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Research on the Driving Factors of Disruptive Technological Innovation of Enterprises

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Abstract:

With the emergence of a new round of global scientific and technological revolution and the accelerated transformation of industries, innovation driven development has become the core strategy for enterprises to enhance their competitive advantage. Disruptive technological innovation, which can bring dual changes in industry and market, is an important measure for enterprises to cope with market changes. Based on the grounded theory, this paper studies the disruptive technological innovation behavior of enterprises from the perspective of driving factors. Based on the analysis of the original data, this paper puts forward the typical relationship structure of the driving factors of enterprise disruptive technological innovation behavior, constructs the driving factor model of enterprise disruptive technological innovation behavior, tests the theoretical saturation, and finally draws the research conclusion and enlightenment.

Keywords: *Disruptive technological innovation, innovative behavior, driving factors, grounded theory*

1. Introduction

American scholar Christensen puts forward disruptive innovation. He thinks that disruptive innovation is a kind of innovation that enterprises use disruptive technology to create low-cost, simple and convenient products for consumers in low-end market or niche market, and improve their own technology and function through continuous improvement, and finally replace and subvert the existing mainstream technology and existing market in unexpected ways.^[1] In recent years, scholars at home and abroad have produced a lot of academic achievements in the study of disruptive innovation: some scholars believe that market environment is an important driving factor for enterprises' disruptive technological innovation, such as Aditi Ramdora, etc. through the case study of four Indian medical and health enterprises, they point out that the bottom market is the source of disruptive innovation.^[2] Scholars believe that external factors play an important role in driving disruptive technological innovation. For example, Haydn Shaughnessy believes that seeking to utilize third-party assets, changing business mode, and creating a large number of new projects and innovation management systems can promote disruptive technological innovation.^[3] Li Jinghua and others believe that innovation resources are the key factors affecting the innovation and development of enterprises, network embeddedness is the main way for enterprises to obtain innovation resources, and innovation legitimacy has a positive impact on Disruptive Innovation.^[4] Shan Juan and others believe that disruptive technological innovation of government policy enterprises plays an important role in promoting or hindering them.^[5] Some scholars believe that the internal factors of enterprises play an important role in driving disruptive technological innovation, including: enterprise's own factors, such as Zhang Guangyu, etc., think that the ability of opportunity identification, resource integration and technology learning affect disruptive technological innovation behavior.^[6] Ma Jinjin and others believe that the organizational factors and production and operation process of enterprises have an important impact on disruptive technological innovation.^[7] Enterprises' innovative thinking, such as Deren a.m., thinks that the creative thinking including innovative thinking, design thinking and strategic thinking determines the structure of disruptive technology development.^[8] The research group on disruptive technology innovation of Chinese Academy of Sciences pointed out that thick accumulation of knowledge and technology and innovative thinking environment are the key factors for the emergence of disruptive technology.^[9] Enterprises' knowledge base management, such as Luo Hongyun, etc., believe that knowledge management can reduce the time and cost of disruptive technological innovation and accelerate market development.^[10] Zhao Xi et al. Think that the depth of enterprise knowledge exploration has a positive impact on the disruptive innovation behavior of enterprises.^[11] Wu Yong et al. Think that the internal and external knowledge exploration of enterprises acts on the disruptive technological innovation of enterprises in a complementary way.^[12]

The research on the driving factors of disruptive technological innovation behavior of enterprises involves many internal and external factors of enterprises. Most of the literatures take a certain industry or some enterprises as research samples, and explain the driving factors of enterprise disruptive technological innovation behavior by empirical research from the perspective of relatively independent market and technology. This paper uses the qualitative research grounded theory research method to analyze the driving factors of enterprise disruptive technological innovation behavior, constructs the driving factor model of enterprise disruptive technological innovation behavior, and tests the saturation of

the theory. Finally, the research conclusion and enlightenment are proposed, which can provide theoretical support and guidance for the management and Practice of enterprise disruptive technological innovation.

2. Research Design

2.1. Research Methods

Grounded theory requires researchers to summarize and summarize the core concepts reflecting the research object directly from the original data statements, then develop into categories, and finally sublimate into theories. This process is mainly coding, including open coding, spindle coding and selective coding (as shown in Figure 1). Grounded theory is suitable for the research of insufficient explanation depth or imperfect theoretical construction. Based on the current situation that Chinese scholars' research on the driving factors of enterprise disruptive technological innovation behavior is relatively low and the theory needs to be improved, this paper adopts the grounded theory to analyze the driving factors of enterprise disruptive technological innovation behavior by triple coding the original data statements.

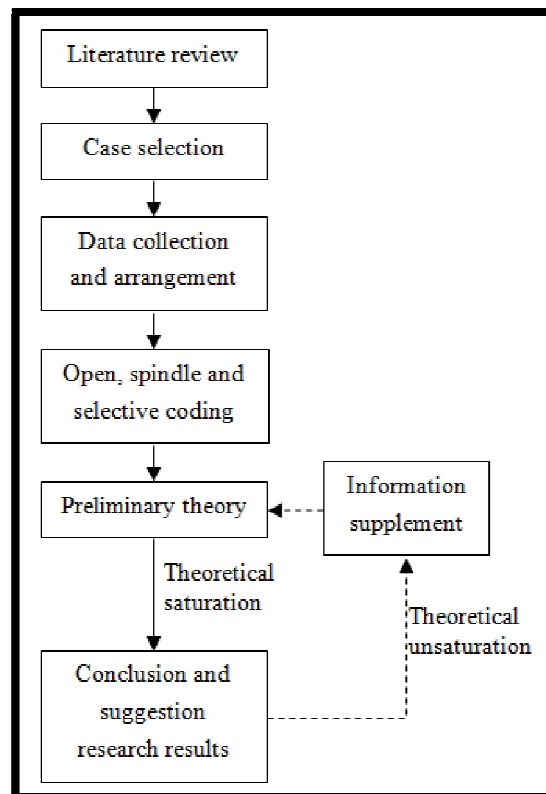


Figure 1: Research Process of Grounded Theory

2.2. Research Design

The interviewees of this article select the employees in the information technology field where disruptive technologies occur frequently, and the interviewees have been engaged in research in this field for more than one year, so as to understand the motivation and objectives of their enterprises to carry out disruptive technology research and development or upgrade, and be familiar with the innovation strategy and product development process of their enterprises. Based on the principle of theoretical saturation, this paper selects 29 people from three research directions in the field of information technology as the sample, including 9 people in the research and development of artificial intelligence and virtual reality technology, and 11 people in the construction of mobile Internet.

The first step is to conduct one-on-one interviews with the interviewees. The content of the interview mainly involves the measures for enterprises to carry out disruptive technological innovation, the factors influencing the choice of enterprises' disruptive technological innovation willingness, and the obstacles in the process of enterprises' R & D of disruptive technology. The interview time for each interviewee was no less than 40 minutes, totally 29 person times. The second step is to sort out the original interview data to ensure the authenticity and accuracy of the interview data. In the process of sorting out the materials that are ambiguous or difficult to understand the meaning of the interviewees only by intuitive understanding, we should pay a return visit to the relevant interviewees one by one to supplement the interview materials and make them more complete. In the third step, 24 materials were randomly selected for coding analysis, and the remaining 5 materials were used for theoretical saturation test. In the fourth step, according to the view of Charmaz^[13], the coding program of grounded theory first sums up and integrates the original data statements into initial categories and concepts to form open coding; secondly, it analyzes the logical relationship between the subcategories induced by open coding, and further induces the main category and forms spindle coding; Finally, the main category and subcategory are further induced to form selective coding, and the theoretical saturation test is conducted before the conclusion is drawn. In

the process of research, strictly follow the purpose of grounded theory, avoid the interference of subjective induction in the coding process, and ensure the objectivity of coding process.

3. Data Analysis

3.1. Open Coding

Open coding is the process of refining the original statement until conceptualizing and categorizing the original statement. According to the requirements of open coding, 546 original data statements and corresponding initial concepts are obtained. Most of the initial concepts are colloquial, with low levels, overlapping meanings and a large number. After combing and summarizing for many times, the research group eliminated the initial concepts with less than 2 occurrences and low attribution. Finally, 29 concepts and 11 domains were abstracted from the original data statements. The results of conceptualization and categorization of original data obtained by open coding are shown in Table 1.

Category	Concept	Source Statement
Corporate interests	The profits are considerable	Y10 e-commerce subverts traditional physical store shopping and attracts more consumers to shop online
	commercial value	X06 Wearable devices have great sales potential in the future market
	Social repercussions	X02 people are willing to experience naked eye 3D technology and holographic display technology, and enterprises have a large number of potential consumers
Decision makers' cognition of innovation	Encourage innovation	Y11 company leaders often hold new technology R & D and improvement exchange meetings to listen to ideas, opinions and suggestions
	Attach importance to innovation	R01 company set up a separate department to carry out artificial intelligence experiments
	knowledge management	X01 company attaches great importance to employees' learning, and will hire experts in relevant fields to organize regular training for employees and advocate staff communication experience
Enterprise innovation ability	International standards	R09 enterprises have introduced international advanced technology experience to assist research and development
	Cooperative innovation	Y06 enterprises and other enterprises to form a long-term stable cooperative relationship, the overall strength has been enhanced
	Staff quality	X03 The company employs personnel with master's degree or above in related majors, and doctor's degree is required for high-level positions
	Hardware facilities	R06 company has the first-class intelligent robot laboratory in China
Employee incentive system	Material incentive	X01 if the employee's suggestions on product design and improvement are adopted, the company will give bonus to show encouragement
	Talent introduction	Y08 company introduces experienced professional talents with high salary to help research and development
Enterprise financial situation	Sufficient funds	Y09 Cooperation and financing between enterprises provide strong economic support for disruptive innovation
market demand	functional requirement	R04 Apple's Siri forced smartphone manufacturers to develop virtual personal assistant technology
	Product utilization rate	X04 Consumers prefer to choose products with complete functions, excellent quality, beautiful appearance and high cost performance
	Product utilization rate	Y02 China's personal Internet applications maintain rapid development, the scale of all kinds of users is on the rise, and the scale of mobile takeout and mobile travel app booking users has increased significantly
Consumer concept	Consumer groups	R02 20-35-year olds are the main consumers of intelligent appliances such as household robots
	consumption vision	X06 Many consumers hope that VR technology can realize the game experience in the movies like player number one
market competition	competition among enterprises	Y01 many enterprises are developing cloud storage products
	Product competition	Y05 instant messaging tool subverts the traditional communication mode and has a large number of downloads
	Talent competition	X08 continuously innovates the product, guarantees the enterprise economic efficiency, avoids the brain drain

Category	Concept	Source Statement
Policy system	Project support	X07 Virtual reality is regarded as an important support direction for national key projects
	National Document	Y04 industry and Information Technology Department issued the information and communication industry development plan (2016-2020) and proposed to vigorously develop 5g key technologies and products
	Local policy	R08 Local cities issue 'artificial intelligence development plan'
Corporate social relations	Combination of politics, industry and learning	R05 universities cooperate with enterprises to undertake provincial projects and broaden the channels of knowledge sharing and transfer
	exchange of learning	X04 The cooperation between video company and VR company is helpful for both parties to understand the demand and improve the products
Development of science and technology	Technology maturity	R03 The development of multi-core CPU, GPU, TPU and cloud computing reduces the cost of parallel computing and enables deep learning to be realized
	Interdisciplinary	X01 The research and development of virtual reality technology requires the comprehensive use of electronics, psychology, computer graphics and other knowledge
	Technical environment	Y02 Internet plus, Internet of things, big data and other technology development and utilization is a major trend.

Table 1: Concept and Category of Open Coding

Note: The Letters in the Table Indicate the Research Direction of the Respondents, R Stands for Artificial Intelligence, X Stands For Virtual Reality, Y Stands for Mobile Internet, and Numbers Represent the Number of Respondents

3.2. Spindle Coding

On the basis of open coding, according to the internal relationship among the subcategories, five main categories corresponding to 11 subcategories are summed up: enterprise innovation willingness, enterprise management situation, market reality conditions, innovation policy environment and technology development degree. The main categories and their corresponding subcategories are shown in Table 2.

Category	Main Category	Corresponding Subcategory	The Connotation Of Category
Internal drivers	Enterprise innovation intention	Corporate interests	Enterprises carry out disruptive technological innovation to maximize their own interests
		Decision makers' cognition of innovation	The personal technical ability, creativity and observation ability of enterprise leaders will affect the disruptive technological innovation activities of enterprises
		Enterprise innovation ability	The strength of enterprise innovation ability will affect the disruptive technological innovation behavior of enterprises
	Enterprise management situation	Employee incentive system	The incentive of enterprises to employees' disruptive innovation behavior can stimulate employees' innovation enthusiasm and enhance the overall innovation strength of enterprises
		Enterprise financial situation	The enterprise has a strong economic foundation and sufficient funds to invest in disruptive technology research and development
External drivers	Market conditions	market demand	The products developed by enterprises are oriented by market demand
		Consumer concept	The change of consumers' concept of product function, quality and appearance provides inspiration for enterprises' disruptive technological innovation
		market competition	In order to ensure the market share of products, enterprises will improve their competitiveness through disruptive technological innovation
	Innovation policy environment	Policy system	Good policy support and institutional environment provide guarantee for disruptive technological innovation activities of enterprises
		Corporate social relations	The cooperative relationship between government, industry, University, research, research, funding and agency will affect the choice and implementation of disruptive technological innovation
	Technological Development	Development of science and technology	To a certain extent, the development of science and technology requires the knowledge of various disciplines to serve scientific and technological innovation through cross integration, so as to adapt to the actual production

Table 2: Main Categories and Connotation of Spindle Coding

3.3. Selective Coding

Taking ‘disruptive technological innovation behavior of enterprises’ as the core category, in accordance with the requirements of selective coding, the relationship between the five main categories and the core categories is reflected in the form of typical relationship structure, including enterprise innovation willingness, enterprise management situation, market reality conditions, innovation policy environment and technology development degree, presenting the following theoretical framework. The typical relationship structure of this paper is shown in Table 3.

Canonical Relation Structure	Connotation Expression
Enterprise innovation intention → innovation behavior	Enterprise innovation intention is the direct driving factor of disruptive technological innovation behavior, which directly determines whether enterprises implement disruptive technological innovation behavior
Enterprise management status → innovation intention → innovation behavior	The state of enterprise management is the indirect driving factor of disruptive technological innovation behavior, which indirectly determines whether the enterprise implements disruptive technological innovation behavior by influencing the enterprise innovation willingness
Market conditions → innovation intention → innovation behavior	Market reality is the indirect driving factor of disruptive technological innovation behavior of enterprises, which indirectly determines whether enterprises implement disruptive technological innovation behavior by influencing their innovation willingness
Innovation policy environment → innovation behavior	Innovation policy environment is the direct driving factor of disruptive technological innovation behavior, which directly determines whether enterprises implement disruptive technological innovation behavior
Innovation policy environment → innovation intention → innovation behavior	Innovation policy environment is the indirect driving factor of disruptive technological innovation behavior of enterprises, which indirectly determines whether enterprises implement disruptive technological innovation behavior by influencing their innovation willingness
Technology development degree → innovation behavior	The degree of technological development is the direct driving factor of disruptive technological innovation behavior, which directly determines whether enterprises implement disruptive technological innovation behavior
Technology development degree → innovation intention → innovation behavior	The degree of technological development is the indirect driving factor of disruptive technological innovation behavior of enterprises, which indirectly determines whether enterprises implement disruptive technological innovation behaviors by influencing their innovation willingness

Table 3: Typical Relation Structure and Connotation Expression of Main Category

According to the typical relationship structure analysis among the main categories in Table 3, the driving factor model of disruptive technological innovation behavior of enterprises is constructed, as shown in Figure 2.

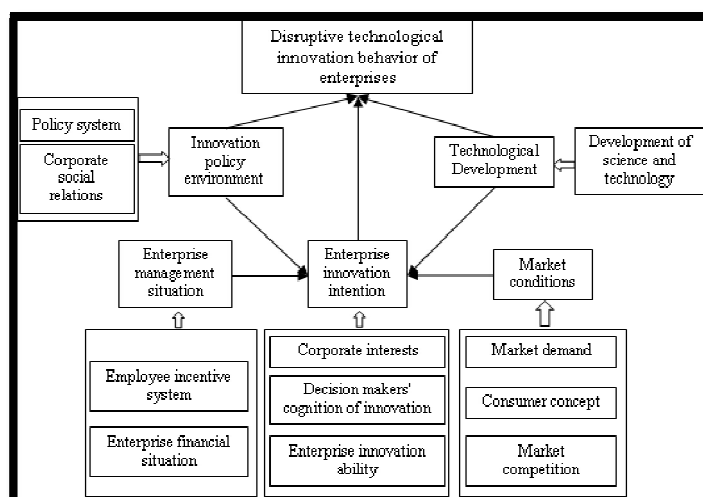


Figure 2: The Driving Factor Model of Disruptive Technological Innovation Behavior of Enterprises

3.4. Theoretical Saturation Test

The principle of theoretical saturation test requires that the newly collected original data statements no longer produce new concepts and cannot induce new categories. Following this principle, this paper codes the remaining five samples with triple coding, which does not produce new concepts and new categories. The theoretical construction is fully applicable to the driving factor model of enterprise disruptive technological innovation behavior, which shows that the driving factors of enterprise disruptive technological innovation behavior have been fully explored, and the extracted concepts and categories are theoretically saturated.

4. Conclusion and Enlightenment

This paper uses grounded theory to study the driving factors of enterprises' disruptive technological innovation behavior, obtains the driving factors of enterprise's disruptive technological innovation behavior, constructs the driving factor model of enterprise's disruptive technological innovation behavior and explains the model, and the theory reaches saturation after testing. The results show that the five main categories of enterprise innovation intention, enterprise management status, market reality conditions, innovation policy environment and technology development degree are the main driving factors of enterprise disruptive technological innovation. Among them, the main category of enterprise innovation intention includes three sub categories: enterprise interests, decision makers' Innovation Cognition and enterprise innovation ability, which are the internal direct driving factors of enterprise disruptive technological innovation behavior. The main category of enterprise management status includes two sub categories: enterprise financial status and employee incentive system, which are the internal indirect driving factors of disruptive technological innovation. The main category of market reality conditions includes three main categories: market demand, consumer concept and market competition, which are the external indirect driving factors of disruptive technological innovation behavior of enterprises. The main category of innovation policy environment includes two subcategories of policy system and enterprise social relationship, which is not only the external direct driving factor but also the external indirect driving factor of enterprise disruptive technological innovation behavior. The main category of technological development degree includes one subcategory of technological development, which is not only the external direct driving factor but also the external indirect driving factor of disruptive technological innovation. Through the research, we can get the following enlightenment:

4.1. Government Level

First, create an innovation environment conducive to the growth of disruptive technologies. We should streamline the government process, strengthen the market supervision of disruptive technological innovation industry, break the industry monopoly, and create a fair competition environment among enterprises. We should encourage the combination of production, teaching and research, strengthen resource integration and scientific research, and promote the output and transformation of scientific and technological achievements of enterprises. Through the construction of subversive technology innovation service platform and the establishment of professional subversive technology innovation management team, we can support and guide the disruptive technological innovation behavior of enterprises, and provide a good innovation environment for the growth of enterprises' disruptive technology.

Second, we should provide policy support for disruptive technological innovation. The government should emphasize the important role of disruptive technological innovation in the current social development, arouse the attention of enterprise managers and scientific and technological workers, and incline the disruptive technology R & D enterprises in policy-making. We should establish intellectual property protection system that is conducive to disruptive technological innovation of enterprises, improve the accountability system for infringement, and formulate fiscal policies that are suitable for the characteristics and needs of disruptive technological innovation of enterprises, including tax incentives and financial subsidies.

Third, formulate the development strategy of disruptive technological innovation in accordance with local conditions. Scientific research institutes, universities and think tanks are the main scientific research forces. The government should encourage scientific research institutes, universities and think tanks to conduct in-depth research on disruptive technological innovation and its policies in accordance with the needs of national development. According to the relevant research results, the government constructs the risk assessment mechanism of disruptive technological innovation, and formulates regional disruptive technological innovation development strategy to guide enterprises to carry out disruptive technological innovation activities.

4.2. Enterprise Level

First, countermeasures. Enterprises should consider the external market environment and internal management situation comprehensively, and formulate the technological innovation countermeasures suitable for their own development. We should optimize the enterprise management system to meet the characteristics and needs of disruptive technological innovation, improve the enterprise management system and organizational framework, establish a special subversive technology R & D department, establish an incentive mechanism for disruptive technological innovation, optimize the innovative talent team, and continuously encourage employees to carry out technological improvement and disruptive technological innovation.

Second, funding guarantee. Capital is an important guarantee for the development of enterprises. Enterprises should increase the investment in disruptive technology innovation to provide strong financial support for R & D, improvement, production and promotion of disruptive technology; purchase experimental equipment, improve various experimental facilities, and provide hardware support for disruptive technological innovation activities of enterprises.

Third, team building. Team and talent construction are the key elements for enterprises to carry out disruptive technological innovation. Enterprises should strengthen the construction of innovative values, and ensure that employees' personal values are in line with corporate culture and disruptive innovation values in terms of team building and talent management; We should strengthen the construction of learning enterprise culture, regularly implement job mobility, and constantly improve the innovation ability of enterprise talent team; we should carry out the cooperation and collaborative innovation of government, industry, University and Research Institute to enhance the disruptive technological innovation ability of enterprises.

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