THE IMPACT OF BUSINESS MODELS ON INNOVATION PERFORMANCE: AN EXPLORATORY CASE STUDY

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ABSTRACT

This paper mainly explores the influence mechanism of enterprise business model on innovation performance. This paper selects 6 representative companies from Chinese high-tech companies to carry out exploratory case studies. In order to improve the scientific nature of the research results, this paper selected 6 representative high-tech service companies. This paper has successively carried out detailed case analysis of sample enterprises, and carried out a comparative analysis of 6 sample enterprises. Through the vertical analysis and horizontal comparative analysis of 6 sample companies, this paper identifies the dominant types of business models of high-tech service companies and the main methods of technological innovation. On the basis of case analysis, this paper puts forward the way of business model's influence on technological innovation, the way of technological innovation's influence on innovation performance, and the way of business model's influence on innovation performance.

Keywords: Business Model, Technological Innovation, Innovation Performance, Influence Mechanism.

INTRODUCTION

Since a large number of e-commerce companies have achieved great success with the help of business model innovation, business models have attracted more and more attention from business managers and academia. Academia has conducted multi-perspective research on the concept, constituent elements, and innovation paths of business models. However, the relationship between business model and enterprise innovation has not yet formed a more unified understanding. Especially the impact of business model on enterprise innovation performance, the theoretical circle has not formed a relatively explanatory theory. Therefore, on the basis of combing the research results of predecessors, this paper carries out an exploratory case study of the impact of business models on innovation performance. This paper focuses on the impact of business models on innovation performance, and finally selects 6 high-tech service companies to carry out exploratory case studies. This paper will use research hypotheses, case selection,

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interview surveys, and data analysis to obtain research results, and build a conceptual model of business model, technological innovation, technological system, and innovation performance based on this.

Theoretical Background Aand Theoretical Presupposition

Previous studies on corporate innovation performance mainly focused on the industrial technology innovation of manufacturing companies, expounding the factors that affect the improvement of corporate innovation performance from the perspective of technology research and development and technology introduction (Lizarelli, et al, 2021). With the rapid development of information technology, especially the development of Internet technology, technological innovation has also brought more and more important influences on the development of modern service industry, and promoted the rapid development of high-quality modern service industry (Xu Ziyan, et al., 2021). With the deepening of research, scholars' research on technological innovation is no longer limited to industrial technological innovation in the narrow sense, but continues to expand to the level of technological innovation in the broad sense (Bruton & White, 2011).

The business model is a framework that takes technological innovation as an input factor and realizes economic output through customers and the market (Loon Mark, et al., 2021). Business models can improve corporate performance through corporate technological innovation, which is mainly manifested in companies discovering new needs in the process of market transactions through business models, and urging companies to continuously improve and upgrade technology to meet market needs (Ferreras-Méndez José Luis, et al., 2021). Technological innovation can also improve corporate innovation performance through business models (Li Huang, et al., 2021). For enterprises, an unreasonable design of a business model will not only affect the realization of the business benefits of the company's new products, but also affect the commercial transformation effect of the company's technological innovation results (Sharmelly Rifat & Ray Pradeep Kanta, 2021).

Business model is an important source of competitive advantage in the market, not only for manufacturing companies, but also for service companies (Ghezzi Antonio, 2020). Companies continue to integrate and internalize external resources and open up new industries to achieve the strategic goal of improving operating efficiency (Dwivedi Ritesh, 2020). Technological innovation is an important indicator for measuring business performance in the process of corporate growth (Matthias Olga & Fouweather Ian, 2021), but the impact of business models on this process is rarely involved in the research of past scholars. Business model can not only promote technological innovation of enterprises, but also help enterprises realize the economic value of technological innovation. More importantly, enterprises can use business model to exert their own advantages and overcome disadvantages. Amit R., Zott C (2015) put forward four prerequisites for business model design: the goal of creating and obtaining value, the activities of stakeholders, the template of existing enterprises, and the constraints of the environment.

An important point of contingency theory is that there is a close connection between corporate strategy and organizational structure, and it has been verified that this connection will

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have an impact on the business performance of the company (Rogerio S. Victer, 2020). Many scholars' research focuses on the causal relationship and dynamic matching between corporate strategy, organizational structure, and business performance, and has gradually expanded to research on the relationship between different types of corporate strategy and organizational structure (Garry L. McDaniel, 2021). According to the theory of contingency, the internal and external environment of an enterprise will not only have a direct impact on the formation process of the enterprise's business model, but also the matching relationship formed between the external environment and the internal organizational structure of the enterprise will also have an impact on the business performance of the enterprise (Magerakis Efstathios & Habib Ahsan, 2021). For enterprises, the business model has a more profound impact than corporate strategy. If the corporate strategy and business model can be combined for planning, the company will gain a greater competitive advantage from the business model design (Dwivedi Ritesh, 2020).

According to the above analysis, technological innovation is an important factor for companies to improve their operating performance, and has received extensive attention and research from scholars. The interaction between business model and technological innovation, and the impact of their interaction on enterprise innovation performance have also attracted more and more attention from scholars (Bei Lixin & Jiao Gaole, 2021). Therefore, this paper mainly focuses on the role of business models in high-tech service companies. Based on the contingency theory, it studies the interaction between business models and technological innovation, as well as the mechanism of their interaction on corporate innovation performance, and proposes the following hypotheses Figure 1 below.

Hypothesis 1, Business model has a significant impact on enterprise innovation performance.

Hypothesis 2, The business model has a significant impact on enterprise technological innovation.

Hypothesis 3, Technological innovation has a significant impact on enterprise innovation performance.

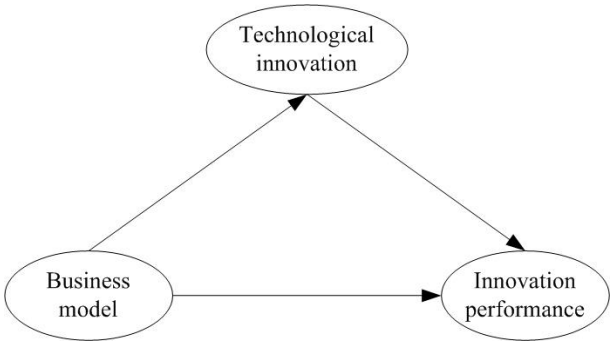

Figure 1

RESEARCH DESIGN AND METHODS

Research method selection

Case study is a qualitative research method that is suitable for initial exploratory research

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and is conducive to solving the basic questions of "what" and "why" in the initial stage of research, thereby establishing a research foundation for the establishment and expansion of theories (Gianmarco Bressanelli et al., 2018). According to different research types, case studies mainly include exploratory case studies, evaluative case studies, explanatory case studies and descriptive case studies (Mohammad M. Foroudi et al., 2019). According to different research purposes, case studies are also divided into two types: theory construction and theory verification (Ma Zheng et al., 2021). This paper is dedicated to exploring the impact of high-tech service companies' business models on innovation performance. However, the existing research results seldom involve this problem, and the existing theories cannot explain the influence mechanism in this respect well. Therefore, this paper attempts to construct relevant theories through exploratory case studies of typical companies. Although the specific steps for different scholars to carry out case studies are different, the overall thinking among different scholars is basically the same. Therefore, according to the relevant research results of scholars, this paper divides the case study into the following steps.

(1) Clarify research questions. By analyzing the real development background of China's high-tech service enterprises and the management difficulties encountered in the process of operation and management, the research question of this paper is put forward: the impact of high-tech service enterprises' business models on innovation performance, which can be used as a guide in massive research Contents related to the research in this paper are collected from the results and data.

(2) Put forward theoretical hypothesis. Based on the existing relevant research results of scholars, this paper puts forward theoretical hypotheses and research constructs on the relationship between key concepts such as business model, technological innovation, technological system and innovation performance, so as to guide the later research process. In order to ensure the scientific nature of the research findings, the proposed research construct only involves the relationship between the key concepts in the theoretical hypothesis, and does not propose the specific relationship between variables, nor does it add other variables.

(3) Case screening and analysis. According to the scientific nature of the screening process and the representative principle of the case, the case screening, interview survey and data analysis are carried out, and the conclusion of the case study is obtained, so as to put forward the initial theoretical hypothesis.

Case Selection

In order to improve the effectiveness and scientificity of the research, this paper repeatedly verifies the case selection. Firstly, the background data of 3520 high-tech service enterprises certified by the Ministry of science and technology in China are collected and analyzed. According to the principle of representativeness and typicality, 18 high-tech service enterprises are selected as the candidate case set. The specific screening criteria of 18 enterprises are as follows: (1) the enterprises have carried out technological innovation activities. (2) Business model design has a significant impact on innovation performance.

In this paper, we conducted in-depth interviews with 18 selected enterprises, and collected

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the specific information of these enterprises in business model design, technological innovation and other aspects. According to the research questions, this paper uses the purposive sampling method to further select 6 high-tech service enterprises from 18 case enterprises as research samples. The specific information of the six sample enterprises is shown in table 1. Purposive sampling is a non-probabilistic sampling method commonly used in qualitative research. It is required to select the research samples that can provide the maximum amount of information for the research problems according to the research purpose, which is conducive to obtain a more in-depth explanatory understanding of the research objects (Qureshi Muhammad nouman & Hanif Muhammad, 2021). Therefore, the purposive sampling method is very consistent with the requirements of this exploratory case study, and can achieve the purpose of this study. In this paper, six sample enterprises were selected according to the following criteria.

(1) In order to make the case representative, this study considered a certain degree of industry dispersion when selecting the case. Six sample enterprises were from six different industries.

(2) In order to improve the multiple verification effect of the study, this study tries to consider the diversity of different enterprises in business model, technological innovation, innovation performance and other aspects when selecting sample enterprises, taking into account different types of high-tech service enterprises.

(3) In order to improve the credibility of the case study, when selecting sample companies in this study, try to select companies that are rich in information collected by surveys and interviews.

(4) In order to reduce the influence of the external environment on the relationship between the business model and innovation performance of the company, this study selected sample companies in the same environment, all of which are from Guangdong Province, China.

Table 1
EXTERNAL ENVIRONMENT ON THE RELATIONSHIP

Enterprise situation	**A technology service company**	**B clothing design service company**	**C Chemical Technology Service Company**	**D logistics service company**	**E elevator service company**	**F Communication Technology Service Company**
Established	1998	1995	1994	1991	1991	2006
Number of workers	6300	587	230	352	4231	96
Sales Amount	RMB 8.9 billion	RMB 1.3 billion	RMB 7.5 billion	RMB 4.5 billion	RMB 6.8 billion	RMB 650 million
Industry	Security industry	Garment Industry	Chemical Industry	logistics industry	Elevator industry	Communications industry
Main business	Manufacture and production of safety protection products, and	Production and sales of casual clothing, and provide clothing	Production and sales of specialty chemicals, and provide chemical	Mainly operate a national logistics information service	Manufacture and sales of elevators, and provide elevator maintenance	Mainly engaged in remote collaborative video communication software and

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	provide solutions for safety protection problems	design consulting services	technical consulting services	platform	services	integrated client terminals, and provide integrated communication solutions
Main market	China domestic and overseas markets	China domestic market	China domestic market	China domestic market	China domestic market	China domestic market

Variable Measurement

In this paper, the process of variable measurement is divided into two steps. First, the data collected from the survey are preliminarily analyzed. Secondly, the most matching measurement method of existing research results is used to analyze and sort out the data, and the structured and coded information is obtained.

The business model describes the transaction structure, transaction content and transaction management activity process of an enterprise for the purpose of creating value. According to the design theme, business models can be divided into efficiency type, novel type, complementary type and lock-in type (Loon Mark, et al., 2021). Miller, D (1996) took innovation and efficiency as the theme of the business model to conduct research on the value activities of enterprises in uncertain environments, and found that innovation and efficiency have an impact on the value creation process of enterprises. Based on the research of Miller, D (1996), Zott, C., & Amit, R (2007) conducted empirical research on efficient and novel business models with 190 European and American start-ups as the research objects. They analyzed the impact of business models on corporate performance. Efficiency and innovation are the basic choices for enterprises to carry out value creation activities in an uncertain environment (Miller, D, 1996). The environment in which high-tech service companies are located is characterized by uncertainty. Therefore, this paper is based on the research results of Zott, C. and Amit, R (2007), Miller, D (1996) on business models, and also chooses efficiency and novelty as the two design themes of business models. An efficient business model refers to a business model that can improve the transaction efficiency between enterprises and partners and reduce the transaction costs between each other (Zott, C. & Amit, R, 2007). Novel business model refers to a business model that can innovate the transaction methods between enterprises and partners and open up new transaction partners (Zott, C. & Amit, R, 2007). A company may have the characteristics of several types of business models at the same time, but there must be a certain type of business model that has a dominant position in the company (Ghezzi Antonio, 2020). Therefore, this paper mainly analyzes the dominant business models of the sample companies.

Technological innovation refers to the process of enterprise application of innovative knowledge, new technologies and new processes, adopting new production methods and management models, improving product quality, developing and producing new products, providing new services, occupying the market and realizing market value (Xu Ziyan ,et al, 2021). According to the different sources of new technologies, technological innovation is

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divided into independent research and development innovation and buy technology innovation. For enterprises that implement independent R&D and innovation, their new technology is the process of technological innovation through their own internal forces. For enterprises that implement buy technology of innovation, their new technologies are mainly obtained by purchasing from outside the enterprise. For an enterprise, independent R & D innovation and buy technology innovation are complementary. Many enterprises have two ways of technological innovation at the same time, and they will not rely on one of them alone, but there must be one way of technological innovation that plays a leading role (Chun dongphil & LV Xiaojing, 2021). Therefore, this paper mainly analyzes the dominant technological innovation mode of sample enterprises.

Enterprise innovation performance refers to the positive results obtained by enterprises through innovation (figureredo Paulo n, 2021), which is a measure of enterprise innovation effect (Veugelers, R., & cassiman, B, 1999). Enterprises provide products to customers not simply by price, but by product quality, service quality, shape design and product function and other factors. Facing the ever-changing needs of customers and the constant updating of products by competitors, continuous innovation has become an important factor for enterprises to obtain market competitive advantage (Figure iredo Paulo n, 2021). The management process of internal innovation knowledge has a positive impact on innovation performance (Zhao Jingjie, Xu Guanglei, Cai Junqiang, Liang Meirong, 2020). Innovation does not necessarily bring benefits to enterprises, because only the innovation accepted by the market is successful innovation. For enterprises, the more important problem is how to ensure the success of innovation and enable enterprises to obtain benefits beyond the cost through innovation (McEvily s k, Chakravarthy B, 2002). Based on the above analysis, this paper adopts Veugelers, R., & cassiman, B (1999) definition of enterprise innovation performance. This paper will analyze the positive results obtained by the sample enterprises through innovation.

Data Collection

In order to improve the reliability and validity of the research process, this paper mainly follows the following standards in the process of collecting sample enterprise information.

(1) (1) Use multi-source data to carry out triangulation verification. Multi-source data is not only the advantage of case studies, but also enables multi-perspective descriptions of research objects, thereby improving the accuracy and objectivity of research conclusions (Rosie, 2020). This paper will collect data from the sample companies from multiple sources. On the one hand, the investigators will go to the sample companies to conduct field observations and visit surveys to collect first-hand data, mainly interviewing the sample companies' senior managers, technical R&D personnel, and business partners and other stakeholders. After the interview, this paper also arranged for investigators to use telephone, email, and multiple interviews later to supplement information, so as to check and organize the collected data. When the content of the interview survey requires the respondent to evaluate the company, this paper avoids the deviation caused by the phenomenon of impression management and retrospective interpretation caused by the respondent's subjective emotional factors in the process of answering. In this paper, the data

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collected by the interview survey is only used as part of the research data, and compared with other sources of information for review (Gianmarco Bressanelli et al., 2018). On the other hand, this paper will also collect and sort out various second-hand materials of the sample companies, including: internal corporate documents, such as internal corporate journals, important speeches by managers, corporate annual reports, etc.; Information published on corporate websites; various corporate-related news reports appearing in the society; various corporate-related books published publicly; Various enterprise-related materials published by industry associations and other organizations; annual reports published by listed companies, etc. The specific sources of the data of the 6 sample companies are shown in Table 2.

Table 2
SPECIFIC SOURCES OF THE DATA OF THE 6 SAMPLE COMPANIES

Sample enterprise	Interview survey	Field observation	Second-hand information
A technology service company	Visit the survey general manager 2 times, R&D director 2 times, and department heads 2 person-times	On-site inspection of the company headquarters and technology research and development center	The research results of the company published by scholars; the company's prospectus and annual report for the past three years; news related to the company; the company's internal journals; industry association reports
B clothing design service company	Visit the general manager for 1 time, 2 heads of the department, and communicate with the general manager 3 times by phone	On-site inspection of the company headquarters, clothing design center, and brand stores in 3 provinces	Company-related news; company internal journals; industry agreement reports; company annual reports
C Chemical Technology Service Company	Visit the survey general manager 2 times, and the technical research director 2 times	On-site inspection of the company's headquarters, technology research and development center, and a visit to the company's development history exhibition once	Company internal journals; industry association reports; company-related news; company annual reports
D logistics service company	Visit the general manager of the survey 1 time, the technical research director 2 times, and communicate with the general manager 1 time	On-site inspection of the company headquarters and trading platform center	Company internal journals; industry association reports; company-related news; company annual reports
E elevator service company	Visit the general manager of the survey 2 times, 2 person-times of department heads, and 1 telephone communication with the technical R&D	On-site inspection of the company headquarters and technology research and development department	Research results of other scholars on the company; company internal journals; industry association reports; company-related news; company annual

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	director		reports
F Communication Technology Service Company	Visit the general manager of the survey 3 times, the director of technical research and development 2 times, and communicate with the general manager 1 time by email	Visit the company headquarters, technology research and development department, and visit the product exhibition hall	Company annual report; company-related news; company internal journals; industry agreement reports

(2) Create a sample enterprise information database to record and organize data. This paper organizes the enterprise internal journals obtained from the interview survey, on-site recordings of interviews, transcripts of interview surveys, information obtained through Email and telephone, and second-hand materials obtained from various sources into a sample enterprise information database. The specific process is shown in Table 3.

Table 3
SAMPLE ENTERPRISE INFORMATION

Data collection process	Work content	Information Sources	Purpose
Before the interview	Collect various public information about the company	Mainly through Internet search, purchasing industry association reports, collecting research papers from related companies, etc.	Understand the basic situation of the company to determine the key content of the interview survey
Visiting investigation (1)	Record and record the interview investigation process with the consent of the investigator	On-site face-to-face interview survey	Get more detailed and accurate information about the company
Interview investigation (2)	Obtain internal business records of the company, important speeches of managers, internal journals, and various promotional materials of the company	Ask the investigator to give	Get more internal information about the company
After the interview (1)	Organize and analyze the on-site recordings and records of the interview survey within 24 hours after the end of the interview survey	Organize and analyze based on on-site recordings and records	Timely sort out the first-hand information obtained from the interview
After the interview (2)	Verify inaccurate data and supplement inaccurate information	Collect information through telephone, email, and multiple visits	Prevent deviations in research conclusions caused by incomplete information or incorrect data

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After the interview (3)	Organize and archive survey data in a unified manner	Classify and code all kinds of information	Fully prepare for data analysis

Data Analysis Methods

In order to improve the effectiveness of data analysis, this paper carries out intra-case analysis of a single sample company and comparative analysis between sample companies, and divides the data analysis process into three stages: data reduction, data display, and analysis conclusions.

First, this paper conducts an in-case analysis of data reduction and data display for each sample company. Data reduction is the process of information selection, focus, simplification, extraction and transformation of on-site recordings, records, and various text materials collected by interview surveys (Mohammad M. Foroudi et al., 2019). Based on the aforementioned theoretical assumptions and variable measurement schemes, this paper archives and encodes the information collected by each sample enterprise according to: efficiency business model, novel business model, independent research and development and innovation, buy technology of innovation, and innovation performance. This paper constantly adjusts and perfects the coding scheme when coding information materials in order to form a scientific and effective coding scheme. This paper displays the characteristics and data of each main variable in the information materials of the six sample enterprises in the form of a table, which is convenient for further in-depth analysis in the later period.

Secondly, by carrying out an inter-case analysis of 6 sample companies, summarizing the data of each variable, so as to identify the relationship between the variables. When exploring the relationship between business model, technological innovation, and innovation performance, this paper continuously compares the variable data of 6 sample companies and summarizes the similarities and differences.In the process of analysis and comparison, this paper will also verify the information from multiple sources to improve the validity of the conclusions (Gianmarco Bressanelli et al., 2018). The process of comparative analysis of the six sample companies in this paper is also a process of mutual verification of business models, technological innovation, and innovation performance, similar to repeated experiments in natural science.

Finally, the results of intra-case analysis and inter-case analysis of the sample companies are used to derive research propositions. When the sample data analysis and display were first carried out, many research ideas in this paper continued to emerge. At this point, this paper will review the previous original data and analyze whether each research idea has the value of in-depth research based on the existing research theory and the context of the interview survey at that time (Ma Zheng et al., 2021). If a research idea has research value, this paper will link it with the variables of the research theme and put forward tentative research propositions. In this paper, these tentative research propositions are further compared with the existing research theories, and the tentative propositions are revised and perfected, and finally a formal research proposition is obtained.Research propositions, variable relations, tentative propositions, and the formation of formal research propositions are a dynamic revision process, as shown in Figure 2.

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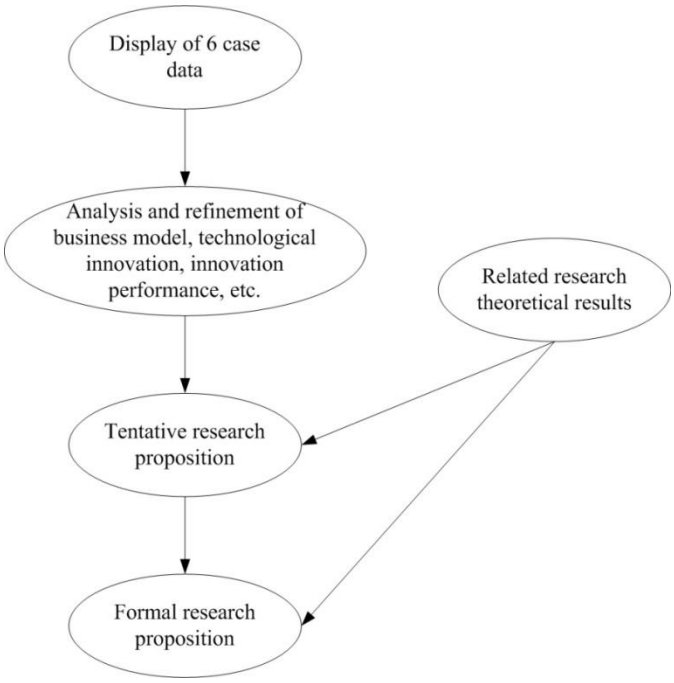

Figure 2
THE PROCESS OF DYNAMIC REVISION OF RESEARCH PROPOSITIONS

Case Analysis and Main Findings

This paper first analyzes and organizes the data collected from the 6 sample companies. Based on this, the business model, technological innovation, and innovation performance of each sample company are described and analyzed in detail, so as to achieve a structured, Encode the flower data. Prepare for further deconstruction and reconstruction of variable relations between cases.

Business Model

Through case analysis of sample companies, this paper finds that business models can help companies find potential market demand, can promptly put forward value propositions that are consistent with new market demands, integrate industry chain resources to create value, and realize value propositions well. In the process of case analysis, this paper also found that the company has two characteristics of efficient and novel business models in the same period, and the business model that plays a leading role in the different development stages of the company will be affected by time and the external environment. change. Among the 6 sample companies, B clothing design service company dominates the efficiency business model, and A technology service company and C chemical technology service company dominate the novel business model. D Logistics Service Company, E Elevator Service Company and F Communication Technology Service Company are dominated by different types of business models at different development stages of the company, as shown in Table 4.

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Table 4
BUSINESS MODEL

Enterprise	Leading business model	The specifics of the business model
A technology service company	Novelty (1998-2020)	The company has gradually expanded in the security industry from scratch, and now has a full line of product series, and has transformed from a simple manufacturer to a global-oriented industry problem solution provider. The company has now abandoned the business model of traditional manufacturers and has designed a "technology + customized service" business model, which can well meet the value demands of customers and achieve value acquisition for itself and customers.
B clothing design service company	Efficiency (1995-2020)	The company realizes resource sharing, network management and information sharing within the industry chain by establishing an e-commerce platform. However, this model is generally effective in improving the efficiency of integration, increasing the speed of goods circulation, and reducing logistics costs.
C Chemical Technology Service Company	Efficiency (1994-2020)	By building a manufacturing service platform, using fourth-party logistics and modern information technology to carry out virtual manufacturing, the company has also transformed from a trader to an operator. However, the company's ability to integrate resources and regional coordination is very low, and provides few financial services to the industrial chain. It mainly undertakes commodity circulation services in the industrial chain, and mainly earns commodity circulation price differences.
D logistics service company	Efficiency (1991-2000)	The company provides logistics outsourcing services for external enterprises by forming its own logistics fleet, and helps other enterprises to reduce logistics costs through high-quality logistics services.
	Novelty (2001-2020)	By building a one-stop logistics service platform, the company integrates logistics carriers, logistics services, and logistics needs in the industry chain, thereby fostering a logistics trading market with incubation functions and promoting the development of a number of small and medium logistics enterprises.
E elevator service company	Novelty (1991-2005)	The company has gradually transformed from an elevator manufacturer to an elevator repair and maintenance company. The company not only provides customers with elevator products, but also provides customized maintenance services and problem solutions. Services have become one of the company's core competitiveness.
	Efficiency (2006-2020)	The company establishes a unified call center and REM-X system by integrating call hotlines, remote monitoring systems, customer management systems, technical support systems, etc., integrating all links of the industry chain, and becoming an important link between the company and customers. Provide customers with all-round, all-weather efficient professional services.
F Communication Technology Service Company	Efficiency (2009-2011)	The company has selected three key target markets based on product characteristics, and established key cooperative customers in each target market. The company dispatches technical personnel to the customer's enterprise to provide timely and effective technical support, and to communicate closely with customers to understand the deficiencies of its own products for optimization, and to grasp

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		the latest changes in market demand.
	Novelty (2006-2008, 2012-2020)	The company continues to find high-quality partners to open up new markets, establish strategic partnerships with many government departments, multinational companies, and large state-owned enterprises, and continue to expand new customers. On the one hand, the company continuously strengthens technology research and development, and on the other hand, attaches importance to the construction of service team, so as to provide customers with high-quality technical support services.

Technological Innovation

Technological innovation is an important foundation for enterprise technological progress. Based on the analysis of sample enterprises, this paper shows that the sources of new technologies of enterprises mainly include: independent research and development and buy technology. Enterprises will adopt different technological innovation methods at different development stages, as shown in Table 5.

Table 5
TECHNICAL INNOVATION

Enterprise	Technological innovation	The specific content of technological innovation
A technology service company	Independent research and development (1998-2020)	The company attaches great importance to the cultivation and improvement of its own research and development capabilities, and invests 7% of the company's sales in research and development every year. R&D expenses are the most invested in the industry, and the company has built the largest R&D team in the security industry worldwide.
B clothing design service company	Buy technology (1995-2020)	Although the company has a research and development team, the design of new products and the selection of new fabrics mainly refer to major international brands. The company has set up fashion information stations in Italy, Japan, France, South Korea and other places, and hired well-known fashion designers from Hong Kong and South Korea.
C Chemical Technology Service Company	Buy technology (1994-2020)	The company actively establishes strategic partnerships with many large international chemical material suppliers to obtain advanced technology and better material supply. The company has also established a technical service platform with many international advanced chemical companies, and hired senior managers of multinational companies as management consultants to guide the company in risk management and control.
D logistics service company	Buy technology (1991-2000)	On the basis of investigating domestic logistics enterprises and freight yards, the company draws on the experience of foreign logistics informatization to carry out the construction of logistics information platform.
	Independent research and development (2001-2020)	The company strengthened independent research and development and built a brand-new fourth-party logistics information platform. The whole process has gone through several stages of informatization exploration, operation optimization and improvement, and informatization improvement.

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E elevator service company	Buy technology (1991-2020)	Although the company has built a research and development team, the company's new technology is mainly derived from the buy technology of the parent company and the acquisition of new technology through cooperation with universities.
F Communication Technology Service Company	Independent research and development (2006-2020)	The company operates like a R&D team, constantly pioneering and innovating. Through independent research and development, the company has solved the in-depth integration of remote collaborative video technology with other industries, and has successfully developed visual application communication products.

Innovation Performance

In the process of technological innovation of enterprises, the innovation results can be measured by innovation performance (Xu Ziyan, et al. 2021).

Innovation performance reflects not only the company's technological improvement compared with its own in the past, but also examines the company's technological innovation compared to peer companies (Figueiredo Paulo N, 2021). The performance of technological innovation of enterprises at different stages of development will show different results. The technological innovation performance of the 6 sample companies is shown in Table 6.

Table 6
INNOVATION PERFORMANCE

Enterprise	Development stage	Innovation performance
A technology service company	1998-2020	Many of the company's key technologies are at the international leading level, and it continues to provide new products and problem solutions to more than 100 countries and regions around the world. The company's sales have increased by 256 times in 11 years, and it has grown into a leading company in the global security industry. Due to the company's continuous technological innovation, the company's labor efficiency has been significantly improved year by year.
B clothing design service company	1995-2020	The company can update clothing styles and fabrics with seasonal and annual changes, and follow up on changes in clothing trends. The company can sometimes be the first to launch new clothing and new fabrics than its peers. Although it has not achieved large-scale sales and huge profits in the early stage of the market, its products have been accepted by many customers and have brought good sales. The company's labor productivity has also increased slightly.
C Chemical Technology Service Company	1994-2020	The company introduced some of its products to the market in the form of virtual manufacturing. The company's operating model and main practice in the process of transforming into an operator still followed the trader's model. The company's overall labor efficiency has improved very little.
D logistics service company	1991-2000	The logistics information platform established by the company has effectively promoted the circulation of goods, significantly improved the level of fourth-party logistics, and the turnover of customer goods has been significantly improved, attracting more customers to cooperate. The company's labor productivity has

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		been significantly improved.
	2001-2020	The company has developed many new products that are in line with the Chinese market, such as highway port logistics. The company not only created a new model, but also established a one-stop service platform, so the company's various operating indicators have achieved rapid growth. The company's labor productivity has been significantly improved.
E elevator service company	1991-2005	The company has achieved the deconstruction and reconstruction of elevator technology through the business involving the entire elevator industry chain. The company's continuous new products have been welcomed by the market. The company also serves more than 20,000 elevators across the country, and its maintenance technology is leading in the industry. The company's labor productivity has increased rapidly.
	2006-2020	The company has made rapid technological progress in elevator energy saving, and the gap with the world's most advanced enterprises is very small. The company produces the most advanced energy-saving elevators in China by combining the purchased technologies with the characteristics of the Chinese market. The company took the shortest time to keep up with two important technological changes in the industry. The company is now the parent company with the largest production and sales volume. The company's labor productivity has increased rapidly.
F Communication Technology Service Company	2006-2008	In one year, the company successfully developed the world's leading remote collaborative electronic whiteboard and launched a visualized remote collaborative construction platform. These new products help the company quickly achieve profitability. Once the new product was successfully developed, it was quickly deployed on servers in more than a dozen central cities across the country. The company's labor productivity has been rapidly improved.
	2009-2011	At this stage, the company's technology research and development has completely stagnated, resulting in the company's products unable to meet the new needs of customers, and customer problems are often not well resolved. The company is in crisis, and labor productivity has stagnated.
	2012-2020	The company has developed a number of world-leading remote collaborative video technologies. The company's new products have more practical and flexible functions and lower prices than peer companies. The company's labor productivity has also been rapidly improved.

Cross-Case Analysis and Proposition

Based on the description and analysis of the data of each sample enterprise, this paper judges and codes its business model and innovation performance according to the actual situation of each sample enterprise. In the process of judging and coding, this paper continuously consults academic experts and senior personnel in the industry to make the results of judging and coding as scientific and reasonable as possible. This paper divides the enterprise's innovation

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performance and business model design effects from low to high in order: poor, poor, general, good, and good. Poor means that the company is at a backward level among the peers; poor means that the company is below the average level of the peer; generally means that the company is at the average level of the peer; better means that the company is higher than the average level of the peer; good means that the company is at the leading level among the peers . According to case analysis, it is found that the business model design of 3 sample companies has undergone great changes in different stages of development. Therefore, this paper divides the companies into stages according to the characteristics of the stage changes in the business model design of the sample companies, as shown in Table7 shown.

Table 7
BUSINESS MODEL DESIGN OF THE SAMPLE COMPANIES

Enterprise / Variable		A technology service company	B clothing design service company	C Chemical Technology Service Company	D logistics service Service company		E elevator service Service company		F Communication Technology Service Company		
		1998-2020	1995-2020	1994-2020	1991-2000	2001-2020	1991-2005	2006-2020	2006-2008	2009-2011	2012-2020
business model	Efficiency		general		better			good		better	
	Novelty	good		Poor		good	good		good		better
Technological innovation	Independent research and development	leading				leading			leading	leading	leading
	Buy technology		leading	leading	leading		leading	leading			
Innovation performance		good	general	poor	better	good	good	good	good	difference	better

Business model and innovation performance

The research results of existing scholars show that the business models of China's high-tech service companies are mainly novel and efficient. The novel business model that emphasizes the spirit of contract and dilutes the human relationship pays more attention to opening up unfamiliar markets (Lingling Wang et al, 2020). Due to the various policy trends brought about by China's economic transformation, companies that adopt efficient business models will have a purpose to conduct more efficient transactions with state-owned companies

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(Teng Su, 2018). Through the comparative analysis of 6 case companies, this paper finds that the business models of the two themes can significantly improve the innovation performance of the companies. Traditional technological innovation mainly focuses on the absorption and tracking of new technologies in the industry, and little attention is paid to the design of business models (Chun Dongphil & Lv Xiaojing, 2021). With the formation of the global industrial chain, the development of information technology has made it possible to re-allocate global resources and become more efficient. Good business model design enables companies to improve their innovation performance faster and gain competitive advantages in global competition (Dwivedi Ritesh, 2020).

Efficient Business Model and Innovation Performance

The efficiency business model has a positive impact on the innovation performance of enterprises.E Elevator Service Company (2006-2020) uses the powerful functions of REM-X system and customer center to establish important communication channels with customers, and the company can always accurately find abnormal signs in the market. Therefore, the company is able to keep abreast of customer information and various technical obstacles in time, which not only shortens the repair time, but also increases the company's new product development speed, which greatly promotes the sales of new products. D Logistics Service Company (1991-2000) expanded the business of self-built logistics fleet from inside the company to outside the company, which not only reduced the logistics cost of itself and its customers, but also created conditions for the exploration and accumulation of logistics technology and improved logistics efficiency. Although B clothing design company uses information technology to carry out the operation and management of chain stores, it has not well realized the integration and information transmission of the clothing industry chain, resulting in the company's failure to achieve industry trends. Companies often need to observe which styles and fabrics of their counterparts are generally welcomed by consumers before organizing production after learning from the successful practices of their counterparts. Compared with E elevator service company and D logistics service company, F communication technology service company (2009-2011) has designed a good efficiency business model, but it has not achieved the ideal result of innovation performance. This paper believes that this situation may be caused by other influencing factors, so this paper will do further in-depth research later.

Novel Business Model and Innovation Performance

Novel business model have a positive impact on corporate innovation performance. A technology service company not only provides customers with high-quality products, but also satisfies the various needs of customers with the help of the "product + customized service" model. Therefore, the company can keep abreast of the industry's latest market demand information in a timely manner, which promotes the research and development of new technologies and the development of new products. D Logistics Service Company (2001-2020) has successfully developed a one-stop trading center for highway port logistics through the

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accumulation of early logistics technology and operating experience, and accordingly releases vehicle source and supply information to national logistics companies in a timely manner. The trading center not only provides industry information for the settled enterprises, but also provides enterprises with education and training in business management and solutions to various problems. D Logistics Service Company has continuously improved the trading center to improve its service level, attracting more and more enterprises to settle in the center, from the initial 6,000 to more than 20,000 in 2009. E Elevator Service Company (2001-2005) adopted a novel business model to help the company transform from an elevator manufacturer to an elevator maintainer. In 2001, 99% of the company's main profit came from product sales. By 2010, the company had transformed into old elevator renovation, elevator maintenance and spare parts sales. During this process, the company continued to carry out technology research and development, and created a number of invention patents, which greatly improved the company's technical capabilities. F Communication Technology Service Company (2006-2008) adopted a novel business model in the early stage of its business. The company continues to develop new partners, seeks to cooperate with companies with strong market capabilities, and provides products with unique value to the market, thereby obtaining good sales. F Communication Technology Service Co., Ltd. experienced a short period of development in 2009-2011. The company quickly changed its business model from the original business model of improving transaction efficiency to a customized service model of "product + customized service". Therefore, the company quickly achieved rapid development and promoted the company's technological innovation. On the contrary, when C Chemical Technology Service Company created a manufacturing service platform, although it carried out virtual manufacturing, it did not have close contact with the international market. The company's way of meeting customer needs is also single, causing companies to lag behind industry leaders in the process of transforming into operators.

Based on the above analysis, this paper proposes the following research propositions, as shown in Figure 3.

Proposition 1: The efficiency business model positively affects enterprise innovation performance.

Proposition 2: Novel business models have a positive impact on corporate innovation performance.

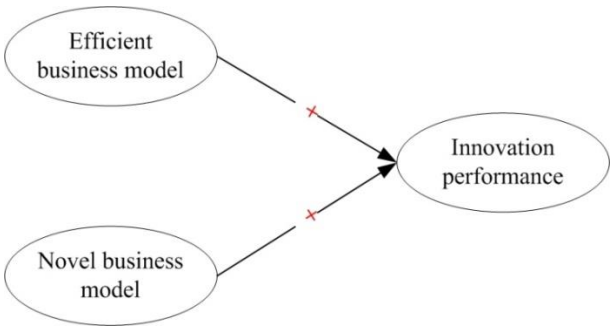

Figure 3
INNOVATION PERFORMANCE

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Business Model and Technological Innovation

Good business model design is helpful to enterprise technological innovation, and fruitful technological innovation can help enterprises to upgrade their technology. Through the vertical analysis within the case and the horizontal analysis between the above 6 sample companies, this paper finds that there is a connection between the business model of the company and technological innovation. According to the design theme of the business model and the type of technological innovation, the relationship between the two can be subdivided into four types: efficient business model and independent research and development, efficient business model and buy technology, novel business model and independent research and development, novel business model and buy technology. The different matching relationship between business model and technological innovation will have different effects on the technological innovation of enterprises. In the context of the globalization of the industrial chain, independent research and development and buy technology are the main methods of technological innovation for high-tech service enterprises and the main source of new technologies. An efficient business model can promote the flow and sharing of information between the enterprise and the outside, thereby urging the enterprise to better deconstruct and reconstruct the new technology in the process of technology introduction, which will help the enterprise to achieve continuous technological innovation. Novel business model can help companies continue to explore the sources of new technologies, and are conducive to the comparison and selection of new technologies, thereby improving the efficiency and success rate of new product development.

(1) Business model and make technology

According to the results of the case analysis, it is concluded that a novel business model is beneficial for enterprises to carry out technological innovation through make technology. A technology service company, D logistics service company (2001-2020), and F communication technology service company (2006-2008, 2012-2020) all carry out technological innovation through make technology. These companies use make technology methods to improve the company's technical level and technical capabilities, and continue to narrow the gap with peer companies. Enterprises that adopt make technology methods to carry out technological innovation need to establish a strong technology research and development team and an efficient technology research and development platform. The novel business model has the characteristics of continuous development and innovation. On the one hand, it can help companies obtain the latest market demand information and cutting-edge technology, thereby helping companies achieve technological upgrades; On the other hand, it can also help companies continue to explore new customers and expand new sales channels for their products. Novel business model can also help companies create new transaction methods and new transaction incentive mechanisms in the process of cooperating with original customers, and increase the enthusiasm of original customers to cooperate with the company. Therefore, increase the enterprise's initiative in product bargaining and promote product sales.

Through case analysis, it is found that, except for F Communication Technology Service Company (2009-2010), the 6 sample companies adopted novel business models when adopting

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make technology methods for technological innovation. When an enterprise adopts make technology as its technological innovation method, it is bound to require an enterprise to have an operating atmosphere of continuous development and innovation. When analyzing the market, D Logistics Service Company found that similar foreign logistics service platforms mainly exist in the form of government services, which do not have market flexibility. D logistics service company hopes that the company's logistics service platform can provide customers with more service content, so the company decided to independently develop a fourth-party logistics service platform. D Logistics Service Company believes that if an efficient business model is adopted at this time, it will not be able to achieve the research and development goals. A technology service company has always insisted on adopting make technology to carry out technological innovation, but when the company adopts an efficient business model characterized by the pursuit of transaction efficiency, it finds that the company's technological innovation is becoming more and more difficult. When the company changed to a novel business model in time, it not only helped the company to transform from an initial product manufacturer to a global-oriented problem solution provider. The company realized the perfect combination of technology and service, and promoted the company's new products to achieve rapid sales.

F Communication Technology Service Company has gone through three different stages of development. Although the company has always insisted on make technology of new technologies, it has adopted different business models at different stages, resulting in different technological innovation effects at different stages. During the 2006-2008 period, F Communication Technology Service Company adopted a novel business model to focus on technology research and development and new product development, and constantly opened up new business partners to help the company sell products. The company at this stage is like a capable technology research and development team that continuously develops new technologies and transforms them into new products, and then uses the power of partners to solve marketing problems. Therefore, at this stage, F Communication Technology Service Company allows the company to focus on technology research and development through a novel business model, and hand over marketing and sales issues to pioneering business partners, thereby helping the company to grow rapidly in the short term. From 2009 to 2011, F Communication Technology Service Company adopted an efficient business model and focused on improving the efficiency of transactions between the company and its customers. Therefore, the company dispatched a large number of technical personnel to important customer companies in various places for long-term stationing, so as to be able to quickly help customers solve technical problems, and timely feedback customer information to the company headquarters. At this stage, although the communication efficiency between the company and its customers has improved, due to the large number of dispatched technicians, the company's technical research and development capabilities have weakened, the efficiency and effectiveness of technological innovation have declined, and the technological upgrading of products has been forced to slow down. Fortunately, the company’s management quickly realized the seriousness of the problem. During the 2012-2020 period, the company quickly adjusted its business model to a novel one, quickly linked the market, R&D, products, sales, and customers to help the company build a "technical +Service”

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customized business model. This transformation has accelerated the development of new technologies and the opening of new products on the one hand, and on the other hand, the rapid expansion of the market has promoted product sales.

Based on the above analysis, this paper proposes the following research propositions, as shown in Figure 4.

Proposition 3: Novel business models have a positive impact on the technological innovation of enterprises' make technology methods.

Proposition 4: The efficiency business model has a negative impact on the technological innovation of the make technology methods of enterprises.

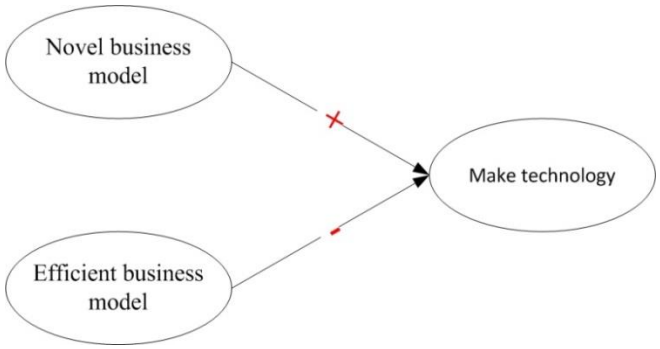

Figure 4
TECHNOLOGY BUSINESS MODEL

Business Model and Buy Technology

Through case analysis, this paper finds that efficient business models and novel business models are conducive to enterprises to carry out technological innovation through buy technology. Among the sample enterprises, 4 enterprises have adopted the method of buy technology to carry out technological innovation, and these 4 enterprises have achieved good results in technological innovation regardless of whether they adopt efficient business models or novel business models. The business model design schemes of B Apparel Technology Service Company and C Chemical Technology Service Company are not very good, resulting in the performance of the two companies in terms of technological innovation falling into the lower-middle level of the 6 case companies. Due to their excellent business model design solutions, D Logistics Service Company and E Elevator Service Company have achieved very good technological innovation effects.

Enterprises that adopt the method of buy technology to carry out technological innovation. The methods of technological innovation mainly include joint ventures with other enterprises, the introduction of external talents, the purchase of external technologies, cooperation with external institutions for research and development, and the acquisition of technologies from public information platforms. An efficient business model has the characteristics of helping companies and partners to strengthen information sharing and flow, and improve the efficiency of corporate transactions. The characteristics of an efficient business model are conducive to enterprises to strengthen the management of technology introduction, improve the closeness

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between technology providers and enterprises, and improve the efficiency and success rate of enterprise new product development. Novel business model help companies continue to develop new partners, but also help companies obtain more sources of new technologies, so that they can acquire new technologies at a lower cost.

In this paper, E Elevator Service Company adopts different business models at different stages but insists on the development process of purchasing and introducing new technologies, and finds that both business models are conducive to enterprises to carry out technological innovation by purchasing and importing. E Elevator Service Company is a subsidiary company controlled by the headquarters 80%. The main new technology comes from the parent company, and a small amount of technology comes from the research and development cooperation with the university. E Elevator Service Company (2001-2005) is dominated by a novel business model. At this stage, the company has realized the transformation from a manufacturer to a maintainer. In the early stage, the company continuously explored new businesses and new models, and gradually increased the proportion of maintenance services in the company's business. Moreover, the company also paid great attention to the absorption and absorption of new technologies from the parent company to rapidly improve the company's technical capabilities. In 2002, E Elevator Service Company took the lead in launching an energy-saving 44% gearless elevator in China, and its technology reached the world's advanced level. E Elevator Service Company (2006-2020) transformed its business model into an efficiency-oriented company. Because the company can quickly acquire new technologies from the parent company, the company focuses its main efforts on the improvement of the service system by establishing a strong customer service center and parts supply network. The company has strengthened information exchanges with customers, improved the efficiency of transactions between the company and customers, and greatly promoted the development of the company's business.

Based on the above analysis, this paper proposes the following research propositions, as shown in Figure 5.

Proposition 5: Novel business model is positively affecting the technological innovation of buy technology.

Proposition 6: The efficiency business model is positively affecting the technological innovation of buy technology.

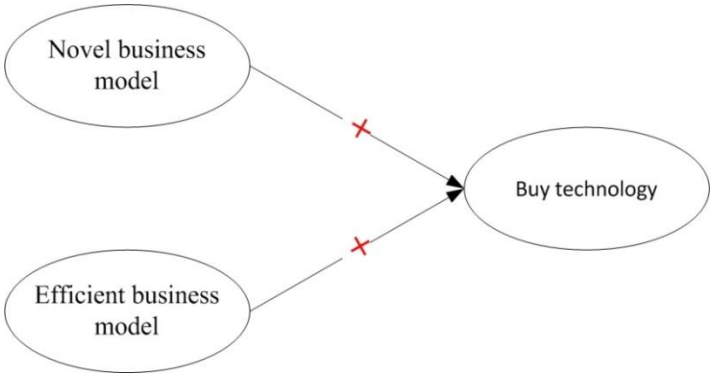

Figure 5

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BUSINESS MODEL

Technological Innovation and Innovation Performance

Through case analysis, it is found that whether the enterprise adopts independent research and development or buy technology to carry out technological innovation, it will help the improvement of enterprise innovation performance. When an enterprise adopts the make technology method to carry out technological innovation, it is conducive to the enterprise's mastery of existing knowledge and technology, and reduces the risk of enterprise research and development, improves the success rate of enterprise new product research and development, and promotes the improvement of enterprise technical capabilities (Lee KH, Min B, 2015). Therefore, independent research and development can have a positive effect on enterprise innovation performance. The focus on technological innovation of enterprises in developing countries is different from that of enterprises in developed countries, and they pay more attention to carrying out technological innovation through buy technology. Buying and introducing new technologies from outside has become an important way for companies to acquire technologies (Thite M, et al., 2016). Buy technology acquires innovative technologies from outside through purchases, which can reduce R&D risks for enterprises, reduce R&D costs and time, and obtain the scope economic advantages of technology R&D. Buy technology can help companies enhance their flexibility in technological research and development, and carry out rapid follow-up of multi-directional technological innovation, so as to quickly adapt to environmental changes (Katila, R., & Ahuja, G, 2002). Companies in developing countries can use buy technology to quickly learn the latest technology in the industry, and achieve rapid improvement of the technological level of their products (Yang Lijun, 2020), thereby improving their innovation performance (Peng Xinmin, Wu Xiaobo, Wu Dong, 2011). A technology service company (1998-2020), D logistics service company (2001-2020), F communication technology service company (2007-2008), and F communication technology service company (2011-2020) all carry out technological innovation through independent research and development, and achieved good innovation performance. Clothing design service company B (2001-2020), logistics service company D (1991-2000), elevator service company E (2001-2020) all carried out technological innovation by means of buy technology, and also achieved very good innovation performance.

Based on the above analysis, this paper puts forward the following research propositions, as shown in Figure 6.

Proposition 7: buy technology of technological innovation is conducive to the improvement of enterprise innovation performance.

Proposition 8: Technological innovation in independent research and development methods is conducive to the improvement of enterprise innovation performance

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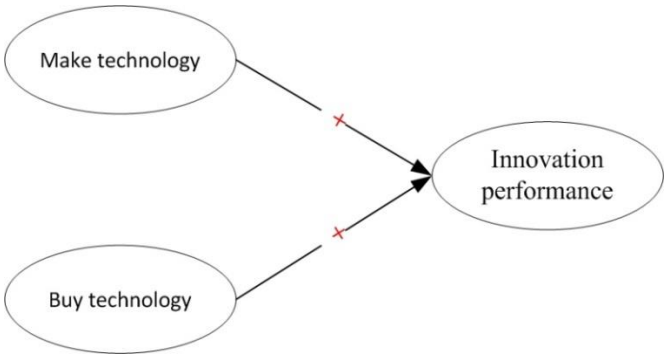

Figure 6
INNOVATION PERFORMANCE

Research Summary

This paper uses exploratory case study methods to analyze the impact mechanism of high-tech service enterprise business models on innovation performance in the context of China's economy. This paper selects 6 representative sample companies from the list of high-tech service companies certified by the Ministry of Science and Technology of China. This paper not only carried out a case analysis for each sample enterprise, but also carried out a comparative analysis among the 6 sample enterprises. Through the horizontal and vertical comparative analysis of the cases, this paper identifies the leading types of business models and the main methods of technological innovation of Chinese high-tech service companies, and proposes conceptual models (1-3, 1-4, 1-5, 1- 6), and 8 research propositions (see Table 1-8). The influence of business model on innovation performance, the influence of business model on technological innovation, and the influence of technological innovation on innovation performance are basically consistent with the theoretical assumptions originally proposed.

Exploratory case study methods are mainly used in situations where the causality of things is not clear, and the relationship between variables is complex and changeable, which helps to analyze the relationship between variables in the early stage of research. Due to the particularity of the sample enterprise itself, the result of the case study is only a preliminary exploratory research proposition, which is only explanatory in a specific scope and situation, and does not have the universality of theory. This paper will further empirically test these research propositions through existing research literature and large sample data in the following research.

Table 8
RESEARCH LITERATURE AND LARGE SAMPLE DATA

Serial number	Research proposition
Proposition 1	The efficiency business model has a positive impact on corporate innovation performance.
Proposition 2	Novel business model is positively affecting corporate innovation performance.
Proposition 3	Novel business model have a positive impact on the technological innovation of

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	enterprises' independent research and development methods.
Proposition 4	The efficient business model has a negative impact on the technological innovation of enterprises' independent research and development methods.
Proposition 5	Novel business model is positively affecting the technological innovation of buy technology.
Proposition 6	The efficiency business model is positively affecting the technological innovation of buy technology.
Proposition 7	Purchasing and introducing technological innovation is conducive to the improvement of enterprise innovation performance.
Proposition 8	Technological innovation through independent research and development is conducive to the improvement of enterprise innovation performance.

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