ANALYSIS ON THE RELEVANCE OF HIGH-TECH INDUSTRY R&D INVESTMENT TO PROFITABILITY

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Thematic Certificate

To

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Abstract

This article studied the correlation between R&D investment and the profitability of high-tech industries. It was found that a strengthened emphasis on R&D investment improved the efficiency of enterprises, gave full play to the endogenous role of enterprises, and enhanced the scientific and technological talent resources and core competitiveness of those enterprises. The research method used was literary research and focused on two main points. First, by increasing research and development investment, enterprises can achieve technological innovation and differentiation advantages, form technical barriers, and continuously expand market share while reducing production costs and improving production efficiency, thus improving profitability. Second, researchers bring increased knowledge and cutting-edge technology to the company, thus improving product quality, increasing market share, and increasing the net cash flow of operating activities. Enterprises should strive to maintain a certain quality of patent rights and protection system, and preventing imitations can also become an effective way to increase profits. The results show that the correlation and influence factors between R&D investment and profitability can improve the competitiveness of high-tech industries and achieve long-term development.

Keywords: research input, researchers, patents, profitability

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Declaration

*I, SHI SU SU, hereby certify that the work embodied in this independent study entitled "*ANALYSIS ON THE RELEVANCE OF HIGH-TECH INDUSTRY R&D INVESTMENT TO PROFITABILITY*" is result of original research and has not been submitted for a higher degree to any other university or institution.*

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CONTENTS

Abstract I
ACKNOWLEDGEMENTS II
Declaration III
CONTENT IV
1. Introduction 1
1.1 Background 1
1.2 Research problems 2
1.3 Research Objective 2
1.4 Scope of study 3
1.5 Research significance 3
2. Literature review 4
2.1 The meaning and industrialization process of high-tech industry 4
2.1.1 Meaning of high-tech industry 4
2.1.2 High-tech industrialization process 5
2.2 R&D and investment 6
2.2.1 Concept of R&D and investment 6
2.2.2 R&D investment and enterprise profitability 6
2.3 Researchers 7
2.3.1 Concept of researchers 7
2.3.2 Profitability of researchers and enterprises 7
2.4 Patent right 8
2.4.1 Concept of patent right.4 Patent rights 8
2.4.2 Number of patent applications and profitability of enterprises 8
2.5 The lagging impact of R&D investment on corporate profitability 9
3. Research methodology 10
3.1 Case analysis 10
3.2 Analysis of R&D investment of Hang Seng Electronics 11
3.2.1. Description of enterprise financial situation 11
3.2.2 Quantitative structure and quality analysis of R&D personnel 12
3.2.3 Research on the investment of research and development funds and the number of invention patents 13

4.Finding and conclusion 13
4.1 Finding 13
4.2 Conclusions 15
5. Recommendation 16
REFERENCE 19

1. Introduction

1.1 Background

R&D activities are the core link of enterprise scientific and technological innovation. R&D activities can not only enhance the core competitiveness of enterprises, but also contribute to the rapid development of social construction, enhance the comprehensive national strength of the country, and promote the development of the world economy (Han & Chuang, 2022). Long-term development. In the rapid development of the information age in the 21st century, scientific and technological innovation has attracted more and more attention from all countries. International competition is faced with competition from comparative advantages of resources to innovative elements, which are indispensable for sustainable economic development. It is scientific and technological innovation. The core of enterprise competition is to increase R&D investment and improve the innovation ability of enterprises. Enterprises should use innovation to stimulate economic growth and become the main body of R&D innovation. Based on this, China has continuously strengthened its R&D investment in the field of R&D activities to improve China's technological innovation level and enhance its original innovation capability (Chen, Meng & Wang, 2019).

High-tech industry refers to the industry with high proportion of R&D expenditure in the business income of manufacturing owners, high knowledge and technology intensity, high R&D investment intensity, large proportion of R&D personnel, and strong industry penetration ability in the national economy. At present, China's economic development has entered the "new normal", abandoning high-polluting and energy-consuming enterprises and focusing on developing high-tech industries, realizing industrial upgrading and seeking new economic growth points (Tsai & Wang, 2020). Compared with ordinary enterprises, high-tech industries have the characteristics of high innovation and high growth. Its development depends on high-tech achievements and high-end talents. It plays a decisive role in promoting China's scientific and technological progress, independent innovation and the development and progress of human society. In 2015, the "American Science and Engineering Indicators" released by the American International Science Foundation showed that China has become a global research

and development country, its innovation capacity has gradually improved, and the innovation and entrepreneurship environment has initially formed.

1.2 Research problems

Enterprises usually improve their core competitiveness and profitability by focusing on production, management and sales (Ren, Eisingerich & Tsai, 2019). For high-tech industries, technological innovation plays a more prominent role in optimizing enterprise production and management. It is the fundamental guarantee to realize competitive advantage for information technology enterprises to improve their innovation ability, expand their market share, maintain long-term stable and sustainable development, and form their core competitiveness. The main way for high-tech industries to realize technological innovation is to strengthen R&D investment, including increasing R&D investment, personnel investment and supporting facilities. And VanderPal's research also shows that the increase in corporate income is mainly due to the high market acceptance of the products developed by enterprises (VanderPal, 2018). Secondly, the impact of early R&D investment in high-tech industries on corporate profitability cannot be realized immediately. Schimke and Brenner et al. believe that R&D investment lags behind. The lag period of R&D investment of listed manufacturing enterprises is three years, during which the contribution to performance increases year by year. According to the inheritance of R&D, the current R&D investment is the main reason for the growth of the profitability and development ability of enterprises in the later stage, while the current performance growth mainly comes from the early R&D investment of enterprises (Schimke & Brenner, 2020). Therefore, by studying the relevant factors of R&D investment and profitability of high-tech industries, we can improve the core competitiveness of enterprises and ultimately achieve the goal of improving profitability.

1.3 Research Objective

The research purpose of this article is to analyze the correlation between R&D investment and profitability of high-tech industries. Through research on R&D investment, it is beneficial

to enhance the core competitiveness of enterprises. To this end, the following objectives are proposed:

1. Analyze the correlation between R&D investment and profitability of high-tech industries.

2. Analyze the factors that affect the R&D investment and profitability of high-tech industries.

3. Provide effective suggestions for improving R&D investment and profitability of high-tech industries.

1.4 Scope of study

The article uses the literature research method. It is carried out in the process of helping the high-tech industry to strengthen the importance of R&D investment, improve the efficiency of enterprises and enhance the scientific and technological talent resources and core competitiveness of enterprises. This article will study the relationship between R&D investment and corporate profitability through statistical investigation and analysis of China's high-tech industry investment, explore whether the impact of R&D investment on profitability has a lag and cumulative effect, and provide development suggestions for this purpose.

1.5 Research significance

In the mature stage of the market, users have formed their own perception of high-end brands and their own judgment of products, which drives the deep resistance to imitation in users' minds. To be sure, in the Chinese market with a slightly lower innovation capacity, the voice of consumers for innovation capacity is becoming higher and higher, and the research on R&D investment is becoming more and more important and practical. The rapid development of high-tech industries has brought new development factors to various industries, and the development of R&D activities plays an indispensable role in enterprises' occupying a considerable share and profits in the fierce market competition. Managers of high-tech enterprises can improve their output performance by increasing the intensity of R&D investment, strengthen their theoretical understanding of R&D activities, and enhance their

confidence and enthusiasm in R&D investment, thus helping to improve their comprehensive competitiveness (Helfat & Raubitschek, 2020).

2. Literature review

2.1 The meaning and industrialization process of high-tech industry

2.1.1 Meaning of high-tech industry

With regard to the concept of high-tech industry, there are many domestic appearances. According to Webster International Dictionary Supplement 9000 words, the main basis for the division of "high-tech" industry is divided into the number of professional and technical personnel and the proportion of investment: first, professional and technical personnel account for 40% - 60% or more of the total number of employees; Second, research and development (R & D) investment costs account for 5% - 15% of the total income. Generally, this proportion is 2-5 times higher than that of non-high-tech enterprises. There are also scholars who discuss the concepts of "high-tech" and "new technology" separately in high-tech. Since the "Torch Plan" approved by the Chinese government in August 1988 was called the guiding plan for the development of China's high-tech industry, most of us have combined the two as "high-tech industry" (Chen & Liu, 2019).

According to the definition of the Organization for Economic Cooperation and Development (OECD), high-tech enterprises refer to industries where the proportion of R&D expenditure in product sales is far higher than the average level of each industry. China has adopted the definition of high-tech industry defined by OECD since 2000, and has made corresponding adjustments according to the industry classification of OECD in 2001. According to the unified classification of OECD and China's high-tech enterprises, China's high-tech industries are divided into five categories. It should be noted that the specific products produced as high-tech industries have a certain time limit. Once the products and technologies are popularized, they can no longer be recognized as high-tech products and industries (Guan, 2015).

2.1.2 High-tech industrialization process

The process of high-tech to high-tech industry transformation, that is, the whole process from high-tech research and development, technological innovation, technology diffusion to the formation of large-scale production, we call it the process of high-tech industrialization. The research and summary of high-tech industrialization process will help us better understand the operation and competitiveness of the industry. High-tech industrialization refers to the process from research and development of high-tech products or processes to commercialization through technological innovation. In summary, it is a vertical chain, and the division of labor at each stage is clear and interlinked（Yang,2022).

(1) In the R&D research and development stage, which is the embryonic stage of high-tech industrialization, the main body of general innovation faces the risk of immature technology and financial risk of technology development failure. At the same time, if the subject of innovation has independent knowledge and property rights, it can raise funds through property rights to ensure smooth access to the market. The competitiveness is formed by: product R&D with independent intellectual property rights can form differentiated competitive advantages under the later marketization; On the other hand, it provides high-tech support for the core capabilities required by economies of scale (Shi, 2019).

(2) In the process of marketization, high-tech enterprises generally face problems such as capital, product quality, process methods, low cost and market division. At this time, it is necessary to combine high-tech core talents and core management talents to form complementary knowledge and capabilities. It is worth noting that at this stage, special attention should be paid to the following time periods: first, continue to raise venture capital (Cheng, 2020); Second, subdivide the market, identify the product positioning, create brand culture and create the market; Third, carry out large-scale production, and handle the relationship between enterprises, customers and society to maintain the brand image and enterprise popularity and reputation; Fourth, continue to adhere to the innovative development route, and continue to carry out organizational innovation, management innovation, technological innovation and update the next round of research and development of high-tech.

2.2 R&D and investment

2.2.1 Concept of R&D and investment

With the increasing impact of R&D activities on the economy, it has become the focus of the country, enterprises and society to attach importance to the positive role of R&D activities in improving enterprise efficiency (Pandit, Wasley & Zach, 2019). From the perspective of theoretical development, on the basis of knowledge and technological innovation, scientific research activities are conducive to improving the efficiency of enterprises and playing its endogenous role. Actively carrying out research and development activities can make enterprises consciously focus on training scientific and technological talents, strengthen the human resource base, significantly improve market competitiveness, and adapt to the development and changes of international and domestic markets. Increasing the intensity of enterprise R&D activities is conducive to increasing and improving the technological content of enterprise products and services, thus enhancing the core competitiveness of enterprises and increasing their market share (Li & Hu, 2021).

2.2.2 R&D investment and enterprise profitability

Warusawitharana found in an empirical study that R&D investment has a significant impact on enterprises. Enterprises can improve their profitability through innovation brought by R&D activities, and these impacts are significantly positively correlated (Warusawitharana, 2020). Wan Jirong, Dai Jianmin and Deng Deyan took China's top 100 electronic information listed enterprises as samples to conduct empirical analysis of the relationship between enterprise R&D investment and profitability. The results showed that there was a significant positive correlation between enterprise R&D investment and profitability (Wan, Dai & Deng, 2021). Munari, Oriani and Sobrero used some Norwegian enterprises as research samples and designed a new model to study the impact of enterprise R&D investment on enterprise dynamic performance evaluation. The research results show that there is a significant positive correlation between R&D investment and enterprise dynamic performance (Munari, Oriani & Sobrero, 2021). Lu Yumei and Wang Chunmei analyzed the annual report data of 99 listed

companies and concluded that there is a negative correlation between the current investment and the profitability of listed companies. There is no significant correlation between R&D investment of private enterprises and corporate profitability. However, after distinguishing industry factors, it is found that the operating return of high-tech enterprises is higher than that of non-high-tech enterprises (Lu, Wang, 2021).

2.3 Researchers

2.3.1 Concept of researchers

The characteristics of high-tech and industrial activities. Knowledge-intensive, technology-intensive and capital-intensive are the core characteristics of high-tech industries. Employees with core human capital must be a group of highly knowledgeable employees. Therefore, researchers can be defined as: possessing key technologies and core secrets of enterprises to form a competitive proportion; It has unique knowledge and ability, has core competence, can create high added value, and forms exclusive and heterogeneous resources that are not easy to be imitated after long-term and uninterrupted professional investment in the enterprise (Shi, 2019).

2.3.2 Profitability of researchers and enterprises

With the rapid development of the economy, high-tech industry, as the driving force of economic development, needs a lot of theories and research to meet its development needs in the process of development, which need to be realized by researchers. In the "Acquisition and Maintenance of the Competitiveness of High-tech Enterprises" published by Zheng Xiaoping and Wen Shaoguo, it was analyzed that the implementation of the researcher system in line with the actual situation of the enterprise and ensuring that the core staff would not be lost was a necessary measure to maintain the competitiveness of the enterprise and achieve profitability, and defined that the competitiveness of high-tech enterprises came from technological competitiveness. Ma Xiaoping pointed out in the Research on the Influence of Core Employees on the Competitiveness and Efficiency of High-tech Enterprises that it is very important for

enterprises to have unique and valuable core employees. The important aspect for high-tech enterprises to achieve a high level of competitiveness is to attach importance to the existence of these core employees (Zheng & Wen, 2021); Li Zhibo used the analytic hierarchy process to study human capital in the article "Research on the Contribution of Human Capital in China's High-tech Industries", and calculated the contribution rate of human capital to high-tech industries through the conclusion of the analytic hierarchy process and the growth model (Yang, 2018); Their research focused on the heterogeneous human capital of enterprises, and finally attributed the source of competitiveness to the construction of core researchers(Shao,2021).

2.4 Patent right

2.4.1 Concept of patent right.4 Patent rights

It is very meaningful for enterprises to apply for invention patents. 1. This can help enterprises obtain monopoly rights: the patentee can directly prevent the corresponding competition of commercial rivals, thus helping to achieve higher profit returns (Shao, 2021). 2. As a defense shield: This is an era of fierce competition, and patent rights are conducive to the stable development of enterprises. 3. Earn royalties: Generally, for a patent, even if there is no immediate need in the market at present, it is likely that people will recognize the use of the patent in the future and be willing to pay royalties. 4. It is helpful for enterprises to make scientific and correct decisions: through patent analysis, enterprises can understand scientific and technological trends, industry trends, market trends, and so on, and then make predictions, which is helpful for enterprises to formulate near, medium and long-term development plans. 5. Increase the value of the enterprise: In addition, if an enterprise applies for an invention patent and a third party is willing to invest in the enterprise, this can greatly increase the share price of the enterprise (12Millet-Reyes, 2019).

2.4.2 Number of patent applications and profitability of enterprises

Ma Xiaoping used panel data to analyze the relationship between the number of patents in the US pharmaceutical industry and the market value of enterprises. The results show that

when the minimum threshold is exceeded, the number of patents and market value of enterprises are significantly positive (Ma, 2019). Relevant Rahko's empirical research on 599 European enterprises shows that intellectual assets such as patents can promote broader knowledge transfer and have a significant positive correlation with corporate profitability (Rahko, 2019). Guan, Zhang and Yan took the number of invention patents granted by high-tech SMEs in the pharmaceutical industry from 2000 to 2014 as the independent variable and the innovation performance as the dependent variable, and concluded that the number of patents was positively correlated with the development capacity of enterprises (Guan, Zhang & Yan, 2015). Taking Taiwan as an example, Zhou Wenjie uses regression analysis method to show that although the total R&D investment and government R&D investment are positively correlated with the number of patents, the correlation between the number of patents and the profitability of enterprises is weak (Zhou, 2020).

2.5 The lagging impact of R&D investment on corporate profitability

Taking the electronic information industry as a sample, Liu Zhen analyzed the correlation between enterprise R&D investment and enterprise profitability from the micro level. The research found that the R&D investment of Chinese enterprises will not significantly affect the profitability of enterprises. The correlation coefficient between the two is relatively high. The low intensity of R&D investment has a lagging impact on the profitability of enterprises (Liu, 2019). Ren Heshi and others introduced a two-way fixed effect model in their research, taking the return on net assets as the dependent variable to control the development of enterprises, free cash flow, leverage ratio, etc. The research results show that R&D investment has an impact on the development ability of enterprises, lagging behind two periods (Ren, Shi, 2019). Ma Xiaoyun uses the principal component analysis method to construct a score function, which can be used as a dependent variable to measure the comprehensive performance of enterprises, and can also control variables such as equity concentration and leverage ratio. The research shows that the higher the R&D investment is, the higher the score of the enterprise's comprehensive performance function is, and there is a certain lag in this impact (Ma, 2018).

3. Research methodology

This article mainly adopts the literature research method and takes Hang Seng Electronics Co., Ltd. as an example to analyze the correlation between R&D investment and profitability. First of all, it analyzed the data of early investment and late profitability of high-tech enterprises in the past, read a large number of documents to understand and conduct research. At the early stage of writing, the article found a relatively large number of data and documents on the Internet to understand the relevant information of early investment and late profitability of high-tech enterprises, as well as the impact of R&D investment on the profitability and development ability of enterprises, Continue the basic content of this article.

3.1 Case analysis

Hang Seng Electronics was founded in February 1995 with a registered capital of 2970.24 billion yuan, and was listed on the Shanghai Stock Exchange in 2003. Hang Seng Electronics The purpose of "focus, professionalism and innovation" is to research and develop industrial application software and overall solutions. It not only provides overall solutions to domestic securities companies, banks, fund companies, futures companies and asset management enterprises, but also serves the transportation, CTI, e-commerce and software outsourcing industries. Hang Seng Electronics has branches in 28 major provinces and cities in China, and also has branches in the United States, Japan and Hong Kong. The company's main business scope: development and computing Computer application software, provision of relevant consulting services, transfer of relevant research results; Computer system integration service; Design, contract and install automation control project; Production and sales of electronic communication equipment, computer equipment, software and hardware; Own house leasing, etc.

Hang Seng Electronics established the Hang Seng Electronics Research Institute in October 2008. The company has a 7416 research and development building. There are 621 R&D and technical personnel (Hang Seng Electronics has about 1300 employees, accounting

for more than one third of the R&D personnel), including 42 doctors and 20 external experts (Pa, An, & Xiao, 2017).

3.2 Analysis of R&D investment of Hang Seng Electronics

3.2.1. Description of enterprise financial situation

It can be seen from Table that the company's operating income, net profit, earnings per share and other financial indicators generally show an upward trend; In 2016, the annual performance showed a turning point, and all indicators decreased; Since then, the performance growth has been more rapid than before, and the indicators such as earnings per share, net profit and total operating income have achieved substantial growth.

Target	2021	2020	2019	2018	2017	2016
Basic Earnings Per Share	0.85	0.52	0.32	0.41	0.35	0.46
Net Profit	361million	323million	200million	254million	219million	206million
Total Operating Income	142million	121million	101million	105million	86million	73million
Net Asset Value Per Share	3.1014	2.6708	2.1424	1.9500	1.5900	1.8100
Undistributed Profit Per Share	1.623	1.2699	0.8907	0.6831	0.3688	0.3261
Operating Cash Flow Per Share	0.9931	0.6441	0.5436	0.3144	0.2756	0.2534
Inventory Turnover Days	250.73	126.34	206.68	292.57	411.31	348.37

(Table of Hang Seng Electronics financial statement, 2021)

From the above table, we can see that from 2016 to 2021, the operating income, net profit and shareholders' equity of Hang Seng Group showed a trend of increasing year by year. This

shows that the company's income in recent years is good. The total asset growth rate of Hang Seng Electronics from 2016 to 2021 was 27.40%, 23.48%, 25.34% and 49.19% respectively, showing a growth trend; The total asset growth in this year was 46.82%, 13.04%, 17.33% and 42.58% respectively, showing a trend of first decreasing and then increasing, and generally showing a downward trend. This shows that the growth of R&D investment of Hang Seng Electronics can accelerate the growth of total asset growth rate, but it is difficult to accelerate the growth of total asset growth this year (Yan, 2021).

3.2.2 Quantitative structure and quality analysis of R&D personnel

With regard to R&D personnel, Hang Seng Group has established state-recognized enterprise technology centers and post-doctoral research workstations, and R&D institutions in Beijing, Shanghai and other places. There are nearly 1200 R&D personnel, including 8 in the national "Thousand Talents Plan" and 19 in the provincial "Thousand Talents Plan", forming a scientific research and innovation talent team (Pa, An, & Xiao, 2017).

IT enterprises are different from other enterprises in that a large proportion of their employees are highly qualified mental workers. Through the previous survey, the research found that more than 50% of the employees of Hang Seng Electronics are engaged in technology research and development, and the proportion of Hang Seng Electronics' technical personnel is more than 82%. Therefore, the education level and business proficiency of employees are the key factors affecting the efficiency of enterprise research and development. According to the data published in the annual reports of Hang Seng and Hang Seng, the article cannot accurately know the educational composition of technical personnel. It can only be inferred from the educational level of all employees of the two companies combined with the professional composition of employees. The educational level of employees of enterprises can reflect the importance of enterprises to R&D activities to a certain extent. At the same time, the more high-quality employees employed, the higher the investment of enterprises, Therefore, it reflects the strength of the enterprise's R&D investment from the side (Zeng, 2019).

In addition, on the one hand, Hang Seng Electronics' technical personnel are increasing, on the other hand, the quality of employees is improving. In 2012, the proportion of employees

with bachelor's degree or above in enterprises increased to more than 86%, while in 2013, the average proportion of employees with bachelor's degree or above in China's software and information technology service industry was 66.8%. Hang Seng Electronics is far higher than the industry level in terms of the number and quality of technical personnel (Verugi, 2020).

3.2.3 Research on the investment of research and development funds and the number of invention patents

In 2016, the number of applications for invention patents of Hang Seng Electronics was 9, with an average of 0.02 invention patents per 10000 yuan of research and development funds. There are differences between R&D investment and the number of invention patents, but the number of invention patents of high-tech enterprises is also increasing with the increase of R&D investment. In 2017, the correlation coefficient between R&D investment and the number of invention patents reached 0.918, with a strong positive correlation between the two. In 2018, the current R&D investment has a strong correlation with the number of invention patents, while the impact of the lag of one year has gradually weakened, indicating that the lag of R&D investment on the output of invention patents is not obvious. In 2019, there was a negative correlation between R&D investment and the number of invention patents, and there was no obvious rule for the lag effect (Rahko, 2019).

4.Finding and conclusion

4.1 Finding

The research in This article finds that the current R&D investment intensity has a negative impact on the main business profit rate and the main business profit growth rate of enterprises. The possible reason is that the amount and risk of R&D investment are relatively large. However, the technology and innovation R&D activities of general enterprises will not be effective immediately. This will take a period of development and research cycle, and it will take a period of time to display the research and development results and benefits (Li, 2020). The huge investment in R&D expenses cannot bring positive profit effect to the enterprise in

the current period. Therefore, by studying the lag effect of R&D investment intensity, This article finds that R&D investment is positively correlated with the output performance of the three lagging stages. The impact of business profit growth rate is generally on the decline. By increasing R&D investment, enterprises realize technological innovation and differentiation advantages, form technical barriers, and continuously expand market share while reducing production costs and improving production efficiency, thus improving profitability (Dai, 2021). High-tech enterprises are in the stage of growth, generally small in scale and weak in resistance to risks. Therefore, they are faced with factors such as low R&D success rate and high management risk, which may lead to the unstable contribution of R&D investment to the development of enterprises, thus leading to the positive impact of R&D investment on the development ability of enterprises, but the degree of impact decreases with the annual growth (Lu, Wang, 2021; VanderPal, 2018).

R&D personnel cannot directly bring changes in cash flow to operating activities, but the increase of R&D personnel can bring more new knowledge and new technology to enterprises, thus improving product quality, increasing market share and increasing net cash flow of operating activities (Chen, 2020).

There is no significant correlation between the number of patents and the profit growth rate of main business. The possible reason may be the low quality of patents. In order to show their R&D level and reflect the results of R&D activities, enterprises usually actively apply for patents, but the quality of patents is not high enough (Hu, 2014). The patents applied by enterprises may not increase the profits of enterprises. In addition, the patent protection system is imperfect and has great substitutability. It is easy to be imitated by competitors in other ways, resulting in failure to become a profit point. Enterprises should maintain a reasonable asset structure. Excessive asset-liability ratio will cause debt risk and affect the enterprise.

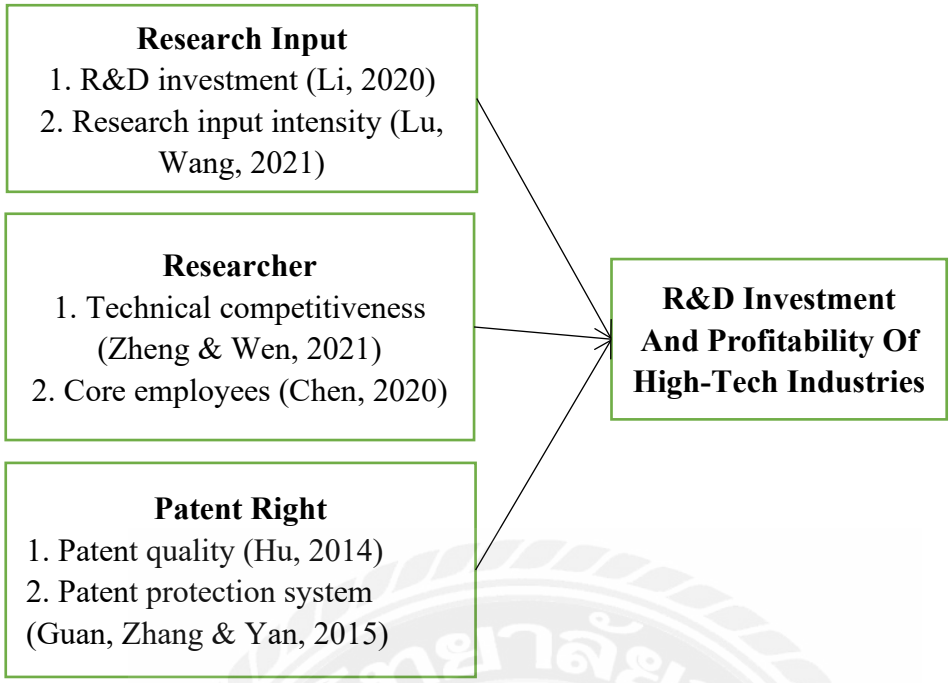

Figure 1: Model used as a guideline for this research

4.2 Conclusions

With the strengthening of the trend of economic globalization, the rapid development of the scientific and technological revolution, and the acceleration of the pace of industrial restructuring, the competition between countries has developed into the competition between various industries, and the competition between various industries has shifted from the traditional consumption of material resources to the competition based on high-tech and knowledge-based. The development of high-tech industries has improved the national innovation ability, the operation of the macro economy The strengthening of international competitiveness will play an extremely important role. We need to explore and explore the internal laws of the growth of high-tech industries, and new methods and ideas to improve the independent innovation ability and competitive advantage of high-tech enterprises, so as to improve the profitability of high-tech industries.

The article uses the literature research method to conduct a large number of literature studies, and then quotes the research case of Hang Seng Group to try to analyze the correlation between R&D investment and profitability of high-tech industries. In the case, the article analyzes the R&D investment of Hang Seng Electronics. From the financial statements, it is

found that the growth of R&D investment of Hang Seng Electronics can promote the growth rate of total assets, but the growth of total assets this year is relatively slow, with a certain lag, which is consistent with the research findings of Ren and Shi (Ren, Shi, 2019). Secondly, after analyzing the R&D personnel of Hang Seng Group, it is found that the quantity structure and quality of R&D personnel are the driving force for the economic development of high-tech industries, and enterprises must attach importance to R&D personnel if they want to gain competitiveness. According to the research on the investment in R&D and the number of invention patents, the investment in R&D is related to the number of invention patents, and the assets such as patents are significantly positively related to the profitability of enterprises (Guan, Zhang & Yan, 2015). Therefore, it is concluded that the R&D investment and profitability of high-tech industries are related. The factors that affect the R&D investment and profitability of high-tech industries include R&D investment, the quality and quantity of researchers and the number of invention patents. Finally, the research also found that the key factor for enterprises to improve their profitability is their core competitiveness, and R&D investment is the necessary factor to form their core competitiveness. Through technological innovation and a series of continuous R&D investment, enterprises can be guaranteed to have leading core technologies and products for a long time, thus ensuring the stable or rapid development of enterprises and maintaining core competitiveness.

5. Recommendation

At present, China's high-tech industry is still labor-intensive. The lack of technology and R&D innovation leads to the lack of core technology and competitiveness of enterprises, which seriously restricts the development of China's economy. Therefore, according to the current situation of China's high-tech industry and the research results of This article, the following corresponding suggestions are put forward.

1. Strengthen the intensity and sustainability of R&D investment

In order to gain faster development capability and increase market share, high-tech enterprises must improve their own operational efficiency and strengthen R&D investment, and gradually improve their independent innovation capability. With the increase of R&D

expenditure, the output performance of enterprises has been improved, enabling enterprises and shareholders to obtain more profits, and effectively improve the potential investment willingness, so that enterprises can achieve a virtuous circle (Yang, Yang & Su, 2022). The R&D investment to promote the output and performance of enterprises is not achieved overnight. The impact of R&D investment on the current and subsequent periods is continuous. The continuous growth of enterprise output and performance requires planned and step-by-step R&D investment. Enterprises should be able to balance short-term profits and long-term development, select reasonable R&D investment standards to ensure long-term development of enterprises, and mature enough investors can tolerate the impact of increased R&D investment on short-term profitability.

2. Improve the R&D information disclosure system

The lack of R&D information prevents investors from fully understanding the capital operation status of enterprises and avoiding the risks brought by investment in time. In addition, most enterprises do not fully distinguish the information disclosure of R&D personnel. They only disclose the information of technical personnel, which leads to the inability of information users to obtain sufficient data, which confuses the authenticity of business results and financial conditions, and makes investors unable to objectively evaluate the profitability of high-tech enterprises' R&D investment. China's corresponding departments should urge listed companies to improve the disclosure of research and development information, standardize the methods and contents of research and development information disclosure, and allow information users to make correct decisions on the basis of full understanding of enterprises, which will help attract more research and development investment and prevent investors from ignoring the lag caused by research and development achievements.

3. Strengthen intellectual property protection

In order to enable enterprises to carry out technological innovation without worry, it is necessary to protect the ownership of innovative technologies from the legal perspective. For the purpose of protecting business privacy, many enterprises may not be willing to disclose a large amount of R&D information to prevent the innovation from being illegally acquired and imitated by competitors before its launch, which will lead to the loss of competitive advantage, serious losses, and reduce the enthusiasm of enterprises in R&D. Due to the lack of attention

to intellectual property issues, many enterprises have suffered losses. As for the protection of intellectual property rights, the ultimate goal is to encourage independent innovation and economic transformation. Therefore, China's corresponding departments need to strengthen the protection of independent intellectual property rights and define the property owner from the legal perspective.

4. Introduce high-quality talents

The role of R&D personnel in enterprise development is limited by the scale of R&D expenditure. At this stage, China's high-tech listed enterprises invest more in R&D personnel than in R&D expenses. Although this statistical result may not be fully disclosed by enterprises, attention should also be paid to introducing high-quality talents to ensure the success rate of R&D projects. For high-quality talents, enterprises must formulate corresponding incentive and training mechanisms, and treat them differently according to their personal ability and profitability (Fu, 2021). Through different levels of wages, bonuses and positions, enterprises establish material and spiritual incentives for employees to fully mobilize the enthusiasm of R&D personnel and attract talents with a fair and fair system.

5. Establish internal R&D mechanism

High-tech enterprises usually have strong R&D capabilities and attach great importance to R&D investment, but there are also enterprises with low R&D investment. At present, the overall R&D investment of high-tech listed enterprises varies greatly and is still at a relatively low level.

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