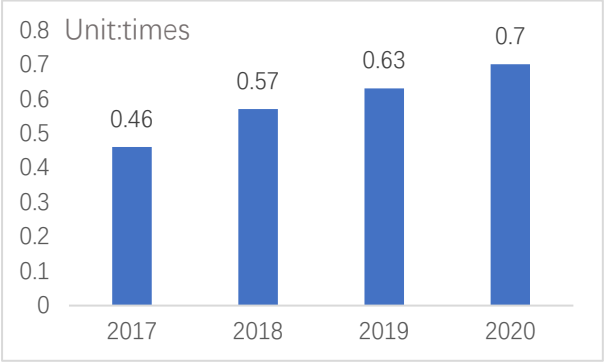


Figure 5: CSP's total asset turnover ratio from 2017 to 2020

Source: CSP's Annual Report

Compared to other companies in the same industry, the profitability of CSP is a bit low. Profitability can be reflected by the return on total assets and the return on net assets. The return on total assets of the enterprise in 2018 fell sharply, mainly due to the substandard operating performance of the two companies previously acquired by CSP at a high premium, and the impairment of goodwill was about 282 million yuan. Since then, the return on total assets has steadily improved, slightly behind the industry average of 6.15%, and there is a big gap compared with the 11.42% return on total assets of the industry leader Hengrui Pharmaceutical Corporation. The return on net assets of CSP has been always below 10% in recent years, and its poor profitability also indirectly reflects the ability of the company's management. The executives need to seriously consider the way to control production costs in the future and balance the impact of the gradual reduction of drug prices after volume-based procurement.

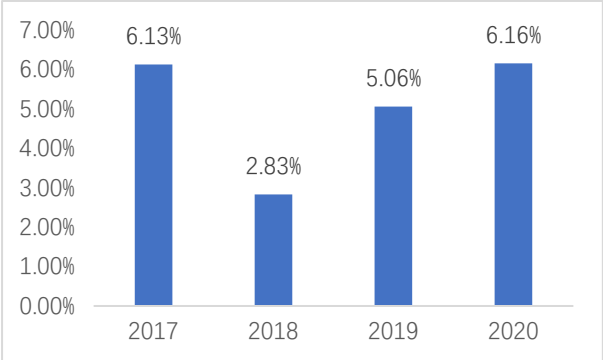


Figure 6: Return on total assets of CSP from 2017 to 2020

Source: CSP's Annual Report

In addition, CSP has great potential for development. Development capacity can be reflected by the growth rate of operating income. Since 2018, the growth rate of enterprise operating income is above good value and the growth rate of enterprise operating income in 2020 has exceeded the excellent level of 26.2% manifesting the enterprise is still in the stage of rapid growth and the business scale is expanding rapidly. CSP has formed a "dual headquarters" model development strategy, establishing a southwest headquarters on the basis of Tianjin headquarters which has accelerated the expansion of business in the western region. In the meanwhile, market share and influence will also be enhanced. In general, the company's development trend is positive.

4. Conclusion

Starting from the development status of scientific and technological small and medium-sized enterprises, and using SWOT analysis method, supplemented by financial analysis, this paper makes a specific and in-depth study on Chase Sun pharmaceutical. There are a large number of national science and technology-based small and medium-sized enterprises which are developing rapidly, mostly distributed in the manufacturing industry. The government attaches great importance to it, with high innovation investment intensity, high innovation ability， and high profits. However, the regional development is unbalanced, and the main resources are concentrated in the East. The small and medium-sized enterprises in other regions need to be strengthened and invested in construction. Based on the SWOT analysis of Chase Sun pharmaceutical, it is found that Chase Sun pharmaceutical has an advanced scientific research foundation and sound facilities. On the basis of government support and the integration of production and research, the research and development level is high and the market has good development prospects. Despite all this, the source of the profit is limited and the profit margin of businesses except traditional Chinese medicine granules is low. Also, in the innovative drugs field, Chase Sun pharmaceutical does not have absolute advantages due to fierce competitions. In the financial analysis of Chase Sun pharmaceutical, it is found that Chase Sun pharmaceutical has strong short-term solvency, but the enterprise's financial strategy is too conservative, which is not conducive to expanding production. The operating capacity and profitability are lower than the industry average level. Under the positive trend of overall industry development, Chase Sun pharmaceutical has great development potential through the strategic expansion scale of dual headquarters mode. The conclusions drawn from the combing of the overall situation of science and technology-based small and medium-sized enterprises and the case analysis of Chase Sun pharmaceutical can provide relevant enlightenment for the future decision-making of subjects such as the government and enterprises. On the government side, the government formulates a more perfect system to further strengthen the support for science and technology-based small and medium-sized enterprises in the central and western regions. On the enterprise side, the conclusion is also applicable to enterprises with similar situations. Measures like internal management reform, introducing more high-quality talents, improving innovation ability, increasing the transformation

level of innovation achievements, and reducing costs can be taken to promote high-quality development.

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