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What Kind of Market Is Conducive to the Development of High-Tech Industry? Configuration Analysis Based on Market Field Theory

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Abstract: The high-tech industry is important in supporting China's construction of a high-quality modern economic system. The high-tech industry markets are spaces for the supply and transaction of high-tech products. The existing research lacks in-depth discussions on the constituent factors and shaping mechanisms of the high-tech industry market. This paper constructs the market field configuration model of the high-tech industry and studies the impact of the market field configuration of the high-tech industry in 30 provinces of China on the innovation performance of the high-tech industry using the fuzzy-set qualitative comparative analysis method. The findings are as follows: (1) The three structural variables of network, institution, and cognition cannot individually constitute the necessary conditions for explaining the high or low innovation performance of high-tech industries; (2) Three high-tech industry market field configurations can lead to high innovation performance, and the condition combination among different configurations has a substitution effect; (3) Four high-tech industry market field configurations will lead to low innovation performance, in which the lack of multiple conditions in the network, system, and cognition is the main reason for the market failure. The research conclusions of this study highlight the cognitive role of market construction and the configuration characteristics of effective high-tech industry market fields, which provides practical enlightenment for China to improve the innovation performance of high-tech industries.

Keywords: high-tech industries; market field; market construction; sociology of markets

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1. Introduction

Currently, China's economic development model is transitioning from high-speed growth to high-quality growth, and this transformation process is facing dual international and domestic pressures. From an international perspective, trade frictions and technological blockades have posed a bottleneck dilemma and low-end lock-in risk for China's technological innovation, leading to serious challenges to the traditional mode and advantages of relying on low-cost and low-end industries to participate in the global industrial division of labor system [1,2]. From a domestic perspective, the issue of regional development imbalance in China is prominent. Some regions have low levels of industrial technology, low technological contents of traditional industrial products, weak regional innovation capabilities, and unsustainable growth models driven by traditional factors and investment [3]. To cope with this situation, the report of the 19th National Congress of the Communist Party of China pointed out that building a modern economic system is an urgent requirement for China's economy to cross the threshold of high-quality development, and accelerating the construction of a strong manufacturing country and the development of an advanced manufacturing industry are the focus of building a modern economic system.

The high-tech industry is characterized by knowledge, technology, and capital intensity and is a high-end component of the national manufacturing system [4]. Due to the need for high-tech industries to guide industrial transformation and upgrading via the supply of high-tech products [5], the market that supplies and trades high-tech products has become important for high-tech industries to play a role in the economy and society. *Opinions on Accelerating the Construction of a National Unified Market*, jointly issued by the Communist Party of China Central Committee and the State Council in April 2022, explicitly proposed to leverage the advantages of a large market and promote technological innovation and industrial upgrading by guiding innovative resource allocation based on market demand. In this context, this study has practical significance for China's construction of a modern economic system and a unified national market.

In recent years, Chinese scholars have mainly studied the relationship between the market and the development of high-tech industries from the following aspects. (1) From the perspective of economic system transformation and institutional logic, the restrictive effects of market segmentation on the improvement of innovation and development levels in high-tech industries are explored [6,7]. (2) Based on the interaction of multiple variables, such as foreign direct investment and technological talent agglomeration, the effects of market competition on the efficiency and innovation performance of high-tech industries were empirically analyzed [8,9]. (3) Based on the market design theory, the impacts of market thickness and market fluency on collaborative innovation and innovation speed in high-tech industries were analyzed [10,11]. (4) Based on the technology market or factor market, the impacts of the market on high-tech industry R&D investment, technological innovation efficiency, and the enterprise innovation gap were analyzed [12,13]. (5) Considering the market as an influencing factor of the innovation environment or institutional environment, the significance of the environment for the innovative development of high-tech industries is analyzed [14,15].

There are two problems with the existing research. (1) Influenced by classic economic paradigms, existing studies often view the market as an economic mechanism related to price or resource allocation (such as market segmentation [6], market competition [8], market environment [12], etc.) rather than exploring how a market itself is conducive to the innovative development of high-tech industries. (2) Existing studies prefer to analyze the relationship between the market and high-tech industries from the perspective of linear assumptions and examine the impact of specific single or multiple variables (such as foreign direct investment [8], technological talent [9], market thickness [10], etc.) on this relationship. However, exploring the regulatory effects of single or multiple factors cannot systematically characterize the relationship between the market and high-tech industries, and the interactions among different factors have not been thoroughly analyzed. This study attempts to apply the theoretical insights of the sociology of markets and the fuzzy-set qualitative comparative analysis (fsQCA) approach to solve two existing research problems.

(1) The theoretical basis for understanding the market in the sociology of markets comes from Granovetter's idea of embeddedness, which states that the market is born from interactions with many social factors [16]. The market is not an abstract black box of economic mechanisms from the perspective of market sociology, but a field structure [17]. Sociologists have conducted extensive research on the formation and maintenance of different types of markets [18]. Based on this theoretical insight, this study argues that the market field structure is a specific system with boundaries.

(2) The fsQCA approach adopts a systematic analysis approach, focusing on configuration issues rather than the net effects in traditional linear assumptions [19]. The fsQCA approach can explain complex systemic problems, focusing on the complex causal relationships and causal asymmetry between conditions and outcome variables [20]. For instance, different market field configurations may result in high or low innovation performance in high-tech industries, which enables this study to conduct a comparative analysis of high-tech industry markets in different regions of China.

By applying the theoretical insights of the sociology of markets and the fsQCA approach, this study attempts to answer the following questions: What are the specific configurations of effective high-tech industry markets in China? What are the core and peripheral conditions that constitute an effective market configuration for high-tech industries? What insights can the research findings provide for constructing China's high-tech industry market? This study contributes to the literature with the following: (1) in theory, a high-tech industry market field configuration model has been built; (2) in practice, using the fsQCA approach, research is conducted on market configurations that are conducive to the innovative development of high-tech industries, revealing the characteristics of China's high-tech industry market and providing differentiated strategies for decision makers.

The remainder of this study is organized as follows. Section 2 reviews the literature related to the sociology of markets and market field theory, establishing a market field configuration model for high-tech industries. Section 3 introduces the research methods and sample data. Section 4 presents the results of the fsQCA analysis. Section 5 further discusses the results. Section 6 presents the conclusion and implications.

2. Literature Review and Model

2.1. Three Main Perspectives of the Market in Sociology of Markets

The market is regarded as an abstract price mechanism in mainstream economic research [21], which is even more vague than the company in modern economic theory, and is implicitly endowed with a "plane without characteristics" in economic analyses [22]. Therefore, the "market" in the theory of mainstream economics is an a priori institutional model applicable to all societies and all periods [23]. In other words, in the research following this logic, the main differences between different markets are determined using the goods being traded (such as factor market, technology market, or product market) rather than the market system itself.

The sociology of markets questioned this logic and pointed out that markets were constructed differently in their respective development processes rather than operating in a vacuum of political and cultural absence, as assumed in the new Classical economics [24]. As the three most important classics on the sociology of markets, Karl Marx's *Das Kapital*, Max Weber's *Economy and Society*, and Emil Durkheim's *Division of Labor in Society* reveal the social process and social differences of market construction from different perspectives. Polanyi pointed out that the market does not originate from random trading behavior, but rather a social entity formed through the interaction of various social factors [25]. Fligstein and Dauter view the market as a socially embedded structure, which is the result of complex interactions between different actors and institutions, and they believe that compared to prior market institutional models in mainstream economics, the sociology of markets focuses more on examining specific real and complex markets [26].

In the sociology of markets, the network, institution, and cognition are the three main perspectives used to examine and explain market phenomena.

(1) The network perspective is the belief that the market comprises a network of relationships among actors embedded in the market, which enables the market to play a role, such as promoting private resource sharing and price acquisition [27]. The network is not a pre-existing structure imposed on actors, but a dynamic generative network shaped by selective and constructive relationships [28].

(2) The institutional perspective is the belief that institutions will support or constrain the behavior of market actors. Since various new markets are formed within a set of established institutional backgrounds, different societies have developed various forms of market arrangements [29]. Institutional change may affect the network structure, as it prevents dominant actors from applying strategies to reproduce their dominant position [30].

(3) The cognitive perspective is the belief that networks or institutions themselves do not directly affect behavior, and the key lies in the significance given to these networks or institutions by market actors and their decisions [31]. Under different cognitions, similar rules may lead to very different behavioral consequences [32]. Therefore, the stability of market order depends on the common understanding and collective identification of actors in the way the market operates [33].

In early research, these three perspectives of the sociology of markets were mutually separated. Subsequently, this segmentation situation was questioned, and in the real world, the formation and development of markets were believed to be the result of the interaction of multiple factors, such as networks, institutions, and cognition [29]. Therefore, the main trend of the three perspectives in the research of the sociology of markets is to shift from segmentation to synthesis.

2.2. Perspective Synthesis and Framework building Based on Field Theory

As a general theory of modern social organizations, the field theory can be seen as a configuration of objective relationships between various positions, which includes three characteristics: social relationships that can be or have not yet been clearly perceived by actors, behaviors of actors reflected in conventions, and a set of principles used by actors to explain their situations [23]. Therefore, most contemporary comprehensive perspectives understand the market as a special field, as the field is an interactive field jointly shaped by networks, institutions, and cognition [29]. Because actors' behavioral preferences come from specific fields, and economic behaviors are embedded in the field structure of the market [21], the field has become the main theoretical framework for a comprehensive market analysis perspective [23].

When the market is interpreted as a field, the focus of market analysis transforms from exchange behavior to the structural variables that shape the market field [17]. This transformation expands the analytical space of the market, as networks in the market field can be used to influence institutions and cognition, and institutions can become resources that force networks to change and influence cognition, and influential ideas in the field can be used to advocate for changes in institutional rules and network composition [30,31]. In other words, resources obtained from any of the three structural variables can be used to influence other structural variables, and the different combinations of resources in the structural variables form different market field configurations. However, if the field theory is to be further applied to the market analysis, it is necessary to distinguish specific market types [23]. Thus, based on the market field theory, this study takes the innovation performance of the high-tech industry as the outcome variable and integrates the three structural variables of network, institution, and cognition to build a configuration model of the high-tech industry market field containing six condition variables (see Figure 1).

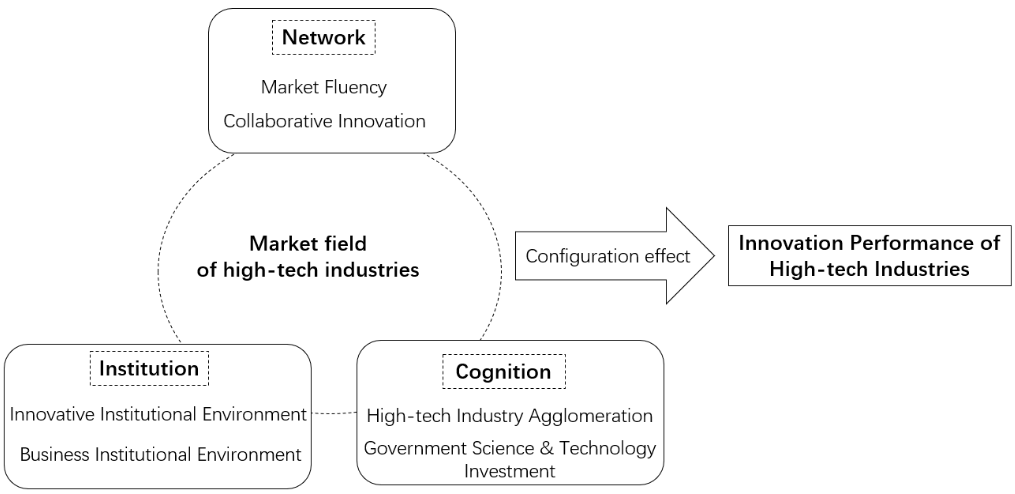

Figure 1. A market field configuration model for high-tech industries.

(1) The network includes two condition variables: market fluency and collaborative innovation. The opportunity for a company to become an efficient producer depends on whether there are broad social relationships in the market field within which it is located, as these networks help allocate resources for efficient purposes [23]. Therefore, the network

conditions in the field can be indirectly reflected in the factors that affect the efficiency of resource allocation.

(i) According to the literature [32], market fluency mainly refers to the speed of technological information transmission and diffusion. Improving market fluency can reduce information asymmetry, accelerate technology trading speed and efficiency, and promote the diffusion of technology resources [10]. If there is a fast speed of technological information transmission and diffusion within a market field, it indicates that the field has good social connectivity. Therefore, market fluency can measure the technology trading network situation in the high-tech long industry market field.

(ii) Ansoff first proposed the concept of "collaboration", believing that collaboration reflects the overall performance of collaboration between enterprises [33]. Collaborative innovation reflects the willingness of enterprises to cooperate, the level of knowledge sharing, and the richness of innovation resources in the technology market. A higher level of collaborative innovation helps improve the efficiency of innovation resource allocation [11]. Thus, if the degree of collaborative innovation in a specific market field is high, it indicates that there is a good innovation collaboration network established among enterprises in this field, which can achieve an efficient allocation of innovation resources.

(2) The institution includes two condition variables: the innovation institution environment and the business institution environment. The external institutional environment constitutes the game rules of commercial economic activities, and the market system is the core system that restricts commercial economic activities [34]. As mentioned earlier, a new market is often built on existing social systems; therefore, different social systems will result in different market institutional arrangements [29].

(i) The innovation institution environment and the business institution environment are the two most important institution environments that affect the formation and development of the high-tech industry market [14]. On the one hand, innovation is an important factor affecting the development of high-tech industries, and the innovation willingness and activities of industrial organizations are influenced by institutions [35]. Therefore, a market conducive to developing high-tech industries is more likely to be embedded in an institutional environment conducive to innovation. On the other hand, a good business institutional environment can reduce institutional transaction costs for enterprises [36], improve their commercial credit financing capabilities [37], eliminate the impact of rent seeking [38], and so on. Therefore, the high-tech industry market embedded in a good business environment will be more conducive to developing high-tech industries.

(ii) The boundaries of a field are not determined by geography, but by culture, politics, society, etc. [23,31]. While restricting the development of high-tech industries [39], China's regional market segmentation actually establishes and develops different high-tech industry markets with the administrative division as the boundary and the innovation institution environment and business institution environment within their respective boundaries as the institutional basis. Therefore, this study adopts the innovative institutional environment and the business institutional environment to measure the social institutional environment embedded in the high-tech industry market in different regions of China.

(3) Cognition includes two condition variables: high-tech industry agglomeration and government science and technology investment. The network or institution itself does not directly affect behavior, and the key lies in the significance given to these networks or institutions by market actors [31,32].

(i) In the market field, the government and enterprises are the most important actors, and these two actors often influence the market via technology investment and industrial agglomeration. In recent studies, high-tech industry agglomeration and government technology investment are generally regarded as the two main variables driving technological innovation or affecting regional innovation performance [40,41].

(ii) These two variables also reflect the local cognition of the government and enterprises towards the high-tech industry market. On the one hand, there are obvious local leading industries and enterprises in high-tech industrial clusters. These enterprises gather within administrative divisions with specific boundaries rooted in local social and cultural factors, constrained by the institutional constraints of the region, and also build interactive networks within the region. On the other hand, government innovation policies play an important role in the agglomeration of high-tech industries, which is often reflected in government science and technology investment [41]. Under the administrative system of China, due to factors such as resources, economy, and historical culture, there are distinct regional differences in government innovation policies. Therefore, in the process of jointly constructing a high-tech industry market, local governments and enterprises will produce their local cognition defined by local culture [23].

3. Method and Data

3.1. Fuzzy-Set Qualitative Comparative Analysis Approach

The Qualitative Comparative Analysis (QCA) approach based on set theory adopts a holistic perspective, assuming the interdependence between conditions, focusing on analyzing configuration effects, and finding causal connections between the conditional configurations and results [19]. The application of the QCA approach enables the cross-case comparisons of large, medium, and small samples, identifying the conditional configurations with equivalent results, thereby helping to understand the differential driving mechanism of the different conditional configurations leading to corresponding results [20]. The QCA approach includes three basic categories: fuzzy-set qualitative comparative analysis (fsQCA), clear-set qualitative comparative analysis (csQCA), and multivalued-set qualitative comparative analysis (mvQCA). Among them, fsQCA can deal with problems related to degree change and partial membership [20].

This study applies to the fsQCA approach. On the one hand, this study takes 30 provinces in China as the research sample. (This study does not include data from Hong Kong, Macao, and Taiwan. Meanwhile, due to Tibet lacking key statistical data on "high-tech industry new product sales revenue", it was not included in our research sample.) The corresponding statistical data are quantitative data with varying degrees, which meets the sample requirements of the fsQCA approach. On the other hand, the purpose of this study is to analyze the causal relationship between market field configuration and the innovative development of high-tech industries. As the market field is the result of the interaction of three structural variables, namely, network, institution, and cognition, and different resource combinations derived from these three structural variables can generate different market field configurations, the fsQCA method can yield more appropriate treatments of the configuration problems.

3.2. Data Source

The outcome variable is measured using the data of the year 2019, while the condition variables are measured using the data of the year 2018. The reasons are as follows.

(1) From the year 2020 to the year 2022, in order to deal with the COVID-19 pandemic, local Chinese governments adopted extremely strict prevention and control measures (such as prohibiting the circulation of people within the jurisdiction and restricting the entry of people from other places into the jurisdiction). Most enterprises in the region were completely shut down during these three years, making it difficult for high-tech enterprises to develop [42,43]. Thus, the 2019 data were used to measure the outcome variable.

(2) Due to the time lag effect of conditional variables on high-tech industry innovation, this study used data from a lagged period (i.e., data from the year 2018) to measure the condition variables.

The introduction of outcome variables and condition variables is shown in Table 1.

Table 1. Outcome and conditions.

Variable Type	Indicators, Year	Abbreviation	Measuring Method
Outcome	Innovation Performance of High-tech Industry, 2019	IPHI	sales revenue of new products in high-tech industries/10,000 people
Conditions	Market Fluency, 2018	MF	R&D internal expenditure/revenue
	Collaborative Innovation, 2018	CI	R&D external expenditure/revenue
	Innovation Institution Environment, 2018	IIE	comprehensive science and technology innovation index of each province in China
	Business Institution Environment, 2018	BIE	evaluation of the business environment of each province in China
	High-tech Industry Agglomeration, 2018	HIA	location entropy
	Government Science and Technology Investment, 2018	GSTI	science and technology expenditure/local general public budgeting expenditure

According to the literature [9], "sales revenue of new products in high-tech industries/10,000 people" is used to measure the innovation performance of high-tech industries. The data are sourced from *China High-tech Industry Statistical Yearbook* and *China Statistical Yearbook*.

According to the literature [32], "R&D internal expenditure/revenue" is used to measure market fluency. According to the literature [11], "R&D external expenditure/revenue" is used to measure collaborative innovation. The above two data sources are from *China High-tech Statistical Yearbook*.

The data source for the innovation institutional environment is *China Regional Science and Technology Innovation Evaluation Report 2018*. The report is released by the China Academy of Science and Technology Development, which is a public institution directly under the Ministry of Science and Technology of the People's Republic of China. This report established an indicator system from the following five aspects and calculated the comprehensive science and technology innovation index of each province in China: the scientific and technological innovation environment, scientific and technological activity input, scientific and technological activity output, high-tech industrialization, and scientific and technological promotion of economic and social development [44]. The data source of the business institution environment is the study of [45]. Based on previous research on business environment evaluation, reference [45] has constructed an evaluation index system for the business environment of Chinese provinces and calculated the scores of each province's business environment.

According to the literature [46], location entropy is used to measure high-tech industry agglomeration, and the calculation formula is "location entropy = regional high-tech industry agglomeration = (regional high-tech industry employment/regional all industry employment)/(national high-tech industry employment/national all industry employment)", the data of which are sourced from *China High-tech Industry Statistical Yearbook* and *China Labor Statistical Yearbook*. According to the literature [47], "science and technology expenditure/local general Public budgeting expenditure" is used to measure government science and technology investment, and the data are sourced from *China Statistical Yearbook*.

According to the measurement method of this study, the measurement results of the initial data for each province in China are shown in Table A1 in Appendix A.

3.3. Calibration

Calibration is the process of assigning a set membership score to a case, and the interval of the score is [0, 1], while the calibration anchor points include complete membership, crossover, and complete non-membership [20]. Due to the lack of clear theories and external standards as the basis for calibration, this study uses the direct calibration method to calibrate the initial data, where the three anchor points, namely, "full membership", "cross-over", and "full non-membership", are set as the upper-quartile value, mean value, and lower-quartile value of the sample data [20]. With this method, the calibration points of each variable are calculated, as shown in Table 2.

Table 2. Result of calibration.

Outcome and Conditions	Complete Membership	Crossover	Complete Non-Membership
IPHI	4512.523	1645.289	509.998
MF	0.028	0.023	0.015
CI	0.004	0.002	0.001
IIE	66.833	56.695	46.740
BIE	59.623	54.130	46.623
HIA	0.903	0.684	0.302
GSTI	0.035	0.017	0.010

This study uses software fsQCA 4.0 to analyze data. Because Yunnan's values at the crossover of variable BIE and Shaanxi's values at the crossover of variables CI and HIA were calibrated to be exactly 0.5, based on the "partial membership" of the crossover values, by adding or subtracting 0.001 [48], the Yunnan's variable BIE was adjusted to 0.449, and the Shaanxi variables CI and HIA were adjusted to 0.501. The calibrated data of each variable are shown in Table A2 in Appendix B.

4. Results

4.1. Necessity and Sufficiency Analysis

Before conducting the sufficiency analysis, it is necessary to conduct separate tests on the necessity of each condition one by one [20]. The necessity analysis results of each conditional variable are shown in Table 3.

Table 3. Results of necessity analysis.

Conditions	IPHI	~IPHI
	Consistency	Consistency
MF	0.634	0.437
~MF	0.455	0.645
CI	0.599	0.556
~CI	0.558	0.589
IIE	0.857	0.304
~IIE	0.263	0.807
BIE	0.773	0.325
~BIE	0.324	0.764
HIA	0.864	0.241
~HIA	0.287	0.898
GSTI	0.887	0.287
~GSTI	0.302	0.887

Note: "~" represents Not in set operation, e.g., IPHI means high innovation performance of high-tech industry, while ~IPHI means low innovation performance of high-tech industry.

Table 3 shows that the consistency of the necessity analysis of all conditions in both high and low IPHI is lower than the critical value of 0.9, indicating that none of the conditions can constitute a necessity condition for explaining the outcome variable. The results of the necessity analysis indicate that the synergistic effect of the three structural variables of network, institution, and cognition on IPHI requires a comprehensive consideration of the concurrent synergistic effect of multiple conditions of network, institution, and cognition in the market field of the high-tech industry.

Sufficiency analysis is to analyze the sufficiency of different configurations on the outcomes. According to the literature [20], the consistency threshold is set to 0.8, and the case frequency threshold is set to 1. Due to the high raw consistency and PRI (Proportional

Reduction in Inconsistency) consistency of the analysis results, each configuration has a strong subset relationship with the results, leading to using a consistency threshold of 0.8, and a PRI consistency threshold of 0.75 cannot further screen configurations. Therefore, this study adopted the natural break value of PRI consistency instead of threshold values [49]. In the sufficiency analysis of high IPHI, 0.986 is the natural break value of PRI consistency. In the sufficiency analysis of low IPHI, 0.960 is the natural break value of PRI consistency. Therefore, this study used the two natural break values 0.986 and 0.960 to conduct a sufficiency analysis on high IPHI and low IPHI, respectively, and obtained their respective complex solutions, parsimonious solutions, and intermediate solutions (see Table A3 in Appendix C).

The fsQCA approach generally interprets the sufficiency analysis results as parsimonious and intermediate solutions. In order to better display the results, this study adopted the approach of Ragin and Fiss [50], which has the advantage of being able to clearly indicate the relative importance of each condition in the configuration (see Table 4). In Table 4, "●" indicates the presence of the core condition, "⊗" indicates the absence of the core condition, "•" indicates the presence of the edge condition, " ⊗ " indicates the absence of the edge condition, and "blank" indicates either presence or absence of the condition.

Table 4. Results of the sufficiency analysis.

Conditions	IPHI			~IPHI			
	H1	H2	H3	L1	L2	L3	L4
MF		•	•	⊗		⊗	⊗
CI		•	•		●	●	⊗
IIE	●	●	●	⊗	⊗	⊗	⊗
BIE	•	•		⊗	⊗		•
HIA	•		•	⊗	⊗	⊗	⊗
GSTI	●	●	●	⊗	⊗	⊗	•
raw coverage	0.547	0.358	0.419	0.387	0.283	0.225	0.083
unique coverage	0.236	0.047	0.108	0.190	0.094	0.029	0.040
consistency	0.996	0.972	0.997	0.998	0.980	0.997	0.992
solution coverage	0.702			0.557			
solution consistency	0.982			0.990			

4.2. Configuration Analysis

4.2.1. Configurations of IPHI

From Table 4, it can be seen that the overall consistency of the three configurations of IPHI is 0.982, while the consistency of each configuration is 0.996, 0.972, and 0.997, respectively, all of which are higher than the critical value of 0.8. Therefore, the configuration analysis of IPHI is effective.

The solution coverage was 0.702, meaning that the three configurations explained 70.2% of the cases of high innovation performance. The solution consistency was 0.982, meaning that 98.2% of high-tech industry markets had a higher level of innovation performance in all cases that met the three configurations.

(1) Configuration H1: IIE*BIE*HIA*GSTI. In this configuration, IIE and GSTI were the core conditions, BIE and HIA were supplemental conditions, and MF and CI had no effects on the outcome. This means that high IPHI could be obtained from the combinations of sufficient IIE, BIE, HIA, and GSTI. In other words, when favorable innovation and business institutional environments provide a framework for market entities to take actions, and if the government and enterprises have a sufficient cognition of the significance, value, and operational rules of the high-tech industry market, it is possible to shape a high-tech industry market field with high innovation performance. Configuration H1 explained approximately 54.7% of the cases of high IPHI; approximately 23.6% of the cases of high IPHI were only explained in configuration H1.

(2) Configuration H2: MF*CI*IIE*BIE*GSTI. In this configuration, IIE and GSTI were the core conditions; MF, CI, and BIE were supplemental conditions; and HIA had no effects on the outcome. This means that high IPHI could be obtained from the combinations of sufficient MF, CI, IIE, BIE, and GSTI. In other words, in favorable innovation and business institution environments, if the government's cognition of the high-tech industry market can effectively synergize with the technology trading network and collaborative innovation network of the high-tech industry, it will be possible to shape a high-tech industry market field with high innovation performance. Configuration H2 explained approximately 35.8% of the cases of high IPHI; approximately 4.7% of the cases of high IPHI were only explained in configuration H2.

(3) Configuration H3: MF*CI*IIE*HIA*GSTI. In this configuration, IIE and GSTI were the core conditions; MF, CI, and HIA were supplemental conditions; and BIE had no effects on the outcome. This means that high IPHI could be obtained from the combinations of sufficient MF, CI, IIE, HIA, and GSTI. In other words, even if there is only a good innovation institutional environment, if the government and enterprises' cognition of the high-tech industry market is effectively synergized with the technology trading network and collaborative innovation network of the high-tech industry, it is possible to form a high-tech industry market field with high innovation performance. Configuration H3 explained approximately 41.9% of the cases of high IPHI; approximately 10.8% of the cases of high IPHI were only explained in configuration H3.

4.2.2. Configurations of ~IPHI

Table 4 shows that the overall consistency of the three configurations of ~IPHI is 0.990, while the consistency of each configuration is, respectively, 0.980, 0.997, and 0.992, all of which are higher than the critical value of 0.8. Therefore, the configuration analysis of ~IPHI is effective.

The solution coverage was 0.557, meaning that the four configurations explained 55.7% of the cases of low innovation performance. The solution consistency was 0.990, meaning that 99.0% of high-tech industry markets had a lower level of innovation performance in all cases that met the four configurations.

(1) Configuration L1: ~MF*~IIE*~BIE*~HIA*~GSTI. In this configuration, ~MF, ~IIE, and ~HIA were the core conditions; ~BIE and ~GSTI were supplemental conditions; and CI had no effects on the outcome. This means that low IPHI could be obtained from the combinations of ~MF, ~IIE, ~BIE, ~HIA, and ~GSTI. In other words, configuration L1 is a configuration with a comprehensive lack of network, institutional, and cognitive conditions. According to the definition of the field, it can be seen that in the absence of the three conditions, an effective high-tech industry market field cannot be formed. Configuration L1 explained approximately 38.7% of the cases of low IPHI; approximately 19.0% of the cases of low IPHI were only explained in configuration L1.

(2) Configuration L2: CI*~IIE*~BIE*~HIA*~GSTI. In this configuration, CI, ~IIE, and ~HIA were the core conditions; ~BIE and ~GSTI were supplemental conditions; and MF had no effects on the outcome. This means that low IPHI could be obtained from the combinations of CI, ~IIE, ~BIE, ~HIA, and ~GSTI. In other words, in the absence of institutional and cognitive conditions, even with a good innovation collaborative network, an effective high-tech industry market field cannot be formed. Configuration L2 explained approximately 28.3% of the cases of low IPHI; approximately 9.4% of the cases of low IPHI were only explained in configuration L2.

(3) Configuration L3: ~MF*CI*~IIE*~HIA*~GSTI. In this configuration, CI, ~IIE, and ~HIA were the core conditions; ~BIE and ~GSTI were supplemental conditions; and MF had no effects on the outcome. This means that low IPHI could be obtained from the combinations of ~MF, CI, ~IIE, ~HIA, and ~GSTI. In other words, in the absence of market fluency, innovation institution environment, and cognitive conditions, a favorable innovation collaborative network alone cannot shape an effective high-tech industry market field.

Configuration L3 explained approximately 22.5% of the cases of low IPHI; approximately 2.9% of the cases of low IPHI were only explained in configuration L3.

(4) Configuration L4: ~MF*~CI*~IIE*BIE*~HIA*GSTI. In this configuration, CI, ~IIE, and ~HIA were the core conditions; ~BIE and ~GSTI were supplemental conditions; and MF had no effects on the outcome. This means that low IPHI could be obtained from the combinations of ~MF, ~CI, ~IIE, BIE, ~HIA, and GSTI. In other words, in the absence of network conditions, innovative institution environment, and high-tech industry agglomeration, the business institution environment and government science and technology investment cannot support the formation of an effective high-tech industry market field. Configuration L4 explained approximately 8.3% of the cases of low IPHI; approximately 4.0% of the cases of low IPHI were only explained in configuration L4.

5. Discussion

5.1. System Structure of High-Tech Industry Market Field

This study builds a configuration model for the high-tech industry market field, taking the high-tech industry market of 30 provinces in China as the research object, providing a theoretical analysis for understanding the systematic structure of the high-tech industry market field.

When existing research discusses the relationship between the market and high-tech industries, the market is often regarded as a certain institutional background, such as the innovation efficiency of high-tech industries in emerging markets [51], how high-tech service industries improve brand innovation in emerging markets [52], the influencing factors of high-tech industries entering emerging markets [53], etc.

In the analysis of high-tech industry-related research using the QCA approach, a certain type of variable is mainly refined, such as refining technology finance investment into multiple secondary variables [54] and then analyzing the configuration relationship between these secondary variables and the innovation performance of high-tech industries. This analysis method lacks a comprehensive theoretical framework.

This study did not follow the research paradigm of classical economics, but instead introduced a market sociology perspective, integrating network, institutional, and cognitive structural variables based on the market field theory to analyze the field configuration of high-tech industry markets (see Figure 2). It is found that the different combinations of the network, institutional, and cognitive structural variables constitute three high innovation performance high-tech industry market field configurations and four low innovation performance high-tech industry market field configurations. These findings reveal that the high-tech industry market field is a system with a specific structure. When there are differences in the configuration matching among different factors, different types of field systems will be shaped, and differentiated system operation results will be generated.

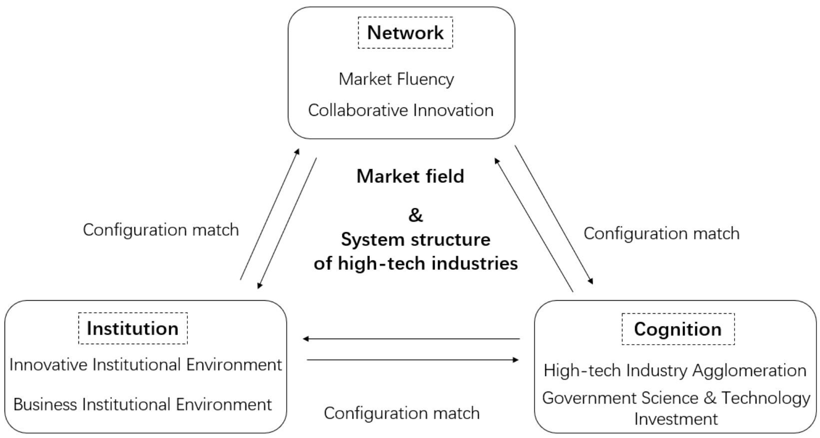

Figure 2. System structure of high-tech industry market field.

5.2. Equivalent Configuration and Substitution Effect

The obtained literature based on linear assumptions often focuses on the moderating or mediating effects of specific single or multiple variables related to the market on the innovation performance of high-tech industries (see the literature [8,10,13]), which leads to a lack of a systematic analysis of the interaction among various factors in the high-tech industry market. The QCA approach applies to configuration problems rather than traditional net effect problems and can directly analyze the interdependence among variables [55], thus helping researchers identify the equivalent configurations and the substitution effect. As shown in Figure 3, by comparing the similarities and differences of equivalent configurations H1, H2, and H3, it can be found that on the one hand, although configurations H1, H2, and H3 comprise different conditions, they can all achieve high IPHI. On the other hand, under the same core conditions (IIE and GSTI), the effects of "BIE * HIA", "MF * CI * HIA", and "MF * CI * BIE" can substitute for each other. Among them, the role of "BIE * HIA" is relatively more important because it plays a role that only exists when the three conditions of "MF * CI * HIA" or "MF * CI * BIE" are combined.

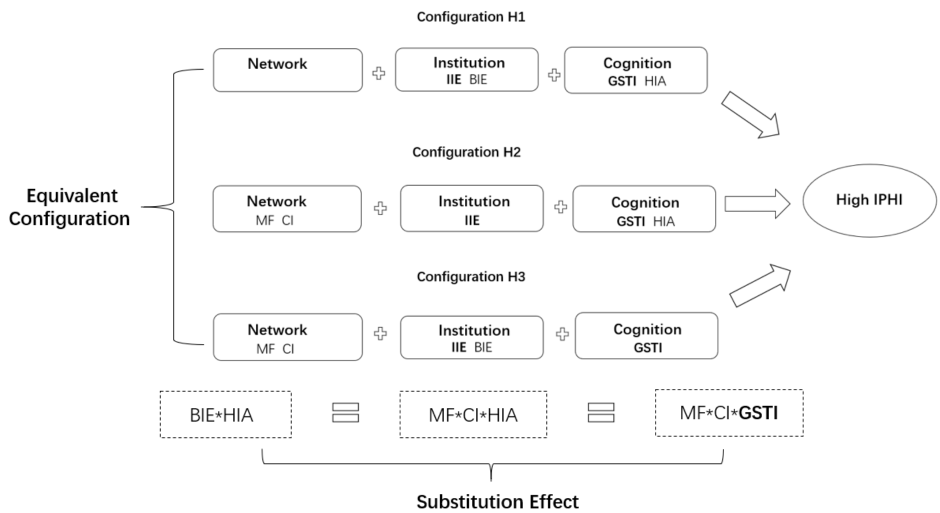

Figure 3. Equivalent configuration and substitution effect of the three configurations of high IPHI.

5.3. Causal Asymmetry

In studies based on traditional linear assumptions, the variable that leads to the occurrence or absence of results is often the same. According to this logic, for example, if high market fluency will enhance the innovation speed of high-tech industries [11], then low market fluency will reduce this speed. However, in reality, a specific factor that leads to the occurrence of a result and a specific factor that leads to the absence of a result are not necessarily the same factor. The QCA approach considers a case as a whole composed of causal conditions and, therefore, focuses on the complex causal relationship and causal asymmetry between the configuration of conditions and the results [55]. In recent years, a series of fsQCA research studies has verified the asymmetric relationship between the causes and results (see [56–58]).

As shown in Figure 4, by comparing the configuration differences between high IPHI and low IPHI, it can be found that the causal mechanisms of high IPHI and low IPHI are asymmetric. For example, high IIE and high GSTI are the core conditions for high IPHI, while low MF, low IIE, and low HIA are the main core conditions for low IPHI. In addition, by comparing the four configurations in low IPHI, it can be found that the values of raw coverage and unique coverage of configuration L1 are relatively high. It can be seen that the comprehensive absence of the three structural variables of network, institution, and cognition is an important reason for low IPHI.

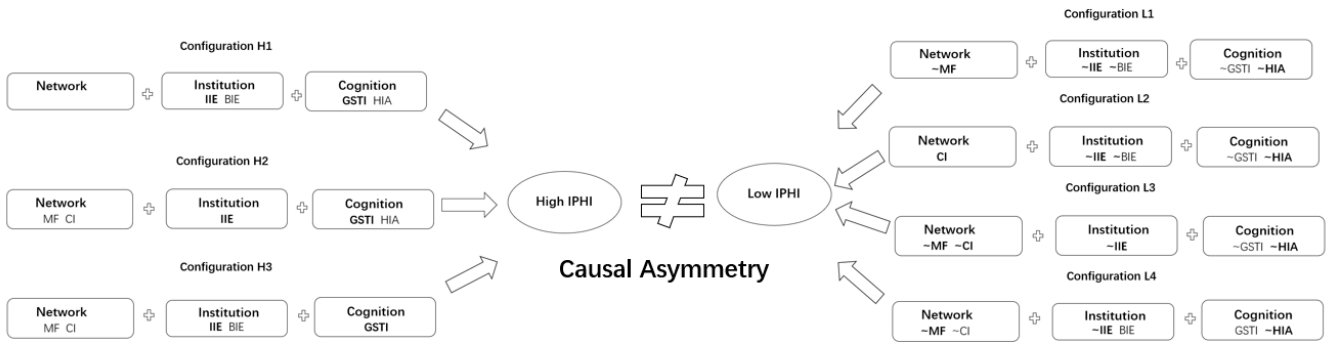

Figure 4. Causal asymmetry between high IPHI and low IPHI.

5.4. Typical Cases of the Configurations

Economic system transformation, local protection, and government competition have led to market segmentation in China, which has a significant negative impact on the innovation level, efficiency, and performance of high-tech industries. However, there are significant differences in the impact on the eastern, central, northeastern, and western regions [6,39]. Table 5 shows the typical cases under different market configurations of high-tech industries, and the regional distribution of these cases is generally consistent with the empirical analysis results of existing research.

Table 5. Typical cases of different configurations.

IPHI			~IPHI			
H1	H2	H3	L1	L2	L3	L4
Guangdong Shanghai Jiangsu Zhejiang Anhui Shandong Fujian	Beijing Zhejiang Shandong Guangdong Anhui	Zhejiang Tianjing Guangdong Hubei Shandong Anhui Hunan	Xinjiang Guangxi Shanxi Jilin Heilongjiang Yunnan	Qinghai Jilin Heilongjiang Hebei	Hainan Jilin Heilongjiang	Guizhou

6. Conclusions

From the perspective of the sociology of markets, this study builds a market field configuration model for high-tech industries and uses 30 provinces in China as samples to study the impact of different market field configurations on the innovation performance of high-tech industries by adopting the fsQCA approach. Our research findings are as follows:

(1) The three structural variables of network, institution, and cognition cannot individually constitute the necessary conditions for explaining the high or low innovation performance of high-tech industries.
(2) Three high-tech industry market field configurations can lead to high innovation performance, and the condition combination among the different configurations has a substitution effect.
(3) Four high-tech industry market field configurations can lead to low innovation performance, and the lack of multiple conditions in networks, institutions, and cognition is the main reason for the failure of the high-tech industry market.

The high-tech industry market is the carrier space for the supply and trade of high-tech products. Previous research has mainly focused on the abstract market mechanism, focusing on breaking down the factors that hinder the functioning of the market mechanism. In comparison, this study explores the construction conditions of specific market types and the complex dependencies among them. The main research contributions are as follows:

(1) Taking a specific high-tech industry market as the research object, this study adopts the field theory to integrate the structural variables that affect the market construction, such as network, system, and cognition, and proposes six secondary conditions to further refine the structural variables, providing a foundation for qualitative comparative analysis of high-tech industry market fields.
(2) Based on the configuration analysis provided in the fsQCA approach and the observation conditions provided in the market segmentation scenario in China, this study empirically analyzes the substitution effect and causal asymmetry of multiple conditions, such as network, institution, and cognition, in the framework of the field theory in shaping the high-tech industry market and expanding the application of field theory in explaining the mechanism of market construction.

On the basis of the existing research that emphasizes the importance of networks and institutions, the main practical implications of this study for improving the innovation performance of China's high-tech industries are as follows:

(1) Policymakers should pay attention to the role of cognition in market construction. It is pointed out that only when actors effectively consider the market as a method to improve the innovation performance of high-tech industries is it possible to endow the relevant networks and institutions of high-tech industries with market significance and reform obstructive institutional rules and network structures.
(2) With the construction of a unified market in China, policymakers should pay attention to the configuration characteristics of the effective high-tech industry market field and focus on the synergistic effects of multiple conditions, such as network, system, and cognition, in the process of shaping the high-tech industry market.

Finally, the limitations in this study and improvements in future research are as follows:

(1) Considering the sample size and the characteristics of the QCA approach, the configuration model constructed in this study mainly analyzed six conditions in the three structural variables of institution, network, and cognition. Our future research will explore including more conditions to enrich the understanding of the high-tech industry market field.
(2) This study mainly conducted a static analysis of the configuration of the high-tech industry market field. Future research will try to apply the dynamic QCA approach to deeply explore the evolutionary mechanism of how multiple conditions combine to shape the high-tech industry market field.
(3) Using the fsQCA approach, this study has identified the market configurations that are conducive to the innovative development of high-tech industries. However, instead of directly providing in-depth vertical explanations for typical cases, the fsQCA approach only provides possibilities for in-depth case analysis. Therefore, future research needs to use approaches such as in-depth interviews to explain the dynamic mechanisms of the construction and evolution of the high-tech industry market.

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Data Availability Statement: The [Excel Form File] data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest: The author declares no conflict of interest.

Appendix A

Table A1. Measurement results of the initial data for each province in China.

Province	IPHI	MF	CI	IIE	BIE	HIA	GSTI
Beijing	10,163.939	0.025	0.0046	84.830	78.230	0.418	0.057
Tianjin	5274.161	0.026	0.0024	80.750	51.760	0.942	0.034

Table A1. *Cont.*

Province	IPHI	MF	CI	IIE	BIE	HIA	GSTI
Hebei	820.701	0.027	0.0036	48.780	53.930	0.469	0.010
Shanxi	742.795	0.010	0.0009	51.280	46.740	0.472	0.014
Inner Mongolia	142.501	0.024	0.0006	46.760	44.970	0.176	0.005
Liaoning	764.732	0.023	0.0031	60.550	47.430	0.410	0.014
Jilin	548.848	0.015	0.0043	54.590	51.210	0.359	0.011
Heilongjiang	489.175	0.014	0.0026	56.050	47.980	0.180	0.008
Shanghai	6611.139	0.017	0.0028	85.630	79.650	0.996	0.051
Jiangsu	10,884.400	0.019	0.0010	77.130	63.200	1.974	0.044
Zhejiang	7916.176	0.036	0.0040	74.260	60.680	1.000	0.044
Anhui	2989.560	0.025	0.0017	63.460	59.270	0.720	0.045
Fujian	5492.937	0.029	0.0011	61.380	54.360	0.801	0.024
Jiangxi	3847.704	0.014	0.0012	51.280	54.540	1.372	0.026
Shandong	1973.534	0.032	0.0041	65.710	59.260	0.713	0.023
Henan	2495.477	0.012	0.0004	50.700	57.170	0.844	0.017
Hubei	3105.104	0.034	0.0037	67.440	53.170	0.718	0.037
Hunan	1665.001	0.025	0.0017	57.340	44.950	0.890	0.017
Guangdong	19,099.977	0.024	0.0047	79.470	68.690	2.556	0.066
Guangxi	366.148	0.004	0.0006	44.840	37.920	0.430	0.012
Hainan	86.349	0.019	0.0127	43.760	55.270	0.259	0.009
Chongqing	4258.644	0.011	0.0005	66.630	60.950	1.061	0.015
Sichuan	1880.438	0.020	0.0015	62.470	67.530	0.866	0.015
Guizhou	526.248	0.017	0.0012	41.240	58.110	0.540	0.020
Yunnan	229.769	0.013	0.0014	43.010	54.130	0.187	0.009
Shaanxi	1625.576	0.029	0.0016	66.580	46.270	0.684	0.016
Gansu	274.084	0.040	0.0015	51.380	41.220	0.153	0.007
Qinghai	516.939	0.023	0.0072	43.950	43.050	0.248	0.008
Ningxia	1624.000	0.032	0.0010	46.680	51.730	0.316	0.024
Xinjiang	61.765	0.016	0.0011	40.590	43.190	0.072	0.008

Appendix B

Table A2. Results of calibration.

Province	IPHI	MF	CI	IIE	BIE	HIA	GSTI
Beijing	1	0.79	0.98	1	1	0.11	1
Tianjin	0.98	0.87	0.73	1	0.28	0.97	0.94
Hebei	0.1	0.92	0.92	0.08	0.48	0.16	0.05
Shanxi	0.08	0.01	0.03	0.16	0.05	0.16	0.23
Inner Mongolia	0.02	0.69	0.01	0.05	0.03	0.02	0.01
Liaoning	0.09	0.56	0.87	0.76	0.06	0.1	0.23
Jilin	0.05	0.05	0.97	0.35	0.24	0.07	0.07
Heilongjiang	0.05	0.03	0.78	0.45	0.08	0.02	0.02
Shanghai	0.99	0.1	0.82	1	1	0.99	1
Jiangsu	1	0.19	0.05	1	0.99	1	0.99
Zhejiang	1	1	0.95	0.99	0.97	0.99	0.99
Anhui	0.8	0.79	0.53	0.88	0.94	0.62	0.99
Fujian	0.98	0.97	0.08	0.8	0.53	0.83	0.77
Jiangxi	0.91	0.03	0.12	0.16	0.56	1	0.82
Shandong	0.59	0.99	0.96	0.94	0.94	0.6	0.74
Henan	0.71	0.02	0	0.14	0.84	0.9	0.51
Hubei	0.82	1	0.93	0.96	0.41	0.61	0.97
Hunan	0.51	0.79	0.53	0.55	0.02	0.94	0.51
Guangdong	1	0.69	0.98	1	1	1	1
Guangxi	0.03	0	0.01	0.03	0	0.12	0.11
Hainan	0.02	0.19	1	0.02	0.65	0.03	0.03
Chongqing	0.94	0.01	0	0.95	0.98	0.99	0.32

Table A2. *Cont.*

Province	IPHI	MF	CI	IIE	BIE	HIA	GSTI
Sichuan	0.56	0.26	0.38	0.85	1	0.92	0.32
Guizhou	0.05	0.1	0.12	0.01	0.9	0.24	0.63
Yunnan	0.02	0.02	0.27	0.02	0.499	0.02	0.03
Shaanxi	0.49	0.97	0.501	0.95	0.04	0.501	0.42
Gansu	0.03	1	0.38	0.17	0.01	0.02	0.01
Qinghai	0.05	0.56	1	0.02	0.01	0.03	0.02
Ningxia	0.49	0.99	0.05	0.05	0.28	0.05	0.77
Xinjiang	0.02	0.07	0.08	0.01	0.01	0.01	0.02

Appendix C

Table A3. Complete results of the sufficiency analysis.

Configurations		Raw Coverage	Unique Coverage	Consistency
	IPHI			
Complex Solution	IIE*BIE*HIA*GSTI	0.547	0.236	0.996
	MF*CI*IIE*BIE*GSTI	0.358	0.047	0.972
	MF*CI*IIE*HIA*GSTI	0.419	0.108	0.997
	solution coverage: 0.702			
	solution consistency: 0.982			
Parsimonious Solution	IIE*GSTI	0.781	0.781	0.948
	solution coverage: 0.781			
	solution consistency: 0.948			
Intermediate Solution	IIE*BIE*HIA*GSTI	0.547	0.236	0.996
	MF*CI*IIE*BIE*GSTI	0.358	0.047	0.972
	MF*CI*IIE*HIA*GSTI	0.419	0.108	0.997
	solution coverage: 0.702			
	solution consistency: 0.982			
	~IPHI			
Complex Solution	~MF*~IIE*~BIE*~HIA*~GSTI	0.387	0.190	0.998
	CI*~IIE*~BIE*~HIA*~GSTI	0.283	0.094	0.980
	~MF*CI*~IIE*~HIA*~GSTI	0.225	0.029	0.997
	~MF*~CI*~IIE*BIE*~HIA*GSTI	0.083	0.040	0.992
	solution coverage: 0.557			
	solution consistency: 0.990			
Parsimonious Solution	~MF*~HIA	0.570	0.338	0.972
	CI*~IIE	0.397	0.165	0.976
	solution coverage: 0.735			
	solution consistency: 0.966			
Intermediate Solution	~MF*~IIE*~BIE*~HIA*~GSTI	0.387	0.190	0.998
	CI*~IIE*~BIE*~HIA*~GSTI	0.283	0.094	0.980
	~MF*CI*~IIE*~HIA*~GSTI	0.225	0.029	0.997
	~MF*~CI*~IIE*BIE*~HIA*GSTI	0.083	0.040	0.992
	solution coverage: 0.557			
	solution consistency: 0.990			

Note: The meaning of * refers to the interaction among conditional variables.

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