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The Impact of Collaborative Development and Knowledge Sharing of Medical Device Enterprises on Innovation Performance

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Abstract

Taking medical device manufacturers in the Yangtze River Delta region as an example, this paper studies the impact of collaborative development, technological innovation, and knowledge sharing on innovation performance. This paper divides collaborative development into two dimensions of network centrality and tie strength, divides technological innovation into two dimensions of institutional innovation and technological innovation, divides knowledge sharing into two dimensions of knowledge specialization and knowledge breadth, and selects financial performance and market performance as proxy variables for innovation performance. At the same time, based on the existing research results, the management of target enterprises is interviewed, and the questionnaire is designed according to the results of small-scale interviews. Investigate, analyze, and obtain innovation performance data from sample companies through questionnaires. The empirical results show that: collaborative development will significantly and positively affect innovation performance, in which network centrality and tie strength both have a significant positive impact on innovation performance; technological innovation can have a significant positive impact on product innovation performance, among which institutional innovation and product innovation can positively affect innovation performance; knowledge breadth and knowledge specialization of knowledge sharing play a mediating role between collaborative development and innovation performance. The results of this research can provide a reference for the medical device industry to build a scientific and technological innovation platform when choosing a collaborative development partner, and help medical device companies to strengthen the quality of the relationship with partners to obtain information and resources. Wisely using knowledge sharing and offering some lessons for improving the innovation performance of companies.

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Introduction

Since the 19th National Congress of the Communist Party of China, the world has been undergoing tremendous changes unseen in a century, and the global Covid-19 pandemic has accelerated such changes. As a sunrise industry, China's medical device industry is growing rapidly like mushrooms after a spring rain. Due to the particularity of medical device products such as high-tech, cross-industry, high technical threshold, large R&D investment, and long cycle, most small and medium-sized medical device companies do not have all the multidisciplinary technologies and knowledge required to develop new products, or even to master one or two core technology, but often influenced by knowledge bottleneck, cannot continue to break through. Therefore, collaborative development and knowledge sharing among enterprises are more conducive to the absorption of knowledge and the integration of external technologies and knowledge to make up for the lack of limited internal resources. The birth of collaborative development among enterprises has prompted the birth of a new R&D innovation model - resource integration and collaborative development. The network platform of collaborative development among the medical device industry emerges as the times require, and gradually evolves into a network structure form of collaborative development in which the core main products are developed by the enterprises themselves, and the formal or informal relationship structure is established between related enterprises or enterprises and customers, upstream suppliers, scientific research institutions and other subjects. Collaborative development of innovation models can effectively improve the innovation performance of enterprises. This cooperation model will have strategic significance for the survival and development of China's medical device industry and even the adjustment of the business model of the entire industry. Collaborative development among enterprises is a multi-departmental and cross-organizational relationship, which is produced through negotiation in the process of enterprise business activities, and neither depends on the market nor on hierarchical mechanisms. Therefore, this paper discusses the difficulties faced by medical device manufacturers through empirical research, which has become an important topic to be studied and solved in the process of improving the innovation performance of medical device companies.

Background of Study

For the past few years, with the improvement of people's living standards, the medical device market has developed rapidly. The average annual output value of the medical device industry has increased by 23.6%, which is nearly four times higher than the national average industrial level of 4.5%. The rapid development of the medical device industry has become a new growth point in China's economic development. China's medical device industry started relatively late. At present, most large-scale medical devices rely on imports, such as "Siemens" in Germany, "GE" and "Johnson & Johnson" in the United States, "Philips" in the Netherlands, and "Olympus" in Japan.In recent years, as China's technology continues to develop, local enterprises have mushroomed to get involved. Due to the impact of imported well-known brands and the disparity between experience and economic strength, China's local ethnic medical device enterprises are on the weak side. As one of the founders of a private medical device R&D company in the Yangtze River Delta region, the author often thinks about how to develop a local national medical device company after work. How can the company get rid of the existing difficulties, show its strength and realize its value? The author hopes this study can provide effective suggestions for the rapid and stable development of the medical device industry in the Yangtze River Delta region.

Problem Statement

With the rapid development of China's economy, people are paying more and more attention to health, and more and more attention to medical devices. Under the strong support of the state, the medical device industry in China is also growing at an unprecedented rate of development. The medical device industry is different from biomedicine and is mostly small and medium-sized enterprises. In China, the medical device industry started relatively late, and most of the enterprises have developed in the past fifteen years, among which small and medium-sized enterprises are the main ones. Local medical device R&D and production enterprises, occupy the low- and mid-range market. Low degree, small scale and scattered is one of the important characteristics of China's medical device industry. Another feature of the medical device industry is the high risk, high investment, and high value-added return on investment. China's population also determines the huge market potential of the medical device industry. With the continuous improvement of people's quality of life, the selection of medical devices will become more and more high-end, which prompts medical device R&D and production enterprises to continue to develop and innovate to meet market demand. The survival and development of medical device companies are inseparable from technological innovation and product innovation. The research and development of products give enterprises a competitive advantage. Only by continuously launching new products and improving new functions can enterprises adapt to the changing market competition environment and maintain the long-term development of the enterprise. Technological innovation is inseparable from the accumulation of knowledge. However, since medical device companies are mostly small and medium-sized enterprises, the research and development of medical devices require cross-industry and multi-disciplinary cooperation. It is difficult to complete it independently by relying on the internal knowledge base of the enterprise. Medical device enterprises have to develop collaboratively with each other, absorb external technologies and complement their knowledge, thus making up for the lack of R&D resources within their own enterprises. Product research and development of medical device enterprises not only depends on financial funds, material resources, and how much market they occupy, but more importantly, how much they can master the core technologies with high barriers that cannot be imitated. Therefore, the impact of knowledge sharing on product innovation in the medical device industry has risen to an unprecedented height. At the same time, the update speed and growth speed of knowledge are also accelerating with the continuous development of technology. Knowledge management expert NONAKA once pointed out that: "In the face of an economic environment full of uncertainties, companies must gain a competitive advantage by mastering enough knowledge. In an environment where the market is ever-changing, technology is constantly innovating, and competition is becoming increasingly fierce, success will belong to those companies that can continuously create new knowledge, share it, and prompt their organizations to quickly absorb it and launch new products." It fully explains the enterprise's ability to manage knowledge, especially in the collaborative development network, the ability to obtain knowledge sharing from collaborative development partners will become one of the key factors to determine the competitiveness of enterprises. Collaborative development can be regarded as a kind of interpersonal relationship between enterprises. In the process of dynamic interaction, related enterprises not only affect the actions of a certain enterprise but also change the relationship between them, thus affecting the entire collaborative relationship.

Research Question

More and more medical device companies use various forms of collaborative development. In addition to developing collaborative development between companies, may also seek to cooperate with scientific research units and research and development institutions to obtain

the external knowledge needed to create new products, new processes, and new technologies. Since most of the medical device companies in China are small and medium-sized enterprises with relatively limited resources and innovation capabilities, this trend is particularly prominent and critical. If medical device companies want to make themselves invincible, they must continuously improve their innovation performance. However, most medical device companies are SMEs, and the companies themselves may not have all the multidisciplinary skills and knowledge needed to develop new products. The most effective solution is to change the closed traditional R&D system and effectively integrate internal and external technologies and resources through cross-platform collaborative development. In the collaborative development network, enterprises cooperate with R&D partners to help absorb and integrate external technologies and knowledge to make up for the lack of internal R&D resources. Collaborative development offers medical device companies the most efficient way to optimize technical capabilities, thus solving the bottleneck problem of enterprise performance improvement. Collaborative development is an inevitable consequence of the increasing complexity of innovative products and services. A collaborative development network represents innovative organizational solutions for products and services because it integrates different organizational skills that contribute to the achievement of common goals. Given the background analysis and problem statement above, how can these problems be addressed? This study addresses the following five questions Does the collaborative development of medical device companies have a positive impact on innovation performance?

Research Objective

How to improve product innovation capability, improve innovation performance, and realize medical device technological progress in the medical device industry is crucial to social and economic coordination tactics. Scholars at home and abroad have achieved a series of valuable research results on the research and development of business model products, but the research and development of business model products in the medical device industry is far from mature. This study takes the enterprises that have settled in the national medical device industry in the Yangtze River Delta region as the research object. Through the combination of theoretical analysis and empirical research, it deeply studies the mechanism of action of knowledge sharing and innovation performance in the medical device industry. On this basis, this paper puts forward the path and strategy suggestions for enterprises to improve innovation performance by improving knowledge sharing through inter-enterprise collaborative development. The specific objective is as follows: To discuss the impact of collaborative development of medical device companies on innovation performance. This chapter discusses the problems and challenges faced by the development of the medical device industry from the perspective of high technical thresholds, difficult product development, and strong reliance on professional knowledge faced by China's medical device industry.

Literature Review

Innovation behavior

With the development of commodity economy, market competition is becoming more and more fierce. As a high-tech enterprise, the medical device industry also pays more and more attention to product research and development. Innovation performance is a very important outcome variable for R&D output and R&D management. From the perspective of management, innovation performance refers to the sum of the results of the effective output of the joint efforts of enterprises to achieve the established goals. Scholars have not fully reached a consensus on the concept of innovation performance due to their own research perspectives and different perspectives. Innovation performance can be divided into

innovation performance in a broad sense and innovation performance in a narrow sense. In a narrow sense, innovation performance refers to the short-term financial performance and long-term financial performance of the enterprise, and the investment income of the enterprise. From a broad perspective, innovation performance includes not only the content of patents (the number of patents and the introduction of patents), and the financial benefits brought by innovation, but also the market expansion brought about by innovative technologies. In a nutshell, financial performance and market performance.

Table 2-1 Conceptual Research on Innovation Performance

Classification	Scholars	Point of view	Source
Market performance	Chen	The number of new vehicle products of vehicle manufacturers announced by the Ministry of Industry and Information Technology each year is taken as the product development performance of the company for that year. Although the single-dimensional measurement method cannot fully reflect the product R&D performance of an enterprise, it has a certain guiding significance for us to dynamically understand the activity trajectory of enterprise product R&D.	Chen (2019). Research on the Impact of Collaborative R&D Network Embeddedness on Enterprise New Product Development Performance [Doctoral dissertation, Hunan University].
	Zhu	Innovation performance is the operational and market aspects of organizational performance.	Zhu (2021). Research on the influencing factors of innovation performance of high-tech enterprises [Master's dissertation, Nanjing University of Posts and Telecommunications].
Financial Performance	Peng	Most scholars use multi-dimensional methods to measure product R&D performance, but some scholars try to measure product R&D performance from a single dimension. Wang et al believe that the average sales of new products can be used to measure product development performance.	Peng (2018). Research on Financial Performance Based on Economic Value Added (EVA) [Master's dissertation, Jiangxi Normal University].
	Wu	Innovation performance is achieved by assessing the achievement of financial objectives such as sales, profit margins, return on assets, and return on investment of new products relative to project objectives.	Wu. (2021). Research on the impact of horizontal mergers and acquisitions of Internet companies on corporate financial performance [Master's dissertation, Xi'an University of Technology].

Although academia has not fully reached a consensus on the concept of innovation performance, scholars generally believe that innovation performance can be comprehensively evaluated from financial performance in a narrow sense and non-financial performance in a broad sense, that is, market performance. Although academic circles have not yet reached a consensus on the conceptual connotation of enterprise innovation performance, scholars generally agree that innovation performance is a multi-dimensional concept. Therefore, this

paper defines innovation performance as the business effect brought about by innovation through various efforts within a specific period of time. It is an important indicator to measure the overall operating status of an enterprise, and it is also a comprehensive reflection of the operating ability of an enterprise.

Collaborative development

Ansoff first proposed the concept of "synergy" in the book "Corporate Strategy". He believes that synergy is the realization of new business expansion by an enterprise by identifying the matching relationship between its own capabilities and external resources. "Collaborative innovation" refers to the effective convergence of innovation resources and factors, and the realization of professional cooperation by breaking through the barriers between innovation subjects and fully releasing the vitality of innovation factors such as "talent, capital, information and technology" between each other. Collaborative innovation is the realization of innovation reciprocity, the sharing of knowledge, the optimal allocation of resources, the optimal synchronization of actions, and the high level of system matching within the elements of each innovation subject, the key to the effective implementation of collaborative innovation lies in the construction of a collaborative innovation platform, which can be macroscopically laid out from two aspects. First, for the organization and implementation of major scientific and technological special projects or major projects, build several collaborative innovation platforms that can achieve key breakthroughs in science and technology; second, for industrial science and technology innovation, build a comprehensive innovation platform at the national level to support industrial technology research and development and industrialization, and accelerate the transformation and industrialization of scientific and technological achievements. - Excerpted from 360 Glossary. According to the division of major needs of the Ministry of Education's "2011 Plan", collaborative innovation centers are divided into four types: oriented to scientific frontiers, oriented to cultural inheritance and innovation, oriented to the industry, and oriented to regional development. There are two main features:

1. Integrity, the innovation ecosystem is an organic collection of various elements rather than simple addition, and the way, target functions and functions of its existence show unified integrity;
2. Dynamic, the innovation ecosystem is constantly changing, so the essence of collaborative innovation is: It is a new paradigm of science and technology innovation today, in which enterprises, government, knowledge, universities, research institutions, intermediaries, and users are working together to achieve major science and technology innovation and collaborate in industrial science and technology innovation and industrialization of science and technology achievements. Reference source: Baidu Encyclopedia - Collaborative Innovation.

Table 2-2 Research on collaboration

Scholars	Point of view	Source
Wang	Collaboration means that an enterprise realizes the expansion of new business by identifying the matching relationship between its own capabilities and external resources.	Wang. (2019). Research on Supplier Management of New Product Collaborative Development of S Company [Master's dissertation, Jiangsu University]. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202001&filename=1019882600.nh
Sun	Collaboration is decomposed into two parts, "complementary effect" and "synergistic effect", and it is believed that synergy is the method by which the	Sun. (2019). The impact mechanism of collaborative R&D network and knowledge ecological niche on technological innovation [Master's dissertation, Beijing

	enterprise maximizes the effectiveness of all its resources.	Jiaotong University]. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202001&filename=1019190401.nh
Song	The research and development of technical products have experienced technology promotion, demand-pull, coupling interaction, integration, system integration and networking, and the sixth-generation collaborative and open product research and development model.	Song. (2018). Research on the Influence of Enterprise Collaborative R&D Network Characteristics on Technological Innovation Performance [Master's dissertation, Jilin University]. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201901&filename=1018065735.nh
Chaudhry Talha Khan.	Synergies occur when resources accumulated from one part of the company can be applied simultaneously and without cost to other parts of the company	Chaudhry Talha Khan. (2019). Knowledge Transfer in University-Industrial Cooperation: A Comparative Study of Knowledge Acquisition by Enterprises in and Out of the Park [Doctoral dissertation, University of Science and Technology of China]. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CDFDLAST2019&filename=1019132741.nh

Since no single company can provide all the knowledge necessary for its R&D activities on its own, open product development facilitates the acquisition of new, complementary knowledge. Considering that the necessary resources are not necessarily available in the market, inter-organizational cooperation offers an effective solution to this problem. Therefore, more and more enterprises cooperate with external organizations such as enterprises, universities, scientific research institutions, governments, and intermediaries to conduct collaborative product research and development through collaborative development, alliances, cooperation networks, etc. Collaborative development is both an entry ticket to an information network and a tool to rapidly disseminate information about opportunities and barriers. Collaborative development enables businesses to realize that they need to acquire ideas and information from a variety of sources to enrich their knowledge base to improve product development performance.

Methodology

This paper mainly adopts quantitative analysis and empirical research method, uses SPSS statistical analysis software as a tool for data statistics and regression analysis, and analyzes the sample data obtained from the questionnaire survey to explore the dimensions of collaborative development, scientific and technological innovation, knowledge sharing, and innovation performance in the medical device industry. Firstly, descriptive statistical analysis is carried out to make a simple classification of the sample data. Secondly, carry out reliability and validity analysis to ensure that the reliability and validity of the sample data meet the requirements. Finally, the theoretical hypothesis model is tested empirically to verify whether each hypothesis is true and explain the research results.

Population / Sampling / Unit of Analysis

In this paper, medical device companies are the subject of study, and it is only necessary that the filler's company belongs to the industry to which the medical device companies belong as defined above. Questionnaires are distributed mainly through online channels, supplemented by small-scale on-site paper questionnaires. The online questionnaire is mainly distributed through the Wenquanxing platform, forwarded to Wechat moment and contacted by the leaders and colleagues of the internship company to help fill it out, and then they help forward it to their colleagues and friends in the same industry to fill out and collect. The paper questionnaires are mainly distributed during the internship period, and the paper

questionnaires are distributed on the spot and entrusted to colleagues to fill out and collect the questionnaires. The questionnaire method is one of the more widely used methods in social surveys at home and abroad. A questionnaire refers to a form used for statistics and surveys to express questions in the way of asking questions. The questionnaire method is a method in which the researcher uses this type of controlled measurement to measure the problem under study in order to gather reliable information. In the questionnaire method, most of the questionnaires are sent by mail, individual distribution or collective distribution. Respondents fill in the answers according to the questions in the form. Generally speaking, questionnaires are more detailed, complete, and easier to control than interviews. The main advantages of the questionnaire method are standardization and low cost. Because the questionnaire method is based on a well-designed questionnaire, the design of the questionnaire should be standardized and measurable.

Instrumentation

The empirical research method is a method of understanding objective phenomena and providing people with tangible, useful, definite and precise knowledge, focusing on the question of "what" the phenomenon itself is. The empirical research method attempts to transcend or exclude value judgments, only to reveal the internal constituent factors of objective phenomena and the universal connections of factors, and to generalize the nature of phenomena and their operating laws. Its characteristics are: (1). The purpose of the empirical research method is to recognize objective facts and study the laws of motion and internal logic of the phenomenon itself.2. Empirical research method is objective in the conclusion of the studied phenomenon and tests it based on experience and facts.

Findings

Summary of respondents

This paper conducts market research on the enterprises in the Yangtze River Delta region settled in the Suzhou National Medical Device Industrial Park by means of a questionnaire survey. According to the collation of data related to collaborative development, scientific and technological innovation, knowledge sharing, and innovation performance, the statistical software SPSS 20.0 is used for empirical testing and data analysis, and reliability analysis is used. It mainly includes two aspects: first, the reliability and validity test of the scale. The reliability and validity of the scale are tested using reliability analysis and confirmatory factor analysis. In addition, multiple regression analysis is used to test the seven hypotheses of this paper. This questionnaire survey distributed 300 questionnaires and recovered 280 valid questionnaires. The survey objects are medical device manufacturers settled in Suzhou National Medical Apparatus Industrial Park in the Yangtze River Delta region, of which 19 founders of senior managers account for 7%, 78 partners account for 28%, 73 middle managers account for 26%, and 109 technical backbones account for 39%. Details are as follows:

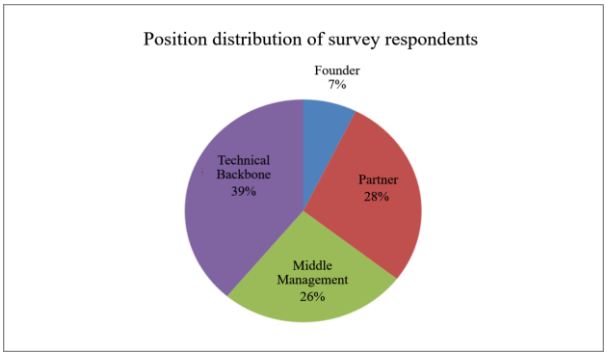

Figure 4-1 Position distribution of survey respondents

In terms of enterprise nature, 209 private enterprises account for 51%, 2 state-owned enterprises account for 2%, 95 foreign (joint venture) enterprise account for 46%, and 4 other and scientific research institutes account for 1%, basically covering the main types of medical device manufacturers in the Yangtze River Delta region.

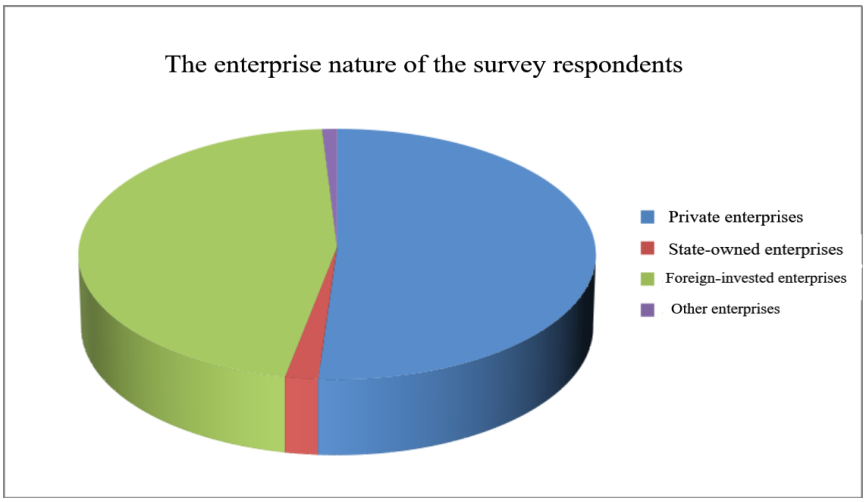

Figure 4-2 The enterprise nature of the survey respondents

In terms of the establishment time of the enterprises, 39 enterprises have been established for more than 20 years, accounting for 10%, 89 enterprises have been established between 10 and 20 years, accounting for 22%, and 205 enterprises have been established for more than 5 to 10 years, accounting for 50%. There are 67 companies established for more than 1~5 years, accounting for 16%, and 9 start-ups established for less than 1 year, accounting for 2%.

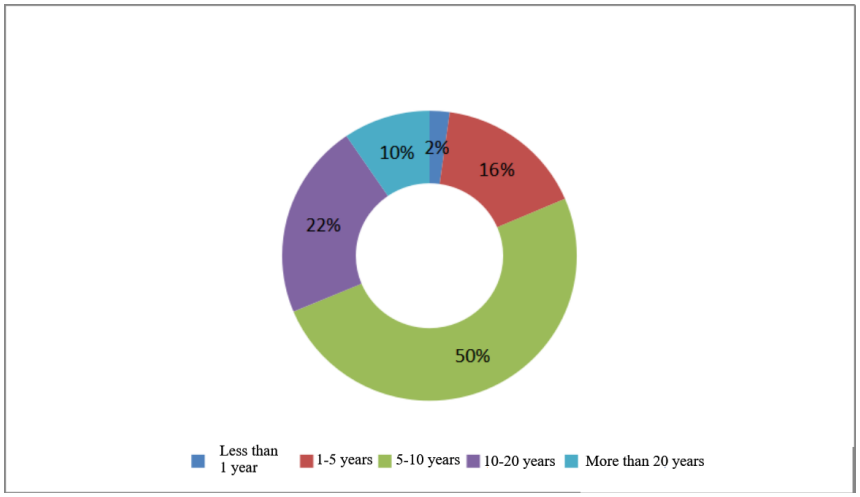

Figure 4-3 Time distribution of company establishment

In terms of the number of employees, 27 companies (7%) have more than 500 employees, 134 companies (33%) have 101-500 employees, 165 companies (40%) have 51-101 employees, and 83 companies (20%) have less than 50 employees, indicating that the majority of medical device manufacturers are small and medium-sized enterprises.

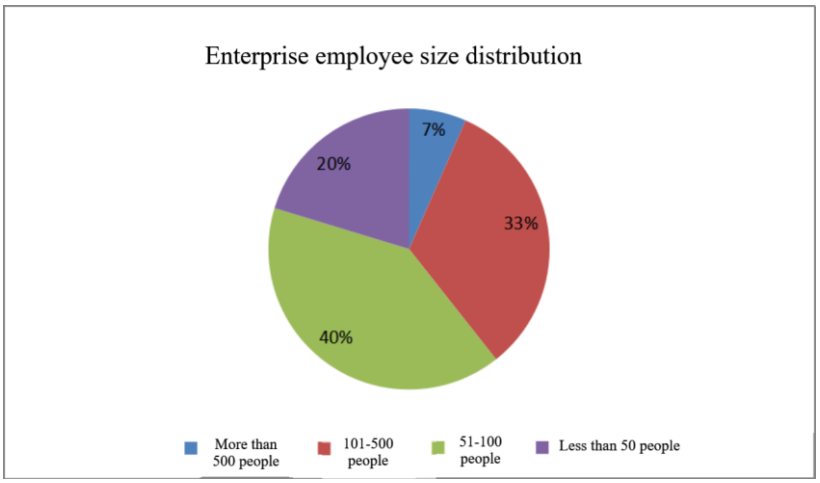

Figure 4-4 Scale distribution of enterprise employees

This part of the questionnaire includes the position of the respondents, the nature of the company Impact of knowledge sharing in medical device enterprises on innovation performance

Analysis

This section examines the model of the relationship between knowledge sharing and innovation performance by discussing the existing literature and related knowledge sharing and innovation performance theories. This study divides knowledge sharing into two dimensions: knowledge breadth and knowledge specialization, and empirically studies the impact of knowledge sharing on innovation performance through the sample data of 280 valid questionnaires. The results of both analyses are shown in the table below. There is a significant correlation between knowledge sharing (KBKD) and innovation performance (NP). There is a significant correlation between knowledge sharing (KBKD) and market performance (NP1). There is a significant correlation between knowledge sharing (KBKD) and financial performance (NP2).

Table 4-3 Results of correlation analysis between knowledge sharing and innovation performance

	KBKD	KBKD1	KBKD2	NP	NP1	NP2
KBKD	1					
KBKD1	0.594**	1				
KBKD2	0.617**	0.521**	1			
NP	0.704**	0.423**	0.418	1		
NP1	0.687**	0.520**	0.413	0.660**	1	
NP2	0.083	0.093	0.086	0.713**	0.785	1

Note: When P<0.05, it is represented by *, when P<0.01, it is represented by **, and when P<0.001, it is represented by ***

Knowledge breadth (KBKD1) is weakly correlated with innovation performance (NP), market performance (NP1), and financial performance (NP2). Knowledge specialization (KBKD2) is weakly correlated with innovation performance (NP), market performance (NP1), and financial performance (NP2).

Results

The multiple regression analysis of knowledge sharing and innovation performance is as follows: the model's R^2=0.036, F=6.599, and the significance level is P<0.001.

Table 4-4 Multiple regression analysis results of knowledge sharing and innovation performance

	Unstandardized regression coefficients		Standardized regression coefficients	t	Sig.
	β	Standard Error			
Constants	1.655	0.26586		5.783	0.000
KBKD1	0.311	0.055	0.324	5.705	0.000
KBKD2	0.203	0.050	0.233	4.085	0.000

The regression coefficient of knowledge breadth (KBKD1) against innovation performance (NP) is significant, p=0.000, which is less than 0.05, and the standardized regression coefficient is 0.324. Hypothesis H1a is valid. The regression coefficient of knowledge specialization (KBKD2) against innovation performance (NP) is significant, p=0.000, which is less than 0.05, and the standardized regression coefficient is 0.233. Hypothesis H1b is valid. The empirical results of multiple regression analysis fully illustrate the relationship between knowledge sharing and innovation performance: knowledge breadth and knowledge specialization have a significant positive impact on innovation performance.

Discussions

According to the theory of knowledge management, the most important thing an enterprise should pay attention to is the knowledge assets of the enterprise. It is an important task for the sustainable development of the enterprise to manage it effectively and then realize the enterprise's strategic plan. In the unpredictable market environment, enterprises need to obtain information and resources from the outside world through knowledge sharing to make up for their own inadequacy, thereby adapting to market changes and seizing market opportunities, and ultimately improving their innovation performance. At present, many scholars have conducted research on knowledge sharing and innovation performance. For example, foreign scholars Lyamah and Ohiorenoya (2015) took non-renewable resources such as oil and natural gas as the research object and found that knowledge sharing can enable enterprises to obtain better sales performance, better supplier support, and reduce enterprise operating costs, which is ultimately beneficial to enterprises. According to the research of Wang et al. (2015), knowledge sharing plays a fundamental role in realizing technology and knowledge innovation through knowledge-sharing organizations, and finally realizing the improvement of organizational performance. Yu et al. (2017) studied the relationship between knowledge sharing and corporate innovation performance in China's special context, and the results showed that there is a significant correlation between the two.

Conclusion

A total of 17 hypotheses are proposed in this study through correlation analysis and regression analysis, all of which are verified. Based on these hypotheses, this chapter summarizes the research. This paper analyzes the collaborative development network in the medical device industry to examine the mediating role of the knowledge base of medical device companies between collaborative development and innovation performance. Through empirical analysis, the research hypothesis of this paper is basically supported, and the following research conclusions are obtained: Network centrality positively affects the innovation performance of enterprises, and tie strength positively affects the innovation performance of enterprises; Both knowledge breadth and knowledge specialization of knowledge have a positive impact on the innovation performance of enterprises; Knowledge breadth plays a complete mediating role between innovation performance; knowledge breadth and knowledge specialization play a partial mediating role between network centrality and innovation performance; knowledge specialization plays a partial mediating

role between tie strength and innovation performance; there is a partial mediating effect between knowledge generality and institutional innovation, product innovation and innovation performance, while there is a partial mediating effect between knowledge professionalism and institutional innovation and product innovation and innovation performance. Based on this, the conclusion of this study supplements the theoretical research on the impact of collaborative development and knowledge sharing on product research and development in the medical device industry, which has important guiding significance for enterprise to carry on collaborative development network management, enterprise knowledge management and enterprise new product development strategy.

When medical device companies face the ever-changing internal and external environment, how to continuously improve their innovation performance is the focus of scholars. This paper comprehensively uses a series of research methods such as the literature review method, questionnaire survey method, and empirical research method, and builds a conceptual model of knowledge sharing, collaborative development and enterprise innovation performance of scientific and technological enterprises on the basis of knowledge management theory and dynamic capability theory. Taking science and technology enterprises as the research object, this paper deeply analyzes the influence and impact mechanism of knowledge sharing on the innovation performance of science and technology enterprises, illustrates that the dynamic ability of enterprises has a positive impact on the improvement of enterprise innovation performance, and verifies that dynamic capability, as a mediating variable of knowledge sharing and innovation performance, has a certain effect on the relationship between them. The main conclusions are as follows: in order to survive and develop, medical device companies must continue to get rid of the stale and bring forth the fresh, which requires the use of existing knowledge to continuously conduct R&D and innovate. Based on resource-based theory, transaction cost theory, collaborative product R&D theory, and knowledge-based theory, this study conducts a series of studies on collaborative development, knowledge sharing and its impact on innovation performance in the medical device industry. The factors that can affect innovation performance are analyzed, and the relationship between collaborative innovation and product innovation performance is understood through questionnaires. A theoretical model of collaborative innovation affecting innovation performance is established, including the direct effect and the mediating effect of knowledge sharing and the data of enterprises applying for new patents, releasing new products, and other related data; the direct effect of collaborative innovation on innovation performance and the mediating effect of knowledge sharing are analyzed.

References

Ansoff I. (1965). *Corporate Strategy.* New York: Mc Graw Hill.

Awaja, D., Awaja, A. & Raju, V. (2018). *Organizational Innovation By Knowledge Management Processes In Palestinian Universities*.

Bai, W.X. (2017). Organizational Dual Learning, Cross-Functional Integration and Innovative Team Performance. *SME Management and Technology*, (21), 2.

Cuervo-Cazurra, A., Nieto, M. J. & A Rodríguez. (2017). The impact of r&d sources on new product development: sources of funds and the diversity versus control of knowledge debate. *Long Range Planning*, 51(5).

Dan, P., Obal, M., Walton, B. & Fearne, A. (2019). The role of market knowledge type on product innovation performance. *International Journal of Innovation Management* (ijim), 24.

Eslami, M. H. (2017). *Knowledge integration with customers in collaborative product development project*.

Feng, J.D. & Meng, R.Y. (2019). The knowledge innovation model and approach of China's medical service supply chain under the background of big data. *Health service Management in China*, 36(12), 7.

Guo, R. & Xie, Y.S. (2021). Research on Knowledge Fusion Mechanism in Knowledge Innovation Network. *Technology and Innovation,* (2), 4.

Haghighi, M., MD Soltani & Farsizadeh, H. (2018). *Explaining the Role of Organizational Ambidexterity in The Impact of Pro-innovation Culture and Organizational Memory on New Product Development Performance.*

Haken H. (1977). *Synergistics*. Berlin: Springer-Verlag.

Jing, X.Q. (2017). The Impact of Knowledge Innovation on Regional Economic Growth and Its Mechanism: An Empirical Analysis Based on Shanghai. *Journal of Tongji University: Social Science Edition*, 28(2), 7.

Jing, X.Q. (2017). The Impact of Knowledge Innovation on Regional Economic Growth and Its Mechanism: An Empirical Analysis Based on Shanghai. *Journal of Tongji University: Social Science Edition*, (02), 110-116.

Kalakada, U.L. & Jesiah, S. (2020). INDIAN INSTITUTE OF MANAGEMENT KOZHIKODE Literature Review on Customer Knowledge Management (CKM). 04th International Conference on Marketing,*Technology & Society,* 7-8, December.

Luo, L., Wang, J.R., Zhang, K., Management, S.O. & University, N.P. (2017). A model for complex product development performance based on knowledge management. *Operations Research and Management Science*.

Lv, T., Lin, H. & Chen, H. (2020). The Impact of Dynamic Capability on Firms' Innovation Performance: The Mediating Role of Ambidextrous Innovation. *China Science and Technology Forum*, (8), 10.

Ma, L., Xu, G. & Gao, Y. (2021). Stakeholder integration and innovation performance of high-tech firms—a moderated mediation model. Science and *Technology Management Research*, 41(21), 11.

Perez-Luno, A., Bojica, A.M. & Golapakrishnan, S. (2019). When more is less: the role of cross-functional integration, knowledge complexity and product innovation in firm performance. *International Journal of Operations & Production Management*, 39(1), 94-115.

Polanyi K. (1944). *The great transformation: the political and economic origins of our time*. Boston, MA: Beacon Press.

Qu, F.L. (2018). Research on the correlation between knowledge management performance and organizational culture. *National Circulation Economy*, (10), 2.

Ruan, G.X. (2021). Cross-organizational improvisation, supply chain agility and innovation performance—the moderating effect of environmental dynamics. *Contemporary Economic Management*, 43(12), 6.

Sa, A., Aa, B., Ad, C., Jkd, A., Zh, A. & Zk, B. (2021). R&d intensity, knowledge creation process and new product performance: the mediating role of international r&d teams. *Journal of Business Research,* 128, 719-727.

Shen, A., Jiang, X. (2019). Research on the Impact of Strategic Flexibility on New Product Performance in Dynamic Environment. *Science and Science and Technology Management,* (1), 13.

Tseng S M, Lee P S. (2014). Title: The Impact of Knowledge Management Capabilities and Dynamic Capabilities on Organizational Performance. *Journal of Enterprise Information Management,* 27(2): 158-179.

Uzzi B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly,* 42(1): P35-67

Wang, B. (2017). *The influence and mechanism of two-way open innovation of enterprises on new product market performance* [Doctoral dissertation, University of Science and Technology of China).

Wang, F. & Liu, D. (2019). The impacts of customer collaboration on new product development performance—the moderating effect of cross-functional collaboration. *East China Economic Management.*

Xu, P.L., Jia, Y.Y. & Yu, X.Y. (2020). Effect reasoning, entrepreneurial team cohesion and innovation performance. *Journal of Management*, (2), 8.

Yan, M.R., Zheng, X.T. & Li, L. (2020). Collaborative R&D network structure, corporate knowledge transfer capability and innovation: An examination of 71 new energy vehicle companies. *Industrial Economics Review*, 11(1), 13.

Yan, T. & Azadegan, A. (2017). Comparing inter-organizational new product development strategies: buy or ally; supply-chain or non-supply-chain partners?. *International Journal of Production Economics.*

Zhao, Y., Yang, X.R., Wang, Y.X. & Wang, J.H. (2021). Good tools are essential things: Team knowledge sharing and innovation performance. *Science Research*, 39(11), 9.

Zheng, A.M. & Liu, C.Z. (2020). Who promotes university knowledge innovation more, "university-enterprise cooperation" or "university-government cooperation"? Journal of Shaoyang University: Social Science Edition, 19(4), 8.

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