The Path Research on the Stimulation of the Business Environment for the Innovation of Science and Technology Innovation Board Enterprises under the Configuration Perspective

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Abstract: Based on the data of listed companies in the Science and Technology Innovation Board from 2021 to 2023, this article uses the QCA method to investigate the operation mechanism of the business environment affecting the improvement of enterprise innovation capability from a configurational perspective. The results show that: a single business environment factor not a necessary condition for the generation of high innovation capability; there are four paths to generate high innovation capability, including human-led, dual-drive of legal and political, human for local matching, and innovation-driven market assistance. Finally, a series of targeted suggestions are given to further optimize the business environment and help improve the steady enhancement of enterprise innovation.

***Keywords*:** business environment, configuration, innovation ability

1. Introduction

Companies listed on the Science and Technology Innovation Board are an important force for China to implement its innovation-driven development strategy, and they have become key to promoting independent innovation and industrial upgrading with their distinct characteristics of high R&D investment and high growth potential. Against the backdrop of the accelerated development of the global new round of technological and industrial transformation, the report of the 20th National Congress of the Communist Party of China clearly put forward the goal of "entering the forefront of innovative countries by 2035", highlighting the strategic significance of innovation to enhance the endogenous driving force of the economy and reshape the global competitive pattern. The factors affecting the innovation capability of enterprises are complex and intricate, among which the business environment is a key external variable. A good business environment can promote the progress of the technology market, strengthen the government's regulatory functions, and expand the extent of market development, thereby helping enterprises to innovate and develop[1].

2. Literature review

The relationship between the business environment and corporate innovation capability is a hot issue of concern to many scholars. Previous research has analyzed individual factors: in government environment, the government reduces innovation costs through financial assistance and fiscal and taxation incentives[2], the reform of “delegation, regulation, and services” and innovation support improve the quality of innovation efficiency[3], and simplify approval to help SMEs innovate[4]; in the market environment, the flow of technological capital optimizes resource allocation[5], venture capital screens start-ups and provides value-added services[6][7], and competition and market expansion force innovation[8]; in the field of human, talent introduction policies gather innovative talents, flexible employment and skills training improve execution efficiency, and there is a strong correlation between the innovation capability of high-tech enterprises and talent density[9]; in the legal environment, patent protection and intellectual property system optimization significantly improve the enthusiasm of enterprises for patent applications[10][11][12]. Existing research on the impact of a single business environment factor on innovation capability, but it ignores the nonlinear synergistic effect between external environment factors. The research contribution is reflected in:, this article adopts the dynamic QCA method, and through the element configuration to analyze the institutional complexity of the business environment, and provides a systematic perspective for the formation mechanism of innovation[13]; The second is to provide a new paradigm for the evolution of the innovation capability of science and technology innovation board enterprises and the analysis of influencing factors, and to provideiated references for all parts of the country to optimize the business environment.

3. Empirical Analysis

3.1 Calibration

This paper selects data from the earliest 70 companies listed on the Science and Technology Innovation Board of China for analysis, and the data of market environment legal protection, public environment, human resources, government services and other elements of the business environment come from the "Evaluation of China's urban business environment" compiled by Li Zhijun[14]. The dependent variable, measuring innovation capability, is operationalized as the natural logarithm of 1 plus the total number of utility model and design patent applications, with data from the CSMAR database. This paper uses the direct calibration method to calibrate the variables[15]. In the process of calibration, this paper selects the 95 quantile, 50% quantile and 5% quantile as key anchor points, which represent full membership, crossover and full non-membership respectively[16].

3.2 Necessity analysis

The identification of individual elements as necessary conditions needs to be based on the consistency level, which can be considered as a necessary condition for the result when it is greater than 0.9. The consistency-adjusted distance is used to judge its accuracy, and it is highly reliable when it is less than 0.2, which can be used as a basis, and it may lead to the instability of the consistency level when it exceeds 0.2, and further in-depth analysis is required[17]. The data show that the consistency level of all conditional variables is below 0.9, and it is preliminarily judged that any condition is not a necessary condition for high/low innovation capability; but the consistency-adjusted distance of the market environment exceeds the 0.2 threshold in some cases, and further in-depth analysis is needed to ensure the accuracy and reliability of the results.

Table 1. Variable pairs with consistency-adjusted distance greater than 0.2

Case	Causal combination	Indicator	2021	2022	2023
case 1	High market environment-high innovation capability	Consistency between groups	0.706	0.740	0.488
		intergroup coverage	0.640	0.632	0.703
case 2	Low market environment-high innovation capability	Consistency between groups	0.597	0.542	0.843
		intergroup coverage	0.672	0.660	0.650
case 3	Low market environment-low innovation capability	Consistency between groups	0.600	0.566	0.792
		intergroup coverage	0.669	0.683	0.605

By examining the variable combinations with a consistency-adjusted distance greater than 0.2 in Table 1, it can be found that: in the three cases of high market-high innovation capability, low market environment-high innovation capability, and low market environment-low innovation capability, the consistency level in each year is less than 0.9, that any one conditional variable cannot become a necessary condition for the generation of high innovation capability or low innovation capability.

3.3 Analysis of the Sufficiency of Conditional Configuration

This article uses R language to conduct a sufficiency analysis of conditional configurations. By setting the consistency threshold at 0.8, PRI at 0.75, and the frequency threshold at 2, Table 2 presents the results of the configuration analysis. As shown in Table 2, the overall PRI of the four configurations is 0.761, indicating that the possibility of the cause and different effects is very small; the overall consistency was 0.912, indicating that in cases that meet these four configurations, 91.2% of innovation-driven enterprises in the Science and Technology Innovation Board will have high innovation capability; the overall coverage was 0.422, indicating that 42.2% the innovation-driven enterprises in the Science and Technology Innovation Board can be explained by these four configurations. Moreover, the adjusted distance between the group and within the group of a single configuration less than 0.2, indicating that the data has a high degree of accuracy, and the four configurations can be regarded as sufficient conditions for the high innovation capability of enterprises in Science and Technology Innovation Board.

Configurations 1 is a combination of human resources as the core existence condition, innovative environment as the core missing condition, public services, market environment, financial services, and government environment as the marginal missing conditions. This configuration is concentrated in Xi'an, an inland city in China, withWestern Superconducting Technologies Co., Ltd. as a typical company. The company is located in Xi'an, an inland city with a relatively low degree of marketization and slower development compared to the eastern coastal. In this case, Western Superconductor relies on Xi'an's unique geographical location to strengthen scientific and technological exchanges with countries and regions

along the "Belt and Road" which in turn promotes the cross-regional flow and sharing of the world's top scientific and technological talent resources. At the same time, Xi'an continuously optimizes the process for foreign experts, simplifies the procedures for foreign talents to work in China, and improves the efficiency of foreign talent processing, providing more convenient conditions for international talent exchange and cooperation.

Configurations 2 is a combination of the rule of law and government environment as the core existence conditions, innovative environment as the core missing condition, and public services, human resources, market, and financial services as the marginal missing conditions. This innovation path, which relies on the "visible hand" of government and the "rigid constraints" of the rule of, has the characteristics of making up for shortcomings through institutional innovation. A typical city that fits this path is Tianjin. Although Tianjin has the shortcoming of a poor environment, it has achieved the transformation of innovative resources by relying on its unique location advantage and excellent rule of law and government environment. First, Tianjin is located in the core circle of the "Jing-Jin Development Axis" and can undertake the spillover of innovative resources from Beijing at a lower cost of innovation, which compensates for the coming of the innovative environment through its location advantage. Second, through the "Several Measures to Promote the Reform of Scientific and Technological Achievement Transformation and Innovation" the Tianjin Municipal Government has continuously improved and refined the service system for the transformation of scientific and technological achievements, promoted the evaluation of scientific and technological achievements into shares, and played the role of this "hand" of government in market innovation. Finally, Tianjin has actively created a good legal environment for enterprise innovation, launched the country's first provincial-level regulation, the "Tianjin Intellectual Property Protection Regulations", strengthened administrative and judicial synergy, and carried out the "Law Firm-Enterprise Travel Together Law to Protect Business Environment" special action. Tianjin Economic-Technological Development Area has also rated Sinocure Medical, a Kechuang Board enterprise, as of the first "Commercial Secret Protection Demonstration Enterprises", helping enterprises prevent the risk of technology leakage. This combination form of "location synergy-effective government-legal" in Tianjin provides an innovative paradigm of "institutional supply resource grafting" for cities of the same kind.

Table 2. Configuration analysis results

Conditional variable	Configuration analysis-high innovation capability			
	Configuration 1	Configuration 2	Configuration 3	Configuration 4
Public service	○	○	▲	▲
Human resources	▲	○	▲	○
Market environment	○	○	▲	▲
Innovation environment	○	○	○	▲
Financial services	○	○	▲	○
Legal environment		▲	○	○
Government affairs	○	▲	▲	○
Consistency	0.926	0.926	0.947	0.941
PRI	0.788	0.753	0.767	0.782
Coverage	0.310	0.272	0.283	0.224
Unique coverage	0.050	0.019	0.061	0.016
Adjusted distance between groups	0.013	0.013	0.015	0.044
Adjusted distance within groups	0.145	0.145	0.145	0.120
Overall consistency	0.912			
Overall PRI	0.761			
Overall coverage	0.422			

Note: ▲ and ◯ indicate core presence and absence, ▲ indicates marginal presence, ◯ indicates marginal absence, and blank indicates that both presence and absence are acceptable.

Configuration 3 is a combination of human resources as the core existence condition, innovative environment as the core missing condition, public service, market, financial service and administrative environment as the edge existence conditions, and legal environment as the edge missing conditions. This configuration is distributed in the city of Guangzhou. The analysis its reasons mainly includes the following points: First, Guangzhou, as the core city of the Guangdong-Hong Kong-Macao Greater Bay Area, is at most cutting-edge position of China's innovation and development. Relying on the geographical advantage of being adjacent to Hong Kong and Macao, it absorbs the abundant human from the world. Secondly, in order

to accelerate the economic development, the Guangdong Provincial Government has implemented the "Pearl River Talent Plan". Through this-level talent recognition project, it can attract excellent talents from home and abroad, and improve the quantity and quality of talents. Finally, in terms of public services and other aspects,angzhou has implemented the "Guangzhou Smart City Management Platform", and also established the Guangzhou Data Exchange, which is constantly improving digital management to achieve digital government reform smart city construction, and provides assistance for the improvement of enterprise innovation and creativity.

Configuration 4 is a combination of innovative environment as the core existence condition, financial service as the missing condition, public service and market environment as the edge existence conditions, and human resources, legal environment and administrative environment as the edge missing conditions. The typical city of this configuration iszhou. Suzhou's innovation capability may come from the pressure of the surrounding cities, such as Shanghai and Nanjing, which leads to insufficient talent attraction capability, but Suzhou its unique path of innovation and development. Suzhou has established the Suzhou Industrial Park, the Suzhou Institute of Nanotechnology and Nanobionics co-built with the Chinese of Sciences, and has created the country's first blockchain development pilot area. These are important innovation carriers in Suzhou, which have attracted a large amount of foreign capital and research development institutions to gather, and have created a "tropical rainforest" innovation and entrepreneurship ecology.

4. Conclusion and Recommendations

This paper takes 70 listed companies in the Science and Technology Innovation Board of China from 2021 to 203 as cases to analyze the business environment with dynamic QCA method, and discusses how the seven precursor conditions of market environment, government environment, human resources, environmental protection, social responsibility corporate governance act to achieve the high innovation capability of enterprises in the Science and Technology Innovation Board. The research results are as follows: a single business environment factor not a necessary condition for the generation of high innovation capability; there are four paths to generate high innovation capability, including human-led, dual-drive of legal and political, human for local matching, and innovation-driven market assistance. Business environment is not only an important foundation to promote economic development, but a key condition to attract investment and an important support to ensure market vitality. Firstly, it is necessary to strengthen the thinking of talent gathering, build a joint training mechanism among, enterprises and scientific research institutions, and improve the long-term incentive mechanism such as technology shareholding and stock option incentive, so as to build the height of innovation with the thickness talents; Secondly, it is necessary to build a "protective wall" of the rule of law, construct a full-chain legal guarantee for innovation, and improve the protection of property rights such as technical secrets and business data; Thirdly, the government should strengthen the service consciousness, simplify the office procedures for the transformation of scientific and technological achievements and cross-ional technical cooperation, and reduce the institutional transaction cost of enterprise innovation; Finally, it is necessary to build an innovation environment ecology, and create an "all-element gathering"tropical rainforest"-style innovation and entrepreneurship ecology. By constantly optimizing the business environment, we can provide a fertile soil for enterprise innovation, and then effectively enhance the innovation of enterprises.

References

[1] Wang S,Zhang R,Wan L.Business environment optimization and regional green innovation: evidence from Chinese provinces[J].Journal of Environmental Planning and Management,2025,68(6):1337-1362.

[2] Hou B,Hong J,Wang H,et al.Academia-Industry Collaboration,Government Funding and Innovation Efficiency in Chinese industrial Enterprises[J].Technology Analysis & Strategic Management,2019,31(6):692-706.

[3] Guo D,Guo Y,Jiang K.Government-Subsidized R&D and Firm Lnnovation:Evidence from China[J].Socialscience Electronic Publishing,2016,45(6):1129-1144.

[4] Hsieh C,Klenow J P.Misallocation and Manufacturing TFP in China and India[J].The Quarterly Journal of Economics,2009,124(4):1403-1448.

[5] Wang Z.,Jia H.F.,Xu T.,et al.Manufacturing Industrial Structure and Pollutant Emission:An Empirical Study of China[J].Journal of Cleaner Production,2018,197:462-471.

[6] Bernstein S.,Giroud X.,Townsend R.R.The Impact of Venture Capital Monitoring[J].The Journal of Finance,2016,71(4):1591-1622.

[7] Chemmanur T.J.,Loutskina E.,Tian X.Corporate Venture Capital,Value Creation,and Innovation[J].Review of Financial Studies,2014,27(8):2434-2473.

[8] Sun L,Shen J,Zhai J, et al.Business environment, financing constraints and enterprise innovation investment[J].Finance

Research Letters,2024,70106310-106310.
[9] Kianto A.,Sáenz J.,Aramburu N.Knowledge-based Human Resource Management Practices,Intellectual Capital and Innovation[J].Journal of Business Research,2017,81:11-20.
[10] Abrams D. Did TRIPS Spur Innovation? An Empirical Analysis of Patent Duration and Incentives to Innovate[J]. University of Pennsylvania Law Review, 2009,157(6).
[11] Galasso A, Luo H. Tort Reform and Innovation[J]. Journal of Law and Economics,2017,60(3).
[12] Hu A, Jefferson G. A Great Wall of Patents:What is Behind China's Recent Patent Explosion?[J].Journal of Development Economics,2009,90(1).
[13] Furnari S.,Crilly D.,Misangyi V.F.,et al.Capturing Causal Complexity:Heuristics for Configurational Theorizing[J]. Academy of Management Review,2021,46(4):778-799.
[14] Li Z. J. (2019). Evaluation of China's urban business environment. China Development Publishing House.
[15] Crilly D.,Zollo M.,Hansen M.T.Faking It or Muddling through?Understanding Decoupling in Response to Stakeholder Pressures[J].Academy of Management Journal,2012,55(6):1429-1448.
[16] Greckhamer T.Ceo Compensation in Relation to Worker Compensation Across Countries:The Configurational Impact of Country-Level Institutions[J].Strategic Management Journal,2016,37(4):793-815.
[17] Dul J.,Van der Laan E.,Kuik R.A Statistical Significance Test for Necessary Condition Analysis[J].Organizational Research Methods,2020,23(2):385-395.