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Configuration of Conditions Leading to High National Innovation Competitiveness: A Fuzzy Set Qualitative Comparative Analysis Approach

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Abstract: Under the conditions of economic integration and globalization, the importance of national innovation competitiveness is rapidly increasing. In order to study what combination of conditions can generate higher national innovation competitiveness, this study proposes an improved integrated framework for national innovation competitiveness and it examines the allocation conditions that affect the innovation competitiveness of countries with different income levels using data from the Global Competitiveness Report 2019. This research finds that, first, the means of achieving high innovation competitiveness output are more diversified for high-income and upper-middle-income countries, with countries at these two economic levels achieving high innovation competitiveness output in three scenarios. Second, lower-middle-income countries have a more homogeneous configuration for achieving high innovation competitiveness outputs, with only one scenario, which still holds after a series of robustness tests. Third, for high-income countries, commercialization is a key element affecting their innovation competitiveness enhancement. The study not only bridges the gap between existing theories and research methods but also provides a useful reference for countries at different levels of economic development to improve their innovation competitiveness.

Keywords: global competitiveness index; fuzzy set qualitative comparative analysis; national innovation competitiveness

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1. Introduction

As globalization development progresses, the all-round and multilevel competition between countries and regions has been gradually deepening, and Michael Porter [1], the father of competitive strategy, has stated: "The boom and fall of national competitiveness is a hot topic". Competitiveness is a prerequisite and a tool for sustainable national development [2], and Bris, A, Director of the International Institute for Management Development(IMD) World Competitiveness Centre, suggests that "competitiveness is a way of making progress that does not lead to winners and losers, but vice versa—when two countries compete—they both win". Under the conditions of economic integration and globalization, the importance of national competitiveness is rapidly increasing. National policymakers focus on competitiveness acquisition and maintenance. Thus, national competitiveness plays an important role in development strategies [3].

Current research on national competitiveness has been conducted on a variety of fronts by domestic and foreign scholars. Many researchers link national competitiveness to innovation [4]. It is unclear which specific configurational conditions lead to higher levels of national competitiveness, and Porter [1] has noted that there are often conflicting accounts of national competitiveness, not to mention a lack of universal theories.

In terms of the drivers of national competitiveness, Elena Nisipeanu [5] argues that the determinant of national competitive advantage is material productivity but that there is heterogeneity in material productivity, as its nature in different contexts depends on the complexity of production factors, competitive relationships between industries, collaboration between upstream and downstream firms, and macro policies. Iosif [6] believes that national competitiveness generally stems from innovation capacity, and such capacity is assessed mainly through specific factors such as human resources and intellectual assets. The research of Pu and Liu [7] notes that the competition for comprehensive national power between countries is actually a competition for the ability to innovate in science and technology and human capital and that innovation in science and technology and the accumulation of human capital are dependent on the country's level of educational development.

From the perspective of the national competitiveness evaluation mechanism, the German economist Liszt proposed the concept of "national productivity" in the first half of the 19th century, arguing that comprehensive national strength is composed of the country's scientific and technological level, the quality of its citizens, its political system, its social state, its natural resources and its material means and conditions of production. This is one of the earliest ways of evaluating the competitiveness of a country. The British economist Freeman et al. explicitly proposed the national innovation system (NIS) based on Lister's view [8] and Lundvall's [9] study, among others, and made the NIS formally popular as an analytical method and research framework. In NIS theory, technological innovation capacity is a key source of national competitiveness, and scientific and technological behavior is not only the exclusive domain of scientists, research institutions, or universities but can be implemented through national behavior and can serve the country as a whole such that technological competitiveness begins to take on a national dimension.

Based on the literature review, it can be concluded that most of the current studies on national competitiveness are focused on the impact of individual factors on national competitiveness, with few studies focusing on the competitiveness of countries based on multiple factors. There are currently many studies on evaluating national competitiveness, and, although various typical methods for evaluating national (regional) competitiveness are widely used, there are still many problems [10]. Or, take an individual country as a case study to study its competitiveness, with fewer studies focusing on multiple countries to explore which common configurations can have a positive impact on national competitiveness.

Based on the current literature and research gaps, this study proposes an improved and integrated framework based on the Global Competitiveness Report to examine the configurational conditions that affect a country's innovation competitiveness. Based on the Global Competitiveness Report 2019, this study applies the fuzzy set qualitative comparative analysis (fsQCA) method by examining five dimensions under two pillars, business dynamism and innovation capability (administrative requirements, entrepreneurial culture, interaction and diversity, research and development and commercialization), and identifies the driving paths to enhance the country's innovation competitiveness. Specifically, this study attempts to address the following three questions: (1) What sets of conditions drive high national innovation competitiveness? (2) Which conditions are more important for the competitiveness of countries in terms of innovation? (3) Are there differences in the pathways to competitiveness for different income countries? A framework for research on the impact of national innovation competitiveness is developed, and based on data on the competitiveness of innovation ecosystems in 140 countries (regions) in 2019, we explore the groups of conditions that lead to differences in national innovation competitiveness and the impact mechanisms.

The innovation points of this study are as follows: first, using the fsQCA method to study the configuration conditions affecting the innovation competitiveness of a country, this study proposes an improved national innovation competitiveness comprehensive framework, thus helping to deepen the understanding of national competitiveness factors and expanding the theoretical space. Second, a framework that is based on the global competitiveness index provides a new way to study national competitiveness from the perspective of the innovation ecosystem, helps broaden the perspective of national competitiveness research, deepens the understanding of the driving path and mechanism of national innovation competitiveness, and promotes the improvement of national competitiveness. Third, this study explores the configuration conditions leading to high national innovation competitiveness, providing a useful reference for economies to improve their national innovation competitiveness to catch up with well-performing countries (regions). Fourth, the findings of the study provide theoretical considerations for countries or regions at different levels of economic development to enhance their innovation competitiveness.

Following the World Bank classification, 140 countries are grouped into high-income countries (regions), upper-middle-income countries, lower-middle-income countries, and low-income countries, with the low-income countries not being part of the high innovation performance set. Low-income countries are not considered in the study, as we are exploring the constructive conditions that promote high innovation competitiveness [11].

The study consists of five parts: In the Section 2, we review the literature. In the Section 3, we present data sources and research methods. The Section 4 presents the results of fsQCA, and the Section 5 includes robustness testing. The Section 6 includes a discussion. The Section 7 includes the conclusion.

2. Theoretical Background

2.1. Research Progress on National Competitiveness

Michael Porter [1] proposed the theory of national competitive advantage, considering that factors of production, demand factors, related and supporting industrial factors, and enterprise strategies and competition constitute the national competitive advantage, in which factors of production are divided into two categories, primary and advanced, with the advanced factors of production including modern communication conditions, access to and use of information, talents in higher education, and scientific and technological research institutions. He noted that the status of the advanced factors of production will cause the level of science and technology to gradually dominate the development of national competitiveness. Currently, international competitiveness and technological competitiveness are increasingly becoming hot topics and focal points of academic discussions, with technological competitiveness being an important component and a strong supporting aspect for sustainable development capabilities [12]. Some scholars and institutions have studied the connotation of national competitiveness in terms of key factors such as institutional framework, technology, innovation, productivity, and efficiency [13].

Delgosha and Saheb et al. [14] identified the necessary and sufficient conditions for digitalization in terms of contributing to higher sustainable national competitiveness through fsQCA based on complexity theory. Yang and Kim et al. [15] analyzed the relationship between technological entrepreneurship and national competitiveness based on knowledge spillover theory, and the regulatory effects of innovation-driven economies, using data from the stages of technological entrepreneurship, national competitiveness index, and economic development in 83 countries from 2011 to 2014. Markova [16] explored the correlation between national digital competitiveness and technological innovation patent applications based on traditional innovation theory, intellectual property (IP), and competitiveness management theory.

Wu selected four international typical national science and technology competitiveness-related evaluation methods, analyzed their development process and the current situation of each system, and compared the evaluation objects, theoretical basis, and specific indicators of several methods [10]; based on this analysis, corresponding suggestions were made for the evaluation of China's national science and technology competitiveness. Youssef and Hussein et al. [17] used sample data from six different samples of 18 countries from six different regional clusters to test the proposed relationship between managerial discretion and national competitiveness, aiming to empirically link the discipline of strategic management, particularly high-level theory, to the concept of national performance as measured by competitiveness. Stroie, Dutescu and Munteanu [18] proposed an innovative risk profile analysis model called Reorganization Decision Test (RDT) from the perspective of restructuring or bankruptcy, which is used to analyze the results and improve the company's risk profile, and lay the foundation for the company's competitiveness improvement and strategic planning.

Vo and Tran [19] measured, compared, and contrasted differences in national intellectual capital levels across 104 countries, aiming to examine the relationship between national intellectual capital and national competitiveness using a new National Intellectual Capital Index (INIC). Fyliuk and Honchar et al. [20] used the Global Competitiveness Index (GCI) as a parameter to compare and analyze Ukraine's economic competitiveness and the living standards of the population in relation to other countries, as well as the economic growth rate required for Ukraine to achieve the level of competitiveness of other developed countries. Markaki and Economakis [21] used the value added of technologically advanced domestic exports as an indicator of the level of competitiveness of the national economy based on the assumption that there is a structural relationship between the competitiveness of the national economy and its level of economic development; hence, they determined the hierarchical position of 43 economies in terms of international competitiveness. Khyareh and Rostami [22], based on Generalized Method of Moments (GMM) panel data covering 12 years (2007–2018) and 16 emerging countries, found that innovation activities have an unconditional positive impact on competitiveness and that macroeconomic stability can be used to enhance the positive impact.

2.2. Modelling the Impact of National Competitiveness

IMD and the World Economic Forum (WEF) are the most authoritative international research institutes with detailed rating scales. There are similarities in their views, such that their definitions of national competitiveness have evolved from considering national competitiveness as the ability to produce physical goods to create wealth to the ability of firms to provide a favorable competitive environment, but IMD favors static comparisons while WEF favors dynamic comparisons. WEF's indicators present a relatively more obvious view in that productivity is essentially equivalent to national competitiveness, whereas the IMD considers productivity only as a subfactor in the assessment of national competitiveness.

Although the concept of NIS has been used for 30 years, thus far, NIS has been regarded as a boundary object, which is subject to various definitions [11]. Based on the national innovation system, scholars have further developed the concept of the "innovation ecosystem". Considering that science, technology, and innovation activities at the national level are based on the policy environment and infrastructure, inputs to supply factors such as knowledge, talent, funds, and equipment meet the requirements of knowledge, patents, and technology. Thus, the evaluation of innovation competitiveness at the national level can be carried out from environmental, input, process, and output aspects.

Based on the Global Competitiveness Index published by the WEF, this study attempts to develop a system of analysis of national innovation competitiveness under the "innovation ecosystem", using administrative requirements, entrepreneurial culture, interaction and diversity, research and development, and commercialization as a framework for the analysis of national innovation competitiveness, and to explore the conditions that influence such competitiveness.

The current research has the following shortcomings. First, although current studies have provided rich explanations for theories related to national competitiveness, it is difficult to provide sufficient theoretical support for the choice of differentiated paths to enhance national innovation competitiveness. Second, the enhancement of national innovation competitiveness is interdependent rather than independent between conditions. The literature assumes a uniform symmetric relationship between the independent and dependent variables, limiting the choice of paths to enhance national competitiveness. Third, the realistic improvement of national competitiveness is manifested in the logical relationship between the matching pattern and the result of different conditions, that is, "which configurations of conditional variables cause the resulting variables to appear. Which conditional configurations in turn cause the result variable to disappear". These conditions that lead to high national competitiveness may not be the same as those that lead to low national competitiveness. The current research has not yet paid attention to the complexity of causality in country competitiveness.

The overall innovation competitiveness of a country not only requires a stable administrative system environment, but also a harmonious entrepreneurial culture, appropriate interaction and diversity, strong research and development capabilities, and a certain degree of commercialization. The political system has a moderating effect on the promotion of innovation [23]. From the perspective of the national innovation system, innovation capability is seen as a learning process that occurs within the institutional structure, where producers, disseminators, users, and government agencies of technological knowledge interact to promote competitiveness [24]. A favorable entrepreneurial culture is the foundation for enterprises to start their own businesses. The inputs and outcomes of innovation activities, from the investment of R&D resources to the generation of new patents, new products, and the eventual introduction of inventions into the market, can be measured using indicators such as R&D investment, number of patents, number of patent citations, and number of new product publications [25].

In response to the above analysis of the factors affecting national innovation competitiveness and the linkages between these factors, this paper attempts to introduce the fsQCA approach, exploring the complexity of the causal relationships between administrative requirements, entrepreneurial culture, interaction and diversity, research and development, and commercialization. The theoretical model framework for national competitiveness is constructed by revealing the interaction between different influencing factors, as shown in Figure 1.

2.3. Research Progress in fsQCA Methodology

The qualitative comparative analysis (QCA) method focuses on the combination diversity of causes that lead to a certain social phenomenon and emphasizes the asymmetric relationship between causes and results. This configuration perspective and method provide new ideas for the study of related issues. In recent years, research based on qualitative comparative analysis methods has gradually increased [26]. Pappas and Woodside [27] summarized the basic concepts and principles of the fsQCA method, discussed the differences between fsQCA and variance-based methods, compared fsQCA with structural equation modeling methods, summarized thresholds and practical guidelines, and provided practical guidance for researchers on how to use fsQCA. Patock et al. [28] used fsQCA to study the relationship between executive team heterogeneity and corporate social and environmental performance in Fortune 200 companies in the United States. Liu and Zhang [29] constructed a resource and capability integration framework based on theoretical learning and practice from 2018 to 2021, using the fsQCA method to derive the path driving sustained innovation in new startups. Shen et al. [30] proposed a configuration model consisting of environment, society, governance, scale, and profitability through fsQCA to examine the risk reduction mechanism of corporate social responsibility.

Based on the analysis of the progress of national competitiveness research and the current situation where existing research is unable to provide sufficient theoretical support for the selection of differentiated paths to enhance national innovation competitiveness, this study intends to introduce fsQCA and explore the configuration of factors that affect national innovation competitiveness from the perspective of configuration analysis.

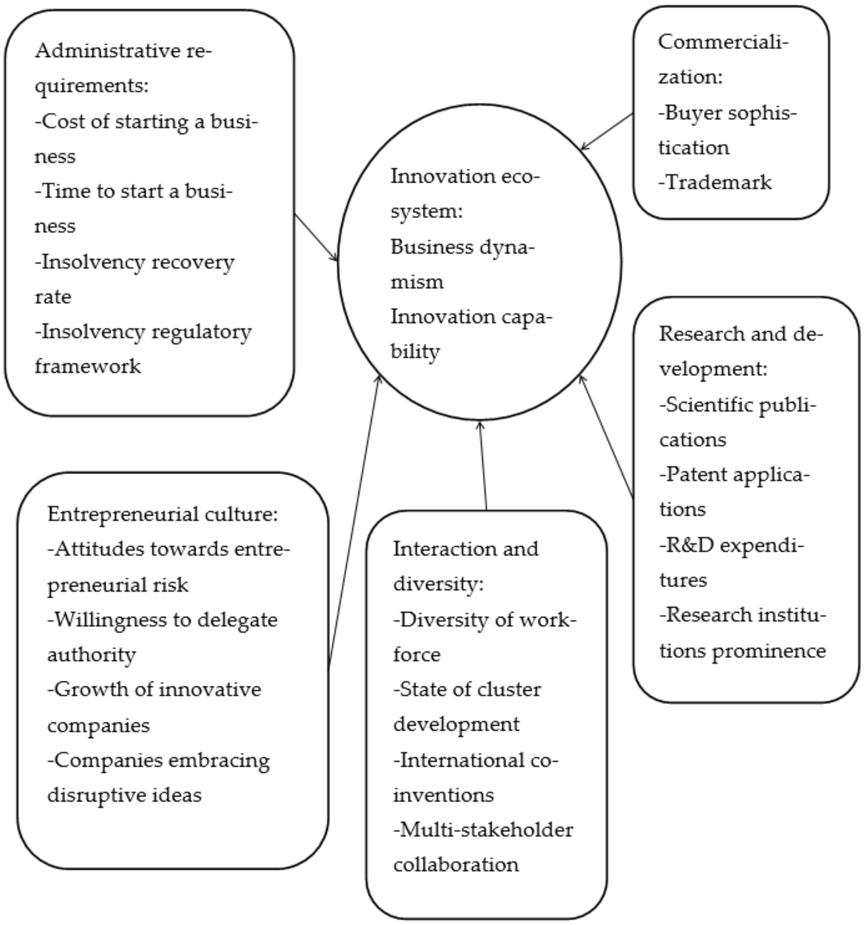

Figure 1. The theoretical model framework for national competitiveness.

3. Data and Methodology

3.1. Data

The sample data selected for this study are from the Global Competitiveness Report 2019. In the report, national competitiveness consists of four parts: Enabling Environment, Human Capital, Markets, and Innovation Ecosystem. This study uses the innovation ecosystem as a measure of national innovation competitiveness, analyzing two dimensions of commercial dynamism and innovation capacity under the innovation ecosystem, including five input indicators—administrative requirements, entrepreneurial culture, interaction, and diversity, research and development, and commercialization—and one output indicator—innovation competitiveness output. The competitiveness output, which evaluates the competitiveness of 140 economies covering 99% of the world's GDP, is a weighted average of the scores of the two pillars of the Global Competitiveness Report: business dynamism and innovation capacity.

To adapt to new economic situations and developments, the Global Competitiveness Index adjusts its indicator system and calculation methods every year, and the data and indicators differ from year to year and cannot be directly compared. And since the National Competitiveness Report 2019 includes 140 countries (regions), covering over 90% of the global GDP and over 90% of the population, the data from the 2019 report are sufficient to support the conclusions, so only one year's data are selected. According to the World Bank's income grouping criteria for economies, high-income countries (regions) have per capita gross national income above $12,536 in 2019, upper-middle-income countries (regions) between $4046 and $12,535, lower-middle-income countries (regions) between $1036 and $4045, and low-income countries (regions) below $1035. Based on the World Bank's income categories, we divided the 140 economies into four groups: high-income group, upper-middle-income group, lower-middle-income group, and low-income group. There are 54 sample data for the high-income group, 34 for the upper-middle-income group, 36 for the lower-middle-income group, and 16 for the low-income group.

3.2. *fsQCA*

Based on the calibration criteria of Du and Jia [31] and Wu et al. [32] and the actual situation of the cases, we manually collected and tabulated data on innovation competitiveness indicators for 140 countries in the Global Competitiveness Report 2019. This paper converts the data into fuzzy set affiliation scores using the direct calibration method based on existing theoretical and empirical knowledge and selects 140 countries with values in the 25%, 50%, and 75% quartiles of coverage for each indicator as the three threshold criteria [33]. If the innovation competitiveness index of a country is above 75%, it is labeled 1, and the country is under the high innovation competitiveness set; if the value is less than 25%, it is marked 0; that is, the country is not affiliated at all with the high innovation competitiveness set. The calibration of the five conditional variables is carried out according to the criteria of 25%, 50%, and 75%. The reason for not calibrating the indicators of each group separately according to their respective 25%, 50%, and 75% percentiles is that if the groups are calibrated separately, it may differ from the actual situation. For example, the 25% percentile value of the Administrative Requirements indicator for high-income groups is 72.1, indicating that countries with innovation output values below 72.1 should not belong to the high innovation competitiveness set at all. However, the 75% percentile value of the innovation output indicator for upper-middle-income groups is 79.2, which means that countries with innovation output values higher than 79.2 should fully belong to the high innovation competitiveness set. This is inconsistent with the results in the Global Competitiveness Report and does not match the actual situation. Calibration information for each condition and its result is shown in Table 1.

Table 1. Calibration of conditions and results.

Variables	Max	Fully Affiliated	Intersection	Completely Unaffiliated	Min
Innovation Ecosystem	84.14	55.47	47.15	39.91	16.98
Administrative requirements	94.00	81.06	70.01	60.61	0.80
Entrepreneurial culture	76.00	56.94	50.26	44.64	27.40
Interaction and diversity	78.70	48.46	40.16	33.56	17.50
Research and development	100.00	47.34	25.11	20.21	13.50
Commercialization	84.90	67.99	55.01	44.51	11.80

Data sources: the Global Competitiveness Report 2019.

Meanwhile, the truth table is obtained after the calibration of the low-income group, as shown in Table 2. In Table 2, the 5 conditional variables of the 12 countries are assigned a value of 0, which means that the 5 conditional variables of these countries are not related to the configuration of conditions that drive high innovation competitiveness. Low-income countries (regions) do not belong to the high innovation competitiveness cluster. Low-income countries (regions) are not considered in the study because we are exploring the configurations of conditions that promote high innovation competitiveness.

Table 2. Calibration results for low-income countries (regions).

Administrative Requirements	Entrepreneurial Culture	Interaction and Diversity	Research and Development	Commercialization	Number	Raw Consist
0	1	0	0	0	2	0.205645
0	0	0	0	0	12	0.033333

4. Data Analysis and Empirical Results

4.1. Necessity Analysis of Individual Conditions

Before undertaking a conditional grouping analysis, it is necessary to examine the 'necessity' of each condition individually. In conjunction with mainstream QCA research, this study first examines whether a single condition (including its nonsets) constitutes a necessary condition for the competitiveness of an innovation ecosystem. In QCA, a condition is necessary for an outcome when it is always present as the outcome occurs. Consistency is an important test for a necessary condition, and when consistency is greater than 0.9, then that condition is necessary for the outcome [33].

Table 3 shows the results of the necessary condition test for the competitiveness of high- and nonhigh-level innovation ecosystems analyzed using fsQCA3.0 software. As shown in Table 3, the level of agreement for all conditions is less than 0.9. Therefore, there are no conditions necessary to influence the competitiveness of nonhigh- and high-level innovation ecosystems in a country (region).

Table 3. Analysis of necessary conditions.

Condition Variables	High Innovation Ecosystem Competitiveness		Non-High Innovation Ecosystem Competitiveness	
	Consistency	Coverage	Consistency	Coverage
Administrative requirements	0.839	0.831	0.298	0.303
Non-Administrative requirements	0.296	0.291	0.834	0.841
Entrepreneurial culture	0.795	0.792	0.327	0.334
Non-Entrepreneurial culture	0.331	0.324	0.796	0.800
Interaction and diversity	0.882	0.897	0.246	0.257
Non-Interaction and diversity	0.269	0.258	0.901	0.887
Research and development	0.872	0.892	0.248	0.261
Non-Research and development	0.278	0.265	0.897	0.877
Commercialization	0.278	0.265	0.262	0.269
Non-Commercialization	0.882	0.881	0.884	0.885

Data sources: the Global Competitiveness Report 2019.

After analyzing the necessary conditions, an initial truth table was obtained. A simplified truth table was obtained by setting minimum case frequencies and consistency thresholds [34]. fsQCA3.0 software is based on Boolean algebraic operations to obtain the configuration conditions. In the operation of the fsQCA3.0 software, the choice of the consistency threshold has a significant impact on the configuration results. Schneider [35] stated that the consistency level for determining adequacy should not be lower than 0.75. The frequency threshold should be determined according to the sample size, with a frequency threshold of 1 for small and medium samples and a frequency threshold greater than 1 [36]. In specific studies, the distribution of cases in the truth table and the researcher's familiarity with the observed cases should also be considered. The final consistency threshold determined for this study was 0.85, and the frequency threshold was 2.

To visually report results, Ragin uses solid circles to indicate the presence of a condition and hollow circles to indicate the absence of a condition; the size of the circle distinguishes between core and peripheral conditions; and a blank indicates that the condition is optional.

4.2. Results for High-Income Countries

In fsQCA, the model is considered valid when the consistency value is above 0.74 and the coverage range is between 0.25 and 0.65 [37]. The results for high-income countries are shown in Table 4. a1, a2, and a3 represent three conditional configurations for high-income countries to achieve higher innovation competitiveness output.

Table 4. Configuration in high-income countries.

Configurations	a1	a2	a3
Administrative requirements	•	•	
Entrepreneurial culture	⊗	⊗	•
Interaction and diversity	•		•
Research and development		•	•
Commercialization	•	•	•
consistency	1.000	0.954	0.999
raw coverage	0.192	0.203	0.709
unique coverage	0.023	0.034	0.623
solution consistency		0.988	
solution coverage		0.849	

"•" indicates the presence of a core condition, "⊗ " indicates the absence of a core condition.

The table above shows that the overall consistency of the results of the configuration analysis for high-income countries is 0.988 and the overall coverage is 0.849, and thus it is greater than the acceptable minimum. The results are therefore valid. The highest coverage of 0.709 was found for configuration 3, which explains 70.9% of the cases. Therefore, this configuration is most relevant for high-income countries. The consistency of configuration 3 is 0.999, meaning that 99.9% of entrepreneurial culture, interaction and diversity, research and development, and commercialization achieve higher innovation competitiveness outputs in high-income countries.

High innovation competitiveness outputs can also be achieved in high-income countries for both configuration 1 and configuration 2. Configuration 1 shows that in the absence of a well-established entrepreneurial culture, high-income countries with well-established administrative requirements, interaction and diversity, and commercialization conditions achieve higher innovation competitiveness output. Configuration 2 shows that in the case of an imperfect entrepreneurial culture, high-income countries with well-established administrative requirements, research and development, and commercialization achieve higher innovation competitiveness outputs. That is, the conditions for achieving high innovation competitiveness output are not unique, and different configurations can achieve closely similar high innovation competitiveness output.

4.3. Results for Upper-Middle-Income Countries

The results of the configuration analysis for upper-middle-income countries are shown in Table 5. a1, a2, and a3 represent three conditional configurations for upper-middle-income countries to achieve higher innovation competitiveness output, respectively.

Table 5. Configuration in upper-middle-income countries.

Configurations	a1	a2	a3
Administrative requirements	•	⬤	•
Entrepreneurial culture	•	⊗	•
Interaction and diversity	⬤	•	⬤
Research and development	⊗	•	•
Commercialization	⊗	⊗	•
consistency	0.995	0.994	0.999
raw coverage	0.243	0.218	0.430
unique coverage	0.104	0.049	0.229
solution consistency		0.998	
solution coverage		0.583	

"•" indicates the presence of a core condition, "⬤" indicates the presence of a peripheral condition, "⊗" indicates the absence of a core condition.

The overall consistency of the MIC results was 0.998, with an overall coverage of 0.583, and thus is greater than the acceptable minimum. Therefore, the result is valid. Among the results, configuration 3 had the highest coverage of 0.430; configuration 3 explained 43% of the cases. Therefore, this configuration has the greatest significance for upper-middle-income countries. The consistency of construct 3 is 0.999, meaning that 99.9% of those with well-established administrative requirements, entrepreneurial culture, interaction and diversity, research and development, and commercialization in upper-middle-income countries have achieved higher innovation competitiveness outputs.

High innovation competitiveness outputs can also be achieved in upper-middle-income countries for both configuration 1 and configuration 2. Configuration 1 shows that in the case of imperfect research and development and commercialization, upper-middle-income countries with well-established administrative requirements, entrepreneurial culture, interaction, and diversity achieve higher innovation competitiveness outputs. Configuration 2 shows that in the case of imperfect entrepreneurial culture and commercialization, upper-middle-income countries with well-established administrative requirements, interaction and diversity, and research and development achieve higher innovation competitiveness outputs.

4.4. Results for Lower Middle-Income Countries

The results of the analysis for lower-middle-income countries are shown in Table 6 below. a1 represents the configuration of conditions for lower-middle-income countries to achieve higher innovation competitiveness output.

Table 6. Configuration in lower-middle-income countries.

Configurations	a1
Administrative requirements	⊗
Entrepreneurial culture	●
Interaction and diversity	●
Research and development	●
Commercialization	⊗
consistency	0.892
raw coverage	0.549
unique coverage	0.549
solution consistency	0.892
solution coverage	0.549

"●" indicates the presence of a peripheral condition, "⊗" indicates the absence of a core condition, "⊗" indicates the lack of a peripheral condition.

The results of the analysis of the configuration for lower-middle-income countries show that the configuration of conditions for achieving high innovation competitiveness outputs is relatively homogeneous in lower-middle-income countries (regions). In the case of imperfect administrative requirements and commercialization, lower-middle-income countries with mature conditions for research and development, entrepreneurial culture, interaction, and diversity may achieve higher innovation competitiveness outputs.

5. Robustness Testing

In the above qualitative comparative analysis, we set the quantiles for data calibration to 25%, 50%, and 75%. Referring to research by Pappas and Woodside [27], to verify the robustness of the findings, we reran the data analysis using the original data, set the quantiles for data calibration to 20%, 50%, and 80%, and further analyzed the configurations of conditions for achieving higher innovation competitiveness output in high-income, upper-middle-income and lower-middle-income countries. The specific configurations of the combination of condition elements are shown in Tables 7–9. b1, b2, and b3 represent the configuration of conditions for achieving higher innovation competitiveness output in each group of countries undergoing robustness testing.

Table 7. Results for high-income countries.

Configurations	b1	b2	b3
Administrative requirements	•	•	
Entrepreneurial culture	⊗	⊗	•
Interaction and diversity	•		•
Research and development		•	•
Commercialization	•	•	•
consistency	1.000	0.954	0.997
raw coverage	0.217	0.228	0.732
unique coverage	0.023	0.033	0.614
solution consistency		0.985	
solution coverage		0.865	

"•" indicates the presence of a core condition, "⊗ " indicates the absence of a core condition.

Table 8. Results for upper-middle-income countries.

Configurations	b1	b2	b3
Administrative requirements	•	•	•
Entrepreneurial culture	•	⊗	•
Interaction and diversity	●	●	●
Research and development	⊗	•	•
Commercialization	⊗	⊗	•
consistency	0.978	1	1
raw coverage	0.305	0.271	0.479
unique coverage	0.103	0.041	0.215
solution consistency		0.989	
solution coverage		0.626	

"•" indicates the presence of a core condition, "●" indicates the presence of a peripheral condition, "⊗ " indicates the absence of a core condition.

Table 9. Results for lower-middle-income countries.

Configurations	b1
Administrative requirements	⊗
Entrepreneurial culture	●
Interaction and diversity	●
Research and development	●
Commercialization	⊗
consistency	0.901
raw coverage	0.583
unique coverage	0.583
solution consistency	0.901
solution coverage	0.583

"●" indicates the presence of a peripheral condition, "⊗ " indicates the absence of a core condition, "⊗" indicates the lack of a peripheral condition.

It can be concluded from the above analysis that after changing the quantiles for data calibration to "20%, 50%, and 80%", the conditional configurations of high-income countries, upper-middle-income countries, and lower-middle-income countries remain unchanged, and the consistency coefficients and coverage rates are roughly the same as the results of the original analysis. Hence, the study results are robust.

6. Discussion

Using the Global Competitiveness Report 2019 as a data source, this study examines the configurational conditions that promote high innovation competitiveness output in countries. The study groups these 140 economies according to the World Bank's income categories, clustering high-income countries (regions), upper-middle-income countries (regions), and lower-middle-income countries (regions) in groups, and explores the differences in configurations between countries at different income levels. This study has profound implications in both theory and practice, and the main conclusions and innovations are as follows.

6.1. Theoretical Significance

Firstly, this study proposes an improved national innovation competitiveness comprehensive framework, thus helping to deepen the understanding of national competitiveness factors and expanding the theoretical space. By using the fsQCA method to study the configuration conditions affecting the innovation competitiveness of a country, this study expands the theoretical space of the fsQCA method in the field of competitiveness.

Secondly, an analysis of the configuration of conditions affecting high-income countries in this study shows that commercialization as a peripheral condition for achieving high innovation competitiveness output is found in all three pathways of configuration 1, configuration 2, and configuration 3, suggesting that for high-income countries, commercialization is a key factor influencing their innovation upgrading. The results of this research provide a theoretical basis for high-income countries to enhance their innovation capacity by improving the market environment [38]. High-income countries can continuously gain competitive advantages through innovative business models and the commercialization of research and development achievements.

Thirdly, based on the results of upper-middle-income countries and lower-middle-income countries, their overall achievement coverage rates are 0.583227 and 0.548561, respectively. The reason for this research result may be that many countries have lower competitiveness rankings and have not achieved high innovation performance. From the configurations that lead to high innovation performance in upper-middle-income countries and lower-middle-income countries, it can be seen that countries at different income levels have different focus points in launching innovative development strategies in order to achieve high-quality innovation results. This research result provides theoretical thinking for high-income and low-income countries to enhance their innovation competitiveness, encouraging them to learn from countries with similar income levels but higher innovation competitiveness.

6.2. Practical Significance

Firstly, the findings show that high-income and upper-middle-income countries achieve high innovation competitiveness output in a more diversified manner, with countries at these two economic levels achieving high innovation competitiveness output in three scenarios. In contrast, lower-middle-income countries achieve high innovation competitiveness output in a more homogeneous configuration, with only one scenario.

Secondly, by observing the configuration path of nonhigh innovation performance in high-, upper-middle- and low-middle-income countries, it was found that the lowest number of core variables were missing in the results for lower-middle-income countries, followed by upper-middle-income countries and then high-income countries, indicating that the lower the income level of the country, the more homogeneous the key barriers to innovation. The result once again confirms the conclusion of this study: lower-middle-income countries have a relatively homogeneous approach to achieving high innovation competitiveness outputs.

When enhancing core competitiveness, countries or regions can refer to the conclusions of this study, and different conditions can achieve the goal of high national innovation competitiveness. For example, for high-income countries, the competitiveness of national innovation can be enhanced through the enhancement of entrepreneurial culture, the increase in interaction and diversity, the improvement of research and development levels, and commercialization. Competitiveness can also be enhanced by improving the administrative level, interaction and diversity, and commercial maturity while emphasizing that commercialization is a key factor affecting innovation in high-income countries.

7. Conclusions

This study constructs a national innovation competitiveness analysis system based on administrative requirements, entrepreneurial culture, interaction and diversity, research and development, and commercialization, exploring the configuration of conditions that affect national innovation competitiveness. We explore the configuration conditions that lead to high national innovation competitiveness and compare the differences between countries with different levels of economic development through fsQCA. The findings show that the paths to high innovation competitiveness vary across countries or regions at different levels of development and that lower-middle-income countries have a more homogeneous configuration for achieving high innovation competitiveness compared to high-income countries and upper-middle-income countries. The study not only bridges the gap between existing theories and research methods but also provides a useful reference for countries at different levels of economic development to improve their innovation competitiveness.

Some limitations remain in this study. First, we only use the data from the Global Competitiveness Report 2019 for analysis, without a comprehensive analysis of the multiyear data. In future studies, we can consider integrating multiyear Global Competitiveness Reports to make the results more robust. Second, this study only uses the indicators from the Global Competitiveness Report and does not consider other indicators that affect national innovation competitiveness. In future research, the configuration that affects national innovation competitiveness can be explored more comprehensively by adding other factors. In addition, we can explore the configurations that affect the innovation competitiveness of low-income countries and provide a reference for low-income countries to improve their innovation competitiveness.

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References

1. Porter, M.E. *The Competitive Advantage of Nations*; Competitive Intelligence Review; The Free Press: New York, NY, USA, 1990.
2. Sachs, J.D. Globalization and patterns of economic development. *Rev. World Econ.* **2000**, *136*, 579–600. [CrossRef]
3. Staskevičiūt, G.; Tamošiūnien, R. The Evaluation of the National Competitiveness: Analysis of Existing Means. In Proceedings of the 6th International Scientific Conference, Vilnius, Lithuania, 13–14 May 2010; Vilnius Gediminas Technical University: Vilnius, Lithuania, 2010; pp. 495–503.
4. Ibrahimov, M.; Aleksic, A.; Dukic, D. (Eds.) Economic and Social Development. In *37th International Scientific Conference on Economic and Social Development—Socio Economic Problems of Sustainable Development, Baku, Azerbaijan, 14–15 February 2019*; Varazdin Development and Entrepreneurship Agency: Varazdin, Croatia, 2019; pp. 279–287.
5. Nisipeanu, E. Determinants of the National Competitive Advantage (NCA). *Int. J. Acad. Res. Bus. Soc. Sci.* **2013**, *3*, 444.
6. Iosif, A.E. Innovation as a generator of national competitiveness in the European Union. In Proceedings of the 8th International Management Conference "Management Challenges for Sustainable Development", Bucharest, Romania, 6–7 November 2014.
7. Pu, X.; Liu, X. A study of the association between educational development and national competitiveness based on potential profile analysis-empirical evidence from a cross-country sample. *World Educ. Inf.* **2021**, 11–17. Available online: https://xueshu.baidu.com/usercenter/paper/show?paperid=1b0f0jt0ex5e08p09m0n0630x3438677&site=xueshu_se&hitarticle=1 (accessed on 21 August 2023).

8. Freeman, C. The Economics of Industrial Innovation. *Soc. Sci. Electron. Publ.* **1997**, *7*, 215–219.
9. Lundvall, B. National Business Systems and National Systems of Innovation. *Int. Stud. Manag. Org* **1999**, *29*, 60–77. [CrossRef]
10. Zhongqian, W. Comparative Study of National Science and Technology Competitiveness Evaluation Methods: Based on Analysis of International Typical Cases. *Sci. Technol. Manag. Res.* **2019**, *39*, 50–56.
11. Wang, X.; Wang, Z.; Jiang, Z. Configurational differences of national innovation capability: A fuzzy set qualitative comparative analysis approach. *Technol. Anal. Strateg.* **2021**, *33*, 599–611. [CrossRef]
12. Tong, X.; Zhou, L. Analysis of the current situation of China's science and technology competitiveness and countermeasures. *Stat. Sci. Pract.* **2005**, 10–11. [CrossRef]
13. Wang, J.; Zhu, T.; An, W.; Li, C.; Zhu, Q.; Deng, J. Studies on Strengthening National Competitiveness through Quality Improvement. *China Soft Sci.* **2021**, 1–8. Available online: https://xueshu.baidu.com/usercenter/paper/show?paperid=1v360mj0x96t0af0gt5h0ea09f423512&site=xueshu_se&hitarticle=1 (accessed on 21 August 2023).
14. Delgosha, M.S.; Saheb, T.; Hajiheydari, N. Modelling the Asymmetrical Relationships between Digitalisation and Sustainable Competitiveness: A Cross-Country Configurational Analysis. *Inf. Syst. Front.* **2021**, *23*, 1317–1337. [CrossRef]
15. Yang, S.; Kim, Y.; Doohee, C. Nonlinear Relationship Between Technological Entrepreneurship and National Competitiveness: The Moderation Effect of Innovation-driven Economy. *Moderat. Eff. Innov.-Driven Econ.* **2019**, *27*, 113–142. [CrossRef]
16. Markova, M. Correlation between National Digital Competitiveness and Country's World Place as a Patent Application Activity in Top Fields of Innovations for 2018 Year. *NTUT J. Intellect. Prop. Law Manag.* **2020**, *9*, 1–20.
17. Youssef, M.S.H.; Hussein, H.M.; Christodoulou, I. Competitiveness and managerial discretion: An empirical investigation at the national-level. *Compet. Rev. Int. Bus. J.* **2019**, *29*, 181–203.
18. Stroie, C.; Duțescu, A.; Munteanu, I.F. The reorganisation decision test: A risk analysis model to increase competitiveness. *Competitiveness* **2023**, *15*, 78–95.
19. Duc Hong, V.; Phu, T.N. Measuring national intellectual capital: A novel approach. *Intellect. Cap.* **2022**, *23*, 799–815.
20. Fyliuk, H.; Honchar, I.; Kolosha, V. The interrelation between economic growth and national economic competitiveness: The case of ukraine. *Competitiveness* **2019**, *11*, 53–69. [CrossRef]
21. Markaki, M.; Economakis, G. International structural competitiveness and the hierarchy in the world economy—Theoretical and empirical research evidence. *World Rev. Polit. Econ.* **2021**, *12*, 195–219.
22. Khyareh, M.M.; Rostami, N. Macroeconomic Conditions, Innovation and Competitiveness. *Knowl. Econ.* **2022**, *13*, 1321–1340. [CrossRef]
23. Xiong, F.; Zang, L.; Gao, Y. Internet penetration as national innovation capacity: Worldwide evidence on the impact of ICTs on innovation development. *Inform. Technol. Dev.* **2021**, *28*, 39–55. [CrossRef]
24. Borrás, S.; Laatsit, M. Towards system-oriented innovation policy evaluation? Evidence from EU28 member states. *Res. Policy* **2019**, *48*, 312–321. [CrossRef]
25. Park, J.; Shin, H.H. The Effect of Venture Capital Investment on Corporate Innovation Performance. *Asia-Pac. J. Bus. Ventur. Entrep.* **2020**, *15*, 1–15.
26. Li, X. The Impact of Top Management Team Heterogeneity on Firm Performance—A Research Based on Fuzzy Set Qualitative Comparative Analysis. Master's Thesis, Yunnan University of Finance and Economics, Kunming, China, 2023.
27. Pappas, I.O.; Woodside, A.G. Fuzzy-set Qualitative Comparative Analysis (fsQCA): Guidelines for research practice in Information Systems and marketing. *Inf. Manag.* **2021**, *58*, 102310. [CrossRef]
28. Patock, V.; Stahl, G.; Doh, J. Linking Top Management Team Diversity and Corporate Social Performance: A Configurational Approach. *Acad. Manag. Proc.* **2018**, 11760. [CrossRef]
29. Liu, Y.; Zhang, H. Driving Sustainable Innovation in New Ventures: A Study Based on the fsQCA Approach. *Sustainability* **2022**, *14*, 5738. [CrossRef]
30. Zhong, S.; Hou, J.Z.; Li, J.W.; Gao, W. Exploring the relationship of ESG score and firm value using fsQCA method: Cases of the Chinese manufacturing enterprises. *Front. Psychol.* **2022**, *13*, 1019469. [CrossRef]
31. Du, Y.; Jia, L. Group Perspective and Qualitative Comparative Analysis (QCA): A New Path for Management Research. *Manag. World* **2017**, 155–167. [CrossRef]
32. Wu, Q.; Zhang, X.; Wang, Q.; Cheng, X. Entrepreneuship Orientation, Strategic Flexibility. Internationalization Degree and Firm Performance. *Chin. J. Manag.* **2019**, *16*, 1632–1639.
33. Ragin, C.C.; Fiss, P.C. *Net Effects Analysis Versus Configurational Analysis: An Empirical Demonstration*; University of Chicago Press: Chicago, IL, USA, 2008.
34. Ragin, C.C. *The Comparative Method: Moving Beyond Qualitative and Quantitative Strategies*; University of California Press: Berkeley, CA, USA, 2014.
35. Verweij, S. Set-theoretic methods for the social sciences: A guide to qualitative comparative analysis. *Soc. Res. Method* **2013**, *16*, 165–166.
36. Zhang, M.; Chen, W.; Lan, H. Why Do Chinese Enterprises Completely Acquire Foreign High-Tech Enterprises—A Fuzzy Set Qualitative Comparative Analysis (fsQCA) Based on 94 Cases. *China Ind. Econ.* **2019**, *4*, 117–135.

37. Woodside, A.G. Moving beyond multiple regression analysis to algorithms: Calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data analysis and crafting theory. *Bus. Res.* **2013**, *66*, 463–472. [CrossRef]
38. Liu, Z.; Cao, P.; Tu, Y. Can High-Income Countries Produce High Innovation Performance?—Fuzzy-Sets Qualitative Comparative Analysis Based on 118 Countries and Regions. *Forum Sci. Technol. China* **2021**, *4*, 171–179.