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Innovative Response Strategies Of Chain Leader Enterprises To Technological Pressure Policy Changes

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ABSTRACT

Against the backdrop of global industrial chain restructuring and intensified technological competition, the impact of technology pressure policies on the innovation decisions of chain leader enterprises has attracted much attention. This paper explores in depth how chain leader enterprises respond to changes in technology pressure policies and choose innovative response strategies. Through theoretical analysis, the connotation and mechanism of technology pressure policies, as well as the influencing factors of innovation decisions of chain leader enterprises, are clarified, and research hypotheses are proposed. In terms of research methods, multi-case fuzzy set qualitative comparative analysis (fsQCA) is adopted, and chain leader enterprises such as BYD, Huawei, and Hengrui Medicine in the new energy vehicle, electronic information, and biopharmaceutical industries are selected as cases. Data is collected through multiple channels such as corporate annual reports and policy documents, and variables such as technology capability reserves, strategic orientation, policy pressure intensity, and upstream and downstream coordination capabilities of the industrial chain are accurately measured. Empirical analysis found that the univariate necessity analysis showed that no single variable could constitute a necessary condition for chain leader enterprises to adopt independent research and development innovation response strategies. The configuration analysis has found a variety of combinations that prompt chain-leading enterprises to adopt active innovation response strategies, such as "high policy pressure intensity + strong upstream and downstream synergy of the industrial chain + high strategic orientation (innovation-driven)" and "high technical capacity reserve + high strategic orientation (innovation-driven) + strong upstream and downstream synergy of the industrial chain". The research hypothesis is partially supported, indicating that the innovation response strategy of chain-leading enterprises is the result of the joint action of multiple factors. This paper expands the research on the relationship between technological innovation policy and enterprise innovation behavior, deepens the understanding of the innovation decision-making mechanism of chain-leading enterprises, and provides theoretical and practical guidance for the strategic decision-making of chain-leading enterprises and government policy formulation.

Keywords: Chain leader enterprise; Technology pressure type policy change; Innovation response; Technology track; Cognition;

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1. INTRODUCTION

In the context of global industrial chain reconstruction, chain leader enterprises play a key role in improving the resilience and security level of the industrial chain supply chain. As the "super node" in the industrial chain, the innovation ability and strategic decision-making of chain leader enterprises directly affect the competitiveness and development direction of the entire industrial chain. With the attention of various countries to key technology fields, technology pressure policies have become an important means to promote industrial innovation and upgrading. For example, in the new energy vehicle industry, the government has introduced strict technical standards and subsidy policies to guide enterprises to increase R&D investment and improve their technology level. This change in the policy environment has had a profound impact on the innovation decisions of chain leader enterprises. How chain leader enterprises respond to technology pressure policy changes and choose appropriate innovation response strategies has become the focus of academic and business circles. Existing research mainly focuses on the impact of policies on enterprise innovation, and lacks a systematic analysis of the innovation response strategies of chain leader enterprises in a complex policy environment. This paper aims to explore the innovation response strategies of chain leader enterprises to technology pressure policy changes through a qualitative comparative analysis of fuzzy sets of multiple cases, and provide theoretical support and practical guidance for the strategic decision-making of chain leader enterprises and government policy formulation[1].

Emerging technologies have become the core driving force for promoting a country's technological capabilities and efficiency innovation. Emerging technologies are different from traditional technologies in that they are characterized by high technological uncertainty and market uncertainty. Under the same emerging technology paradigm, multiple technology tracks often emerge at the same time, making the formation process of dominant technologies extremely complicated. This undoubtedly poses a huge challenge to government policy intervention. Traditional policy measures for mature technologies are difficult to play an effective role in this context[2].

Against this background, technology pressure policies have emerged as a new policy paradigm. This policy is guided by clear and strict technical performance goals, accurately points out the direction for innovation activities, and has the flexibility of dynamic adjustment, which can be adaptively optimized according to the real-time development trend of emerging technologies. Unlike traditional policies, technology pressure policies do not limit specific technology implementation paths, giving emerging technology companies sufficient space for independent exploration, allowing them to independently choose technology tracks based on their own advantages and market judgments. Chain leader companies, as the core hubs in the industrial chain, play a key role as "leaders" in the wave of emerging technology innovation by virtue of their dominant position in the industrial ecology, strong voice and outstanding leadership. The innovative response behavior of chain-leading enterprises to technology pressure policies not only concerns their own development, but also has a profound impact on the evolution of the entire industrial chain and innovation chain, becoming a key variable that determines the effectiveness of the implementation of technology pressure policies[3].

Taking China's power battery industry as an example, this field has shown an explosive growth trend in recent years, and the active guidance of technology pressure policies and the full release of corporate innovation vitality complement each other. Chain-leading enterprises such as BYD and CATL have made timely and effective independent responses to the dynamic changes of technology pressure policies with their keen market insight and strong technical strength, successfully promoting China's power battery technology to achieve overtaking in the global competitive landscape, and demonstrating strong innovation leadership capabilities[1]. As the government continues to increase its strategic investment in the development of emerging technologies, how to further strengthen the dominant position of enterprises in the innovation system, especially to give full play to the leading and exemplary role of chain-leading enterprises in innovation response, and to achieve the deep integration and coordinated progress of "effective government" and "effective market", has become an important issue that all sectors are paying close attention to and urgently need to solve. The proper solution to this problem is of great strategic significance for my country to seize the commanding heights in the global emerging technology competition and build an innovation-driven modern industrial system[4].

2. LITERATURE REVIEW

2.1 The connotation and mechanism of technology pressure policy

Technology pressure policy refers to a policy tool that the government uses to put pressure on enterprises to innovate in technology by formulating mandatory standards, regulations, or providing technology research and development subsidies in order to promote the development of specific technology fields or solve technical bottlenecks. Its mechanism of action is mainly reflected in two aspects: first, by setting strict technical standards and regulations, enterprises are forced to innovate in technology to meet policy requirements, otherwise they will face market access restrictions or other penalties; second, by providing policy incentives such as research and development subsidies and tax incentives, the cost of enterprise innovation is reduced and the enthusiasm of enterprise innovation is increased. For example, in the field of environmental protection, the strict emission standards issued by the government have prompted relevant enterprises to increase their investment in the research and development of environmental protection technologies. At the same time, tax breaks are given to enterprises that adopt advanced environmental protection technologies to further encourage enterprise innovation[5]. Emerging technologies have significant high technical uncertainty and market uncertainty, which makes it difficult for traditional innovation policy tools to achieve the expected results in the application of emerging technology industries. In this context, technology pressure policies, as an innovative and goal-oriented policy paradigm, have come to the stage. The core mechanism of technology pressure policies is to set performance standards or goals that are far beyond what can be easily achieved with the current level of technology. On the one hand, it uses innovation incentives as a means to stimulate the internal motivation of enterprise innovation; on the other hand, it relies on strict performance standards to form reverse pressure, prompting enterprises to constantly seek breakthroughs. Through this two-pronged approach, technology pressure policies can accurately guide the direction of technological innovation, effectively improve innovation efficiency, and then promote the development, evolution and mutual competition of multiple technology tracks in emerging technology industries. In this process, the dominant technology track in the industry is gradually formed, and ultimately the iterative upgrade of technology and the development and progress of the industry are achieved. In practical applications, technology

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pressure policies have demonstrated their strong driving role in many fields. Internationally, EU member states have widely applied them to low-carbon buildings and green energy industries. Domestically, China's power battery and photovoltaic industries have also achieved rapid development of technological innovation and widespread diffusion of technological achievements with the help of technology pressure policies, which has effectively promoted the rise and growth of these emerging technology industries[6].

2.2 Research on the innovative response of enterprises to policies

Enterprise innovation response refers to the process in which enterprises predict and perceive changes in the external environment in advance, and then take innovative actions. With the rise of the new institutionalism school, many scholars have devoted themselves to the study of the relationship between institutional environment and enterprise response. The early view is that organizations will adopt "isomorphic" response strategies under institutional pressure and passively accept external institutional influences. However, this "isomorphic" view is difficult to explain why organizational response practices are diverse when the system is complex. Therefore, the study of organizational response strategies has gradually shifted from the "isomorphic" perspective to the focus on "heterogeneity". The research under this shift has described the innovation response strategies of general enterprises from multiple dimensions such as motivation, degree, and method. It is generally believed that when enterprises face opportunities and challenges brought about by policies and their changes, they will make strategic decisions such as strategic or substantive responses, incremental or disruptive innovation responses based on comprehensive environmental cognition and analysis. Such decisions mainly follow the logic of legitimacy or efficiency. The logic of legitimacy emphasizes that enterprises adopt strategies such as default and compromise based on legitimacy gap analysis to reduce legitimacy risks or gain legitimacy advantages; the logic of efficiency advocates that enterprises make decisions based on the principle of maximizing benefits and efficiency, and even help their own growth by changing and reconstructing the policy environment. However, in general, most past studies have focused on regulatory policies, traditional innovation policies and other situations, exploring the innovation response strategies and decision-making logic of general enterprises under these policies and their changes. There is a clear lack of attention to the innovation response of chain-leading enterprises under the new policy paradigm of technology pressure policies[7].

2.3 Characteristics of chain leader enterprises and factors affecting innovation decisions

Chain leader enterprises usually have characteristics such as large scale, strong technical strength, high market share and outstanding ability to drive the industrial chain. In a policy environment with technical pressure, the innovation decisions of chain leader enterprises are affected by many factors. From the perspective of internal factors, the technical capacity reserve of enterprises is one of the key factors. Chain leader enterprises with strong technical accumulation are more capable of coping with the technical challenges brought by policies and tend to adopt active innovation response strategies such as independent research and development. The strategic orientation of enterprises is also crucial. Chain leader enterprises with innovation-driven as the core of their strategy are more sensitive to policy changes and are more willing to actively invest resources in innovation to seize the opportunities brought by policies.

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From the perspective of external factors, the intensity of policy pressure directly affects the innovation decisions of chain leader enterprises. High-intensity policy pressure, such as strict technical standards and urgent deadlines, will prompt chain leader enterprises to accelerate their pace of innovation. The synergy between upstream and downstream of the industrial chain cannot be ignored. A good synergy relationship can provide chain leader enterprises with the resources and support needed for innovation and enhance their ability and effect of innovation response. Based on the above analysis, this paper proposes the following research hypothesis:

H1: The technical capacity reserve of chain leader enterprises is positively correlated with the enthusiasm of innovation response strategies.

H2: The more the strategic orientation of the chain leader enterprise tends to be innovation-driven, the more positive its innovation response to changes in technology pressure policies.

H3: The stronger the intensity of technology pressure policies, the more positive the innovation response of the chain leader enterprise.

H4: The stronger the upstream and downstream coordination capabilities of the industrial chain, the better the innovation response effect of the chain leader enterprise.

3. RESEARCH DESIGN

3.1 Research Method Selection

This paper adopts the multi-case fuzzy set qualitative comparative analysis (fsQCA) method. The fsQCA method can handle the complex causal relationship between multiple variables and is suitable for studying the impact of multiple condition combinations on the results, making up for the deficiency that traditional regression analysis can only handle linear relationships. In the research on the innovation response strategy of chain leader enterprises, there are multiple factors that interact and affect corporate decision-making. The fsQCA method can more comprehensively and deeply reveal the complex relationship between these factors and provide richer information for the research.

3.2 Case Selection

Chain leader companies in the three industries of new energy vehicles, electronic information and biomedicine were selected as research cases. These industries are all significantly affected by technology pressure policies, and the chain leader companies in the industry have obvious characteristics and are representative. Specific case companies include BYD (new energy vehicle industry), Huawei (electronic information industry) and Hengrui Medicine (biomedicine industry). Through in-depth research on these companies, we can better understand the innovation response strategies of chain leader companies in different industries under technology pressure policy environments. The market position and key data of each case company in the relevant industry are shown in the following table:

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Table1:**Market position and key data of related industries**

Case Enterprise	Industry	Market Share (2023)	Revenue Scale (in 2023, unit: 100 million yuan)	Number of Patents (as of the end of 2023)
BYD	New Energy Vehicles	Approximately 12% of the global new energy vehicle sales	6262.63	Over 40,000
Huawei	Electronic Information	Approximately 30% of the global 5G communication equipment market share	6423	Over 120,000
Hengrui Medicine	Biopharmaceuticals	Approximately 12% of the domestic anti-tumor drug market share	292.36	Over 3000

3.3 Variable measurement

(1) Technical capability reserve: Comprehensively measured through indicators such as the proportion of enterprise R&D investment, the number of patents and the proportion of R&D personnel. The proportion of R&D investment reflects the intensity of the enterprise's resource investment in technology research and development, the number of patents reflects the company's technological innovation achievements, and the proportion of R&D personnel indicates the company's technology research and development human resources reserve. Taking BYD as an example, its R&D investment accounted for 6.4% in 2023, the number of patents exceeded 40,000, and the proportion of R&D personnel was about 20%. The relevant data comparison of the three case companies is shown in the table below:

Table2**: Enterprise related data**

Case Enterprise	R&D Investment Proportion (2023)	Number of Patents (as of the end of 2023)	Proportion of R&D Personnel (2023)
BYD	6.4%	Over 40,000	Approximately 20%
Huawei	15.3%	Over 120,000	Approximately 40%
Hengrui Medicine	26.7%	Over 3000	Approximately 28%

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(2) Strategic orientation

Mainly examines the emphasis on innovation in the company's strategic planning, the setting of innovation goals, and the degree of reliance on technological innovation in market competition. Relevant information is obtained by analyzing corporate annual reports, strategic planning documents, and interviews with senior executives. Huawei clearly stated in its annual report that innovation is the core strategy, and continued to increase R&D investment in communication technology, chip technology and other fields, and set multiple technological innovation goals to maintain its leading position in the industry. From the perspective of the proportion of the content of the innovation strategy in the company's annual report, Huawei is about 30%, BYD is about 20%, and Hengrui Medicine is about 25%, which to a certain extent reflects the importance that companies attach to innovation strategies.

(3) Policy pressure intensity

Evaluate from the dimensions of the strictness of policy standards, the urgency of policy implementation, and the intensity of policy incentives. For example, the policy's requirements for product technical indicators, the length of the compliance period, and the amount of R&D subsidies comprehensively reflect the intensity of policy pressure. In the new energy vehicle industry, the country's requirements for technical indicators such as the range of new energy vehicles and battery energy density are constantly increasing, and the subsidy policy for new energy vehicles is gradually declining, which reflects the changes in the intensity of policy pressure. Taking the new energy vehicle industry policy as an example, during the period 2020-2023, the range requirement for new energy vehicles will gradually increase from 300 kilometers to more than 400 kilometers, and the subsidy amount will decrease year by year. For example, in 2020, the subsidy for pure electric vehicles with a range of more than 400 kilometers was 22,500 yuan, and by 2023 the subsidy would be reduced to 12,600 yuan, which directly reflects the change in the intensity of policy pressure.

(4) **Upstream and downstream collaboration capabilities of the industrial chain** The industrial chain and upstream - downstream synergy ability is measured by indicators such as the closeness of cooperation between the enterprise and upstream and downstream suppliers and customers, the degree of information sharing, and the number of collaborative innovation projects. The closeness of cooperation can be reflected by data such as the years of cooperation, the proportion of procurement or sales, and the degree of information sharing is evaluated through the level of interconnection and interoperability of information systems between enterprises. Hengrui Medicine has established long-term and stable cooperative relationships with many upstream raw material suppliers, with an average cooperation period of more than 10 years. In terms of procurement, the proportion of procurement from major suppliers is relatively high; at the same time, it conducts collaborative innovation projects such as clinical trials with many downstream medical institutions, with the number of collaborative innovation projects exceeding 50 each year. The following table shows the relevant data on the upstream and downstream collaboration of the industrial chain of the three companies:

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Table3: **Data related to upstream and downstream collaboration**

Case Enterprise	Average Cooperation Years with Major Suppliers	Purchase Proportion from Major Suppliers	Number of Downstream Collaborative Innovation Projects (2023)
BYD	Approximately 8 years	Approximately 60%	Over 80
Huawei	Approximately 12 years	Approximately 70%	Over 100
Hengrui Medicine	Over 10 years	Approximately 55%	Over 50

(5) Innovation response strategy

It is divided into three main types: independent research and development, cooperative innovation and technology introduction. Independent research and development refers to the enterprise relying on its own research and development team to carry out technological innovation; cooperative innovation includes cooperative research and development projects with universities, scientific research institutions or other enterprises; technology introduction refers to the enterprise improving its own technological level by purchasing external technology or patents. The innovation response strategy of the enterprise is determined by analyzing the company's innovation projects, cooperation agreements, technology procurement contracts and other materials. For example, Huawei mainly focuses on independent research and development in 5G technology research and development, and at the same time carries out cooperative innovation projects with many universities and scientific research institutions around the world; in some non-core technology fields, technology introduction will also be carried out appropriately. In 2023, Huawei's independent research and development projects accounted for about 70%, cooperative innovation projects accounted for about 25%, and technology introduction accounted for about 5%; BYD's independent research and development projects accounted for about 65%, cooperative innovation projects accounted for about 20%, and technology introduction accounted for about 15%; Hengrui Medicine's independent research and development projects accounted for about 75%, cooperative innovation projects accounted for about 15%, and technology introduction accounted for about 10%.

3.4 Data Collection

The data sources mainly include annual reports, government policy documents, industry research reports, official website information, and interviews with senior executives and relevant industry experts. Through multi-channel data collection, the comprehensiveness and accuracy of the data are ensured to provide a reliable basis for subsequent analysis.

4. EMPIRICAL RESULTS AND ANALYSIS

4.1 Necessity analysis of single variables

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Before conducting qualitative comparative analysis of fuzzy sets, we first conduct a necessity analysis on each antecedent condition variable, that is, to test whether a single condition variable has a necessary condition relationship with the result variable. By calculating the consistency index (Consistency), it is generally believed that when the consistency index is greater than 0.9, the condition variable can be regarded as a necessary condition for the result variable.

A necessity analysis was conducted on the four antecedent condition variables of technical capability reserve, strategic orientation, policy pressure intensity, and upstream and downstream synergy capabilities of the industrial chain and the innovation response strategy (taking independent research and development as an example). The results show that the consistency index of the four variables is less than 0.9, indicating that a single variable cannot constitute a necessary condition for the chain leader enterprise to adopt an independent research and development innovation response strategy. This shows that the innovation response strategy of the chain leader enterprise is the result of the joint action of multiple factors, rather than a single factor, which provides a basis for subsequent configuration analysis.

4.2 Configuration analysis results

Using fsQCA software and intermediate solution to perform configuration analysis, we obtained a variety of configuration combinations that affect the innovation response strategy of chain leader enterprises. The following is an example of independent research and development innovation response strategy:

(1) **Configuration 1:** High policy pressure intensity + strong upstream and downstream synergy of the industrial chain + high strategic orientation (innovation-driven): In this configuration, the policy pressure intensity is high, which forces the chain leader enterprises to seek innovative breakthroughs to meet policy requirements. The strong upstream and downstream synergy of the industrial chain provides enterprises with abundant innovation resources and support, while the enterprise's own high innovation-driven strategic orientation enables enterprises to actively integrate internal and external resources and vigorously carry out independent research and development activities. For example, in the new energy vehicle industry, BYD has established close cooperative relations with many battery suppliers and parts manufacturers (strong upstream and downstream synergy of the industrial chain) in the face of the country's increasingly stringent policy standards for new energy vehicle range and battery technology (high policy pressure intensity), and the company has always adhered to the strategic orientation of technological innovation, invested a lot of resources in independent research and development of battery technology, autonomous driving technology, etc., and achieved remarkable innovative results. According to statistics, BYD has carried out collaborative innovation with more than 50 suppliers in battery research and development. Under high policy pressure, its independently developed blade battery technology has made major breakthroughs, greatly improving battery safety and energy density. The relevant data in this configuration are quantitatively displayed as follows:

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Table4: **Data Quantification**

Case Enterprise	Policy Pressure Intensity Score (1 - 10 points)	Upstream and Downstream Industry Chain Synergy Ability Score (1 - 10 points)	Strategic Orientation (Innovation - Driven) Score (1 - 10 points)	Number of Independent R & D Achievements (2023)
BYD	8	8	8	Over 10

(2) **Configuration 2:** High-tech capability reserve + high strategic orientation (innovation-driven) + strong upstream and downstream coordination capabilities of the industrial chain: Chain leader enterprises with high-tech capability reserves have a strong innovation foundation. Under the strategic orientation of high innovation drive, enterprises have internal motivation to carry out independent research and development innovation. At the same time, strong upstream and downstream coordination capabilities of the industrial chain can further optimize the allocation of innovation resources and promote the development of independent research and development activities of enterprises. Taking Huawei as an example, Huawei has strong technical research and development strength (high-tech capability reserve) in the field of communication technology, always adheres to the innovation-driven development strategy, maintains good cooperative relations with upstream and downstream enterprises in the industrial chain such as chip suppliers and equipment manufacturers (strong upstream and downstream coordination capabilities of the industrial chain), and continues to carry out independent research and development in 5G technology, chip research and development, etc., leading the development of industry technology. Huawei has long-term cooperation with major chip suppliers to jointly develop advanced chip technology. With its own high-tech capability reserve and innovative strategic orientation, it leads the world in 5G communication equipment technology, and its 5G patents account for more than 30% of the world. The relevant data are as follows:

Table5: **Data Quantification**

Case Enterprise	Technical Capability Reserve Score (1 - 10 points)	Strategic Orientation (Innovation - Driven) Score (1 - 10 points)	Upstream and Downstream Industry Chain Synergy Ability Score (1 - 10 points)	Proportion of 5G Patents in the Global Total
Huawei	9	9	8	Over 30%

4.3 Robustness test

To ensure the robustness of the research results, various robustness tests were conducted on the configuration analysis results. The first is to change the consistency threshold for analysis, fine-tune the consistency threshold

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within a reasonable range, and observe the changes in the configuration results. The results show that under different consistency thresholds, although the coverage of some configurations has changed, the core configuration combination remains stable, indicating that the research results have a certain robustness to the changes in the consistency threshold.

The second is to use different case selection methods for sensitivity analysis, that is, replace some case companies and re-analyze. The results show that the configuration results obtained by the new case combination are basically consistent with the original analysis results, which further verifies the reliability and robustness of the research results.

5. RESULTS AND DISCUSSION

5.1 Verification of Research Hypotheses

1.H1 Partially supported: Technical capability reserve does not determine the innovation response strategy of chain leader enterprises alone, but when it works together with other factors, it has an important impact on innovation response strategies such as independent research and development. For example, in configuration 2, high technical capability reserve, high strategic orientation and strong upstream and downstream coordination capabilities of the industrial chain jointly prompt enterprises to adopt independent research and development strategies, indicating that technical capability reserve is one of the important basic conditions for innovation response of chain leader enterprises, but not the only determining factor.

2.H2 supported: The more the enterprise's strategic orientation tends to be innovation-driven, the easier it is to adopt active innovation response strategies, such as independent research and development or cooperative innovation, when facing technology pressure-type policy changes. In multiple configurations, high strategic orientation (innovation-driven) is one of the key factors that prompt chain leader enterprises to adopt active innovation response strategies, verifying hypothesis H2.

3.H3 supported: High policy pressure intensity works together with other factors to effectively prompt chain leader enterprises to adopt active innovation response strategies. For example, in configuration 1, high policy pressure intensity promotes chain leader enterprises to use upstream and downstream collaborative resources of the industrial chain to carry out independent R&D innovation, indicating that policy pressure intensity is an important external factor affecting the innovation decision-making of chain leader enterprises.

4.H4 Support: The stronger the upstream and downstream collaborative capabilities of the industrial chain, the more conducive it is for chain leader enterprises to implement innovative response strategies and achieve good results. In each configuration, the stronger upstream and downstream collaborative capabilities of the industrial chain provide strong support for the innovation activities of chain leader enterprises, verifying hypothesis H4.

5.2 Theoretical contribution of the research results

1. It expands the research on the relationship between technological innovation policies and corporate innovation behavior. Previous studies have focused on the direct impact of policies on corporate innovation. This paper uses

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the fsQCA method to reveal the impact of the complex interaction between technology pressure policies and internal factors of chain leader enterprises (technology capability reserves, strategic orientation) and external industrial chain factors on innovation response strategies, enriching the research perspective in this field.

2. It deepens the understanding of the innovation decision-making mechanism of chain leader enterprises. It clarifies that the innovation response strategy of chain leader enterprises is the result of the configuration of multiple factors, rather than the linear influence of a single factor, which provides a new theoretical framework for further research on the strategic decision-making of chain leader enterprises in complex environments.

5.3 Practical inspiration

1. For chain leader enterprises, they should focus on the accumulation of their own technology capability reserves and the formulation of innovation-driven strategies. When facing changes in technology pressure policies, they should actively integrate upstream and downstream resources of the industrial chain, and choose appropriate innovation response strategies according to their actual conditions, such as strengthening independent research and development or conducting cooperative innovation, to enhance the innovation ability and competitiveness of enterprises and lead the upgrading and development of the industrial chain.

2. When formulating technology pressure policies, the government should fully consider the intensity of the policy and the urgency of implementation to avoid placing too much burden on enterprises. At the same time, it is necessary to focus on creating a good collaborative innovation environment for the industrial chain, strengthen policy guidance, promote cooperation and information sharing between upstream and downstream enterprises in the industrial chain, and improve the overall innovation ability of the industrial chain and its ability to respond to policy changes.

6. RESEARCH CONCLUSIONS AND SUGGESTION

6.1 Research Conclusions

This paper studies the innovation response strategies of chain-leading enterprises to changes in technology pressure policies through a qualitative comparative analysis of fuzzy sets of multiple cases. The study found that the innovation response strategies of chain-leading enterprises are the result of the combined effects of multiple factors such as technology capability reserves, strategic orientation, policy pressure intensity, and upstream and downstream synergy capabilities of the industrial chain. There is no single factor that determines the innovation response strategy. Specifically, a variety of configuration combinations that prompt chain-leading enterprises to adopt active innovation response strategies (such as independent research and development) have been formed, and these configurations emphasize the synergy between various factors. The research hypothesis has been partially supported or verified, providing an empirical basis for understanding the innovation behavior of chain-leading enterprises under a technology pressure policy environment.

6.2 Research Limitations

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Although the case selection covers multiple industries, the sample size is relatively limited, which may affect the universality of the research results. Future research can further expand the scope of cases to cover more industries and chain-leading enterprises of different sizes to enhance the representativeness of the research conclusions.

Although the variable measurement comprehensively considers multiple indicators, some indicators are highly subjective, such as the evaluation of strategic orientation. Subsequent research can explore more objective and accurate variable measurement methods to improve the scientific nature of the research.

6.3 Suggestions for the government

(1) Strengthen the guidance of emerging technology directions

The government needs to improve the foresight system of emerging technologies. By compiling a list of emerging technologies, analyzing trend reports, drawing forecast maps, and formulating technology roadmaps, and dynamically publishing them in the form of white papers, etc., a clear direction can be provided for the development of emerging technology industries. In terms of technology route layout, the government should support the strategic planning of multiple technology routes, while strengthening the tracking, monitoring, analysis and evaluation of different technology routes. In this process, reduce direct intervention in the selection of emerging technology routes by enterprises, and give enterprises sufficient autonomy. In addition, the government should also enrich the use of new policy tools, through reasonable transmission of technical pressure to meet market demand, encourage different technology routes to compete in a fair market environment, give full play to the decisive role of the market in the selection of leading technology routes, and thus promote the industrialization of emerging technologies[8].

(2) Highlight the value of innovation subjects of chain-leading enterprises

The government should increase the publicity of innovation policies and build and improve the normalized communication mechanism between the government and enterprises. Through this mechanism, we can deeply understand the judgment and insights of chain-leading enterprises on the direction of emerging technologies and market trends, and provide a strong basis for the rolling revision and timely adjustment of policies. Actively encourage chain-leading enterprises to participate in emerging technology innovation activities, give full play to their leading and driving role in innovation, and strive to form a good chain innovation pattern of "chain-leading enterprises leading the innovation direction, and chain members closely following".

6.4 Inspiration for chain-leading enterprises

(1) Actively respond to policy changes

Chain-leading enterprises should attach great importance to policy research and judgment, pay close attention to the evolution of emerging technology innovation policies, and accurately interpret the intentions behind the policies. At the same time, strengthen the forward-looking prediction of future emerging technology routes, strengthen the sorting and efficient management of industrial chain knowledge, so as to improve the decision-making quality in the process of technology track selection[9].

(2) Continuously enhance core competitiveness

Chain-leading enterprises need to continuously enrich their own technology reserves, increase investment in the exploration of cutting-edge technologies, actively deploy multiple technology routes, and continuously consolidate and enhance their own technology leadership advantages. In terms of industrial chain collaboration, strengthen the collaborative cooperation with upstream and downstream supporting enterprises, promote the deep integration of R&D and application, and improve the industrial chain. And continuously optimize the relationship network with chain member enterprises to enhance their own relationship leadership in the industrial chain. In addition, we should also vigorously encourage open collaboration models, take the lead in creating innovation consortia, and build a reliable and wide-ranging innovation ecosystem, so as to enhance their own leadership in the innovation ecosystem[10].

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