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Research on the Generating Mechanism of Urban Talent Competitiveness Based QCA Method: A Configurational Analysis of 24 Chinese Cities

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Abstract: Talent competition is the core of urban competition; urban development needs strong talent competitiveness. This study applies configuration thinking and the QCA method through the integration of six influencing conditions, namely talent scale, talent structure, talent innovation, talent development, talent efficiency and talent living, it selects 24 Chinese cities as research cases, explores the generation mechanism of urban talent competitiveness. The results demonstrate that: (1) Talent scale, talent innovation, talent development and talent living are the key conditions for generating urban talent competitiveness; (2) The quality improvement mode, innovation leading mode and resource competitive mode are the main modes of generating urban talent competitiveness; the resource competitive mode is the most common combination of strategies for generating urban talent competitiveness; (3) Talent development and talent living have a substitution relationship in the process of generating urban talent competitiveness; (4) The configuration that hinders the generation of competitiveness and promotes the generation of competitiveness is asymmetric.

Keywords: urban talent competitiveness; urban development; talent cultivation; talent sustainable development; QCA method

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1. Introduction

Urban competition is the competition for talents, and talent dividends are the future of a city [1,2]. The competitiveness of urban talents shows the competitive advantages of a city in talents. Urban talent competitiveness is a comprehensive, multi-level and systematic concept, covering many factors [3,4]. Nowadays, urban competition is becoming increasingly fierce; all kinds of high-quality resources quickly gather in highly competitive cities. Talent has become an important variable affecting urban competitiveness; cities with strong talent competitiveness are likely to stand out in urban competition [5–8]. Talent has become an important resource for the development of global cities. New York, London, Tokyo and other first-tier cities in the world have become international high-quality talent-gathering places, while cities in developing countries, such as Beijing and Shanghai, are also striving to create a high-quality talent development environment, and gradually become a new gathering place for international talent [9].

From a micro perspective, talent competitiveness is an important manifestation of urban development and also a source of power that affects urban development and innovation [10,11]. It is also the key to urban industrial transformation and upgrading, consumer market construction, the improvement of research and the development strength [12]. Which is of great significance to innovation, entrepreneurship and high-quality urban development. From the macro level, the coordinated development of talents and cities has effectively improved the comprehensive strength of the country, and has kept the country in a favorable position in the global competition, which is key to developing countries to "jump out of the middle-income trap" [13,14].

Meanwhile, because of the rapid development and changes of cities, the research on urban talent competitiveness also presents a larger scope of research. The research on the causes and mechanisms of urban talent competitiveness needs to be described subjectively from the perspective of talent attraction, talent cultivation and talent development [15–17]. Cerna and Mujtaba are the representatives of talent attraction [18,19]. They believe that cities should formulate more policies to attract talents, take attracting talents as the main direction of urban development and attract talents through the construction of livable urban environment, housing and other conditions [20–22]. Some scholars also believe that urban talent competitiveness is the result of urban development, and point out that it should not violate the law of urban development in order to attract talents [23–25]. Some scholars, who comment from the perspective of demand and supply, believe when cities can provide enough middle- and high-end jobs, cities will attract more high-quality talents [26,27]. Some scholars put forward more views on talent cultivation. They believed that cities need to build a talent cultivation system and cultivate local talents through innovative development and other ways, which can not only improve the competitiveness of cities, but also make local talents more stable [28–30]. Because there are many reasons for talent competitiveness, many experts have carried out systematic analysis around the evaluation indicators of talent experience, and have given a series of indicator systems, such as talent quality, talent innovation and talent environment [31,32]. The above research provides an important research foundation for the generation of urban talent competitiveness. At the same time, the existing research mostly focuses on the description of the reasons for urban talent competitiveness. However, it is worth asking the following: How are many of the reasons connected? What interaction rules are followed? What circumstances will urban talent competitiveness generate? These issues still need to be further clarified.

Therefore, this study focuses on the core issue of "how to generate urban talent competitiveness", and based on the talent competitiveness index system developed by experts and scholars, adopts the qualitative comparative analysis research method, systematically analyzes the influencing factors of the generation of urban talent competitiveness, constructs the generation model of urban talent competitiveness, and reveals the internal logic of the generation of urban talent competitiveness. Additionally, this study provides a theoretical basis and practical reference for the cultivation of urban talent competitiveness.

2. Theoretical Basis and Research Framework

2.1. Theoretical Analysis on the Generation of Urban Talent Competitiveness

Urban talent competitiveness refers to the comprehensive effect of various factors such as the quantity, scale, quality, ability, structural level, output efficiency and growth environment of talent resources, and then, generates a comparative competitive advantage over other cities in terms of introducing, cultivating and stimulating talent potential [33,34]. The generation of urban talent competitiveness is a complex process, which is affected by multiple factors. To generate urban talent competitiveness, two aspects are involved: one is the talent attraction of the city, such as talent scale, quality structure, talent benefits and so on [35,36]; the other is the city's ability to acquire, maintain and develop talents; this is reflected in the attraction talents of cities [32,37]. The widely recognized study of the World Competitiveness Yearbook published by IMD sets the complex factors of talent scale, talent structure, talent innovation, talent development, talent efficiency and talent living [38]. Then, the paper deeply analyzes the production mechanism of urban talent competitiveness in view of these six conditions.

Talent scale mainly refers to the talent reserve of cities. The permanent population and employees are both important driving forces towards the increase of talent competitiveness. Especially in modern cities, the increase in population flow has affected the stability of urban population size. Talents with technology and skills have the advantage of free flow; city managers also attract talents by formulating preferential policies such as housing and income [18]. The frequent flow of talents initially existed in international cities of developed countries; managers provided high-quality services to urban talents, which

could maintain the talent number high. Then, with the increasing demand for talents in developing economies, more and more cities in developing nations began to build attractive talent policy systems, which could expand the scale of urban talents [39] Professor Glaeser of Harvard University pointed out in his book Triumph of the City that urban prosperity depends on population flow and talent gathering; cities provide a large number of jobs for the workforce, which creates a key platform for talent competition and makes employees from different industries settle down in the city [40]. The advantage of human resources gives the city strong competitiveness.

Talent structure is a form of talent system. The structure of personnel is composed of three levels: individual quality structure of talents, group structure of talents and social structure of talents. Education level is the basic standard of measuring talent structure; the urban talent system needs to be jointly constructed by talents with different academic qualifications [41]. Employment status is an important reflection of talent structure, as primary, secondary and tertiary urban industries all need sufficient employment talents [42]. The conditions of finance, technology and education guarantee a reasonable talent structure; first-class cities in the world often have these high-quality conditions [43]. The process of urban development and evolution need different types of talents. The Handbook of Regional and Urban Economics emphasizes the importance of talents' work on scientific research, finance and other fields [44]. Additionally, high-knowledge talents can effectively promote urban economic growth [45]. So, talent structure is a significant factor to improve urban talent competitiveness.

Talent innovation is the process of discovering, cultivating and adding value to talents through effective methods. Enhancing talent innovation ability has become the common in urban competition [29]. Both developed and developing countries put no effort in urban talent innovation investment. Cities with strong innovation ability tend to have stronger competitiveness with talents. Innovative cities have invested large amounts of resources for talent development, which provide an advanced system and environment for stimulating talents' innovative vitality, and it is more conducive to the formation of a talent gathering effect [17]. According to the Global Talent Flow: Trends and Prospects report by CCG, to a great extent, the performance of urban innovation determines the competitiveness of urban talents [46]. Therefore, the key role of talent innovation cannot be ignored in improving the competitiveness of urban talents.

Talent development has been a long-term issue in the relationship between knowledge level and work ability. Talent development is based on the combination of theory and practice [47]. Talent sustainable development requires continuous updating of knowledge, and quality cultural and educational resources are significant conditions for knowledge acquisition [48]. The role of education in the cultivation of urban competitiveness is crucial; educational conditions mainly include basic education, secondary education, vocational education and higher education; the quality of education provides knowledge and skills for talent growth and makes talents increase their employability in cities [4,15]. High-quality education conditions also make cities more attractive; in the process of talent migration, people prefer cities with richer educational resources [3]. Meanwhile, skills training should also not be ignored, especially when the manufacturing industry returns to the main economic battlefield. Cities in developing countries have increased their investment in vocational and technical education [13]. Toyota Talent: Developing Your People the Toyota Way underlines the great value of skills and practical talents for the modern manufacturing industry [49]. Urban competitiveness is inseparable from the comprehensive development of talents.

Talent efficiency is the performance of expected results or influence achieved by talent management. In the theory of human resource, talent efficiency demonstrates the effectiveness of the human resources system by calculating whether different human inputs have produced corresponding effects [50]. Investment and consumption are important cornerstones for improving urban competitiveness, and investment and consumption need to be activated by talents. Talent gathering increases high consumption demand and

enhances urban purchasing power [12]. As explained in the Harvard Business Review (HBR), talent gathering makes cities obtain better economic and social benefits, and it is an important embodiment of the competitiveness of urban talents [51]. Young talents can more effectively promote urban competitiveness; the consumption demand of young people, such as college graduates, is stronger. Cities where young talents gather are also more likely to attract domestic and foreign capital investment [16].

Talent urban living is an experience that is comprehensive and impressive; it is a component of the urban soft environment. Based on the UNDP of the Human Development Report 2021–2022, talent gathering depends on the livability level. Talents' living environment is one of most core competitiveness factors in urban transformation and development [52]. To some extent, the quality of life has become the primary guarantee of urban competitiveness; many talents choose to leave a city because of high housing prices, air pollution, traffic jams, lack of entertainment or insufficient medical resources [1,20,22]. In a study by WEF, the talent living environment is the potential competitiveness of cities, which determines whether talent vitality can be effectively released [53]. Thus, talent living is a crucial influencing factor for urban talent competitiveness.

2.2. Research Framework

Recent research has extensively discussed the competitiveness of urban talents, and it shows that the formation of urban talent competitiveness has affected multiple dimensions. Compared with the single-factor consideration or regression analysis of multiple factors, there seems to be room for expansion in the interactive research on the factors affecting the competitiveness of urban talents. Investigating the configuration effect among different influencing factors can help us uncover the black box of the generation of urban talent competitiveness, and compare and analyze the cases of different cities. Based on the scholars' summary of the factors affecting the competitiveness of urban talent, this paper builds the research framework of "scale + structure + innovation + development + efficiency + living" (Figure 1). In this paper we discuss the generation mechanism of urban talent competitiveness from the perspective of configuration.

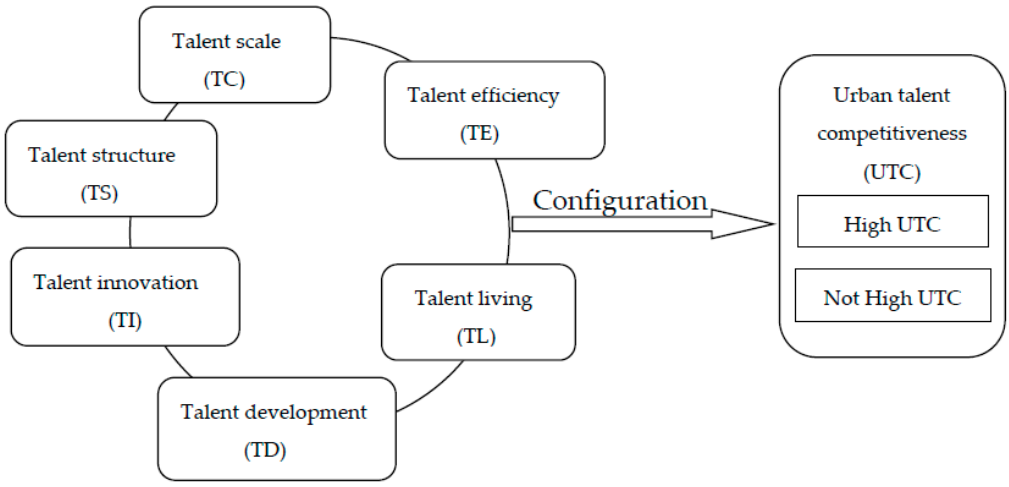

Figure 1. Research framework on the generation of urban talent competitiveness.

3. Methods, Data and Case Selection

3.1. Methods

This study analyses the interaction of factors such as talent scale, talent structure, talent innovation, talent development, talent efficiency, talent living and the common influence of these factors for generating urban talent competitiveness based on the QCA (qualitative comparative analysis) method. QCA is a qualitative comparative research method that uses Boolean algebra and set analysis to explore the "chemical reaction" of the combination

of independent variables in order to find equivalent paths or solutions [54,55]. The QCA method selected in this paper is mainly based on the following reasons.

First, the generation of talent competitiveness is a system project; it is the unity of multiple aspects, multiple levels and integrity, which need to adopt a way of holistic thinking, explore the causal relationship between the combination of influencing factors and urban talent competitiveness. Additionally, the QCA method takes a general perspective; it uses configuration thinking, takes the research object as a cluster of practices with interrelated structures, rather than an independent single factor or a loosely structured entity [56]. Therefore, QCA prefers to analyze the complex relationship and mutual dependence between influencing factors for the generation of urban talent competitiveness.

Second, urban talent competitiveness is an important part of urban competitiveness, and it is closely related to urban development [48]. Understanding urban talent competitiveness should be combined with urban development, which is an analysis of the performance of talent competitiveness based on the development and changes of cities [57]. QCA precisely focuses on specific situations from the perspective of configuration through multi-case comparison to determine the number and characteristics of different causal models, so as to discover and explore complex multiple concurrent causal relationships.

Thirdly, the QCA method has the dual advantages of qualitative and quantitative analysis. It can not only reflect the uniqueness and depth of qualitative research, but it can also reflect the popularization of quantitative research [58]. On the one hand, it avoids the weakness of the poor external promotion effect of qualitative research; on the other hand, it also avoids the weak point of insufficient depth of quantitative research. So, the advantages of qualitative analysis and quantitative analysis are integrated in the QCA method, which achieve complementary advantages.

Additionally, according to different technical characteristics, the QCA method involves of crisp-set QCA (csQCA), fuzzy-set QCA (fsQCA) and multi-value QCA (mvQCA). This study selects csQCA, which has the widest scope of application [59]. The concise method of binary assignment of csQCA, which is beneficial to protecting the multiple connections between various influence factors of urban talent competitiveness and enhancing the diversity and credibility of the investigation results [60].

3.2. Case Selection

In this study, the cases that were selected follow these principles: (1) This study mainly aims at cities with large economic scale, and select cases from cities with GDP exceeding CNY 1 trillion in 2021. Talent growth is closely related to urban development, cities with certain economic scale could better reflect talent competitiveness; (2) Select cities cover the eastern, central and western regions of China, and make the research sample more representative. Therefore, according to the economics scale of Chinese mainland cities in 2021 and the availability of the relevant data, this study selects 24 representative cities, which are Beijing, Shanghai, Shenzhen, Guangzhou, Chongqing, Chengdu, Suzhou, Hangzhou, Nanjing, Tianjin, Changsha, Wuhan, Qingdao, Xi'an, Hefei, Ningbo, Dongguan, Jinan, Zhengzhou, Wuxi, Quanzhou, Foshan, Nantong and Fuzhou.

3.3. Indicators, Data and Encoding Process

The research data come from the ANALYSIS REPORT ON HUMAN RESOURCE MARKET IN CIHINA (2022) [61]. This report is the research achievement of the Chinese Academy of Personnel Science based on the statistical survey data of the National Bureau of Statistics, the Ministry of Human Resources and Social Security and other departments, as well as universities, scientific research institutions and human resources institutions, the report focused on the comprehensive sorting and index ranking of the talent scale structure, talent innovation, talent development, talent efficiency and talent living of major cities in China from 2020 to 2021 (Table 1). These indexes are obtained by comprehensive statics of multiple relevant indicators according to different weights, and the report ranks urban talent competitiveness based on the index. These talent indexes are widely adopted by

government departments and scholars, which has important research and reference value. Compared with conditional measurement using single data, the comprehensive index can more systematically reflect the reality of urban talent competitiveness.

Table 1. Correlation indicators and preliminary data of talent competitiveness in 24 cities.

NO.	City	Talent Scale	Talent Structure	Talent Innovation	Talent Development	Talent Efficiency	Talent Living
1	Beijing	0.1197	0.0504	0.0905	0.1668	0.1174	0.1061
2	Shanghai	0.1339	0.0218	0.0885	0.1377	0.1376	0.1005
3	Shenzhen	0.1314	0.0330	0.1089	0.0930	0.0972	0.1008
4	Guangzhou	0.0872	0.0466	0.0659	0.0943	0.0749	0.0958
5	Chongqing	0.0949	0.0111	0.0214	0.1195	0.0735	0.0887
6	Chengdu	0.1032	0.0054	0.0523	0.0736	0.0439	0.0673
7	Suzhou	0.0589	0.0089	0.0746	0.0403	0.0653	0.0831
8	Hangzhou	0.0556	0.0133	0.0542	0.0630	0.0454	0.0903
9	Nanjing	0.0225	0.0134	0.0503	0.0618	0.0477	0.0938
10	Tianjin	0.0518	0.0150	0.0289	0.0835	0.0347	0.0674
11	Changsha	0.0514	0.0088	0.0264	0.0581	0.0222	0.1086
12	Wuhan	0.0332	0.0148	0.0493	0.0804	0.0398	0.0527
13	Qingdao	0.0378	0.0140	0.0334	0.0530	0.0228	0.0865
14	Xi'an	0.0590	0.0172	0.0427	0.0545	0.0193	0.0482
15	Hefei	0.0324	0.0122	0.0529	0.0471	0.0189	0.0694
16	Ningbo	0.0377	0.0104	0.0431	0.0334	0.0261	0.0798
17	Dongguan	0.0374	0.0169	0.0262	0.0166	0.0280	0.0897
18	Jinan	0.0299	0.0111	0.0236	0.0373	0.0136	0.0923
19	Zhengzhou	0.0521	0.0100	0.0192	0.0544	0.0219	0.0343
20	Wuxi	0.0294	0.0080	0.0347	0.0169	0.0208	0.0722
21	Quanzhou	0.0245	0.0156	0.0124	0.0326	0.0290	0.0620
22	Foshan	0.0224	0.0090	0.0329	0.0159	0.0279	0.0564
23	Nantong	0.0245	0.0039	0.0238	0.0295	0.0120	0.0667
24	Fuzhou	0.0152	0.0105	0.0179	0.0404	0.1520	0.0602

This study selects 6 conditional variables of talent scale (TC), talent structure (TS), talent innovation (TI), talent development (TD), talent efficiency (TE), talent living (TL), which, as mentioned above, observe the conditional variables of talent competitiveness in 24 major cities of China and the urban talent competitiveness (UTC) as a result variable. This study measures condition variables based on the correlation index provided by the ANALYSIS REPORT ON HUMAN RESOURCE MARKET IN CIHINA (2022).

We have tested the combined conditions for generating urban talent competitiveness. According to the dichotomy assignment method of csQCA, the 24 cities with the index of conditional variables ranking at or above the middle level (top 12) are assigned a code of 1, cities below the middle level as 0. Regarding the result variable, the report divides urban talent competitiveness into three levels, A, B and C (Table 2); Level A is the best, followed by level B. Level A and B cities are considered to have better performance of talent competitiveness, so code cities of Level A and B are assigned code 1, cities of Level C are assigned code 0 (Table 3).

Table 2. Cases of 24 cities in China mainland.

A level	Beijing; Shanghai; Shenzhen; Guangzhou; Chongqing; Chengdu; Suzhou; Hangzhou
B level	Nanjing; Tianjin; Changsha; Wuhan; Qingdao; Xi'an; Hefei; Ningbo
C level	Dongguan; Jinan; Zhengzhou; Wuxi; Quanzhou; Foshan; Nantong; Fuzhou

3.4. Truth Table Analysis

After the variables are coded, the coded data need to be summarized and analyzed. The truth table shows the state whether the condition combinations produce the result or not. Talent scale (TC), talent structure (TS), talent innovation (TI), talent development

(TD), talent efficiency (TE) and talent living (TL) are the condition variables in this study; urban talent competitiveness (UTC) is the result variable. According to Table 4, there are 19 combinations in the truth table.

Table 3. Variable selection and data coding.

Variable Name	Measurement	Assignment Criteria
Talent scale (TC)	Number of employee permanent population Employees in the secondary industry Employees in the tertiary industry	Rank at or above the middle level is 1; otherwise it is 0
Talent structure (TS)	Proportion of employees in secondary and tertiary industries Finance, technology and R&D personnel Number of college students	Rank at or above the middle level is 1; otherwise is 0
Talent innovation (TI)	R&D funding Proportion of R&D expenditure in GDP Per capita financial expenditure on science and technology Patent authorization	Rank at or above the middle level is 1; otherwise is 0
Talent development (TD)	Unemployment rate Number of universities Number of secondary vocational schools Education expenditure per 10,000 people	Rank at or above the middle level is 1; otherwise is 0
Talent efficiency (TE)	GDP Per capita retail sales Growth rate of fixed investment Industrial output value Balance of loans from financial institutions	Rank at or above the middle level is 1; otherwise is 0
Talent living (TL)	Per capita income Per capita consumption expenditure Number of health institutions per 10,000 people Number of buses per 10,000 people Per capita green area Public library collections per 10,000 people Social security participation rate	Rank at or above the middle level is 1; otherwise is 0
Urban talent competitiveness (UTC)	-	Cities of Levels A and B is 1; Level C is 0

Table 4. Truth table.

TC	TS	TI	TD	TE	TL	Number	UTC
1	1	1	1	1	1	5	1
1	1	1	1	0	0	2	1
1	0	1	1	1	0	1	1
1	1	1	1	1	0	1	1
0	1	1	1	0	1	1	1
1	1	1	1	0	1	1	1
1	0	1	0	1	1	1	1
1	1	1	0	1	1	1	1
1	0	0	1	1	1	1	1
1	1	0	1	1	1	1	1
0	1	1	1	1	1	1	1
0	0	0	1	0	0	1	0
0	1	0	0	1	0	1	0
0	0	1	0	1	0	1	0
1	0	0	1	1	0	1	0
0	0	0	0	0	1	1	0
0	1	0	0	0	1	1	0
0	0	1	0	0	1	1	0
1	1	0	0	1	1	1	0

4. Result

Based on the experience of scholars [62], first of all, the study should analyze the single variable of necessity in order to observe the relationship between the single condition variable and the specific result by analyzing the consistency. The study could check whether there is a single necessary variable for the occurrence of a specific result, and through analysis, the coverage, it could describe the extent to that a single cause variable can explain a specific result. According to the set principle, the consistency is the proportion of the intersection of X and Y in X (1); the coverage is the proportion of the intersection of X and Y in Y (2).

$$Consistency(X_i \leq Y_i) = \sum(min(X_i, Y_i)) / \sum(X)_i \quad (1)$$

$$Coverage(X_i \leq Y_i) = \sum(min(X_i, Y_i)) / \sum(Y)_i \quad (2)$$

4.1. Necessarity Analysis

In the analysis of QCA, through consistency and coverage, it could determine whether there is a sufficient and necessary relationship between the condition variable and the result variable [63]. This study uses the fs_QCA3.0 software to calculate the data and the necessity analysis results of the single condition variable for the result variable, as shown in Table 5.

Table 5. Necessary condition test.

Conditional Variable	High UTC		Not High UTC	
	Consistency	Coverage	Consistency	Coverage
TC	0.875000	0.875000	0.250000	0.125000
~TC	0.125000	0.250000	0.750000	0.750000
TS	0.812500	0.812500	0.375000	0.187500
~TS	0.187500	0.375000	0.625000	0.625000
TI	0.875000	0.875000	0.250000	0.125000
~TI	0.125000	0.250000	0.750000	0.750000
TD	0.875000	0.875000	0.250000	0.125000
~TD	0.125000	0.250000	0.750000	0.750000
TE	0.750000	0.750000	0.500000	0.250000
~TE	0.250000	0.500000	0.500000	0.500000
TL	0.750000	0.750000	0.500000	0.250000
~TL	0.250000	0.500000	0.500000	0.500000

Note: The conditions and outcome with the symbol '~' mean low, and the ones without '~' mean high. For example, TC means high talent scale, ~TC means low talent scale.

According to Ragin's research, when the consistency is at or above 0.9, the single variable could be the necessary condition of the result [64]. As seen in Table 4, is no variable could reach the point, which shows that the single condition variable could not generate high urban talent competitiveness. It is noteworthy that the consistency of talent scale, talent innovation and talent development are close to 0.9, which demonstrates that these three conditions are significant variables for generating urban talent competitiveness. Moreover, the consistencies of other conditions are all around 0.8; this shows the positive impact of these variables for promoting talent competitiveness. At the same time, it also validates the previous research. Meanwhile, because the consistency of all variables is lower than 0.9, it is necessary to make configuration analysis on the generation of urban talent competitiveness.

4.2. Configurations

This study uses the fs_QCA3.0 software to analyze the urban talent competitiveness of 24 Chinese cities, and find out the generating configuration of urban talent competitiveness. Based on the advice of Fliss [54], the set consistency threshold is 0.8; the case threshold is 1. QCA provides three kinds of solutions; they are complex solution, parsimonious solutions and intermediate solutions. The form of intermediate solution is generally simpler than

that of complex solutions; compared with the parsimonious solution, the intermediate solution is more reliable because it only includes counterfactual assumptions. Therefore, Ragin reports the intermediate solutions with a consistency greater than 0.8 [56]. As shown in Table 6, the generation paths to promote urban talent competitiveness finally output five combinations, solution consistency and solution coverage are one; it demonstrates that these five configurations could explain all circumstances for generating urban talent competitiveness; solution consistency and solution coverage are higher than the QCA level of organization and management. In accordance with the structure of configurations, this study divides the configuration into three modes.

Table 6. Configurations of promoting the generation of urban talent competitiveness.

Configuration	Innovation Leading Mode	Quality Improvement Mode		Resource Competitive Mode	
	H1	**H2a**	**H2b**	**H3a**	**H3b**
TC	●	●	●		•
TS	•			•	
TI	●	●	●	•	⊗
TD	•	•	⊗	●	●
TE		•	•		•
TL		⊗	●	•	●
consistency	1	1	1	1	1
coverage	0.5625	0.125	0.125	0.5	0.125
unique coverage	0.125	0.0625	0.125	0.125	0.125
solution coverage			1		
solution consistency			1		

Note: ● indicates the existence of core conditions; • indicates the existence of edge conditions; ⊗ indicates the absence of edge conditions; the space indicates that the condition can either appear or be absent, which is irrelevant.

(1) Innovation Leading Mode

Configuration H1: TC*TS*TI*TD. H1 is the combination of high talent scale, high talent structure, high talent innovation and high talent development. When the city has a large population and employees, the proportion of people employed in different industries is reasonable; scientific and technological R&D expenditure remains at a high level, and so does the adequate supply of cultural and educational resources, which could be promote the urban talent competitiveness. The total amount of urban talent reserves is large; talents generally have high academic qualifications. Finance, science, technology and other service industries are relatively prosperous, which provides a stimulating and competitive environment for talent innovation and development, lays a talent foundation for the improvement of urban innovation strength, and it is also conducive to attracting more external innovative talents. At the same time, long-term innovative development requires the participation of new forces and strong educational support, so cities should provide rich cultural and educational resources that are the basis of cultivating innovative talents. Shanghai, Shenzhen, Hangzhou, Tianjin and Xi'an are representative of this type of city.

(2) Quality Improvement Mode

Configuration H2a: TS*TI*TD*TE*~TL and H2b: TC*TI*~TD*TE*TL. H2a is the combination of high talent scale, high talent innovation, high talent development, high talent efficiency and low talent living. If the city has more labor reserves, an attractive talent innovation environment, strong education support for talent development, high per capita performance in consumption, output value, deposits, etc., even if the urban living environment is not satisfactory, it still might be able to produce high urban talent competitiveness. H2b is the combination of high talent scale, high talent innovation, high talent efficiency, high talent living and low talent development; even with lack of educational and devel-

opment resources, the configuration can still achieve the target of generating urban talent competitiveness. When the total number of urban talents is large and the expenditure on innovation and R&D is high, cities need to reflect the value of talent investment by strengthening the quality of talent development [36,65]. Additionally, positive ways to improve talent development quality is to create an attractive and competitive talent development environment, such as providing more jobs with growth potential, allowing talents have more learning opportunities. Due to benefits from the combined effect of talent innovation, talent development or talent living, the effective release of the talent scale effect, and the talent efficiency have improved significantly. Chengdu, Wuhan, Suzhou and Ningbo are representative of this type of city.

(3) Resource Competitive Mode

Configuration H3a: TS*TI*TD*TL and H3b: TS*~TI*TD*TE*TL. H3a is the combination of high talent structure, high talent innovation, high talent development and high talent living. When the employment structure of urban talents is relatively optimized, providing strong support for talent innovation, talent development has sufficient cultural and educational resources, and the quality of urban life has been effectively guaranteed, cities can achieve the goal of generating talent competitiveness. H3b is the combination of high talent scale, high talent development, high talent efficiency, high talent living and low talent innovation. If the total number of urban talents is large, urban cultural and educational resources are abundant, and the high quality urban living environment, even if the talent innovation investment is insufficient, cities could still allow for a high level of performance of talent competitiveness. The configuration of 3a and 3b tends to take the excellent performance of urban resources as an important basis. Cultural and educational resources and living conditions being superior is conductive to attracting more talents and improving the cultural knowledge level of talents. Factors such as talent scale and talent structure could be improved too to some extent. Significantly, in the full supply of urban resources, increasing the total number of talents and improvement in per capita performance could make up for insufficient investment in talent innovation. This provides another way to effectively release urban talent dividends. Urban competition is talent competition in the final analysis; cities with talents could have a better future. Beijing, Guangzhou, Nanjing, Qingdao, Hefei, Chongqing, and Changsha are representative of this type of city.

Additionally, this study explores the configuration of cities without high urban talent competitiveness. The results still use an intermediate solution, and the generation paths to hinder urban talent competitiveness finally outputs seven combinations. The results are shown in Table 7.

In the combinations of N1–N7, the coverages of N1 and N2 are higher than other combinations, so these two combinations deserve more attention. N1: ~TC*~TI*~TD*~TE*TL is the combination of low talent scale, low talent innovation, low talent development, low efficiency and high talent living. N2: ~TC*~TS*~TD*~TE*TL is the combination of low talent scale, low talent structure, low talent development, low talent efficiency and high talent living. The combination of N1 and N2 are the typical paths for hindering talent competitiveness in cities, which cover half the cases. This shows that under the circumstances of insufficient population size and inadequate cultural and educational conditions, even if urban life is more convenient, cities still cannot achieve the strong talent competitiveness.

As seen in Table 7, the condition variable of talent efficiency does not have a clear positive incentive effect; the impact of generating urban talent competitiveness is not significant. This explains why talent efficiency may not be pursued excessively in urban development, especially in developing countries, where many cities are still in the stage of talent cultivation; if the city adopts too many incentive policies to release talent dividends, it may prematurely consume talents' enthusiasm for innovation and development. Talent development and talent living occur six times in the configuration as edge conditions; except for configurations N4 and N5, these two conditions appear alternately in the other configurations; talent development and talent living cannot exist at the same time.

Table 7. Configurations of hindering the generation of urban talent competitiveness.

Configuration	N1	N2	N3	N4	N5	N6	N7
TC	⊗	⊗	⊗	⊗	⊗	●	●
TS		⊗	⊗	●	⊗	⊗	●
TI	⊗		⊗	⊗	●	⊗	⊗
TD	⊗	⊗	●	⊗	⊗	●	⊗
TE	⊗	⊗	⊗	●	●	●	●
TL	●	●	⊗	⊗	⊗	⊗	●
consistency	1	1	1	1	1	1	1
coverage	0.25	0.25	0.125	0.125	0.125	0.125	0.125
unique coverage	0.125	0.125	0.125	0.125	0.125	0.125	0.125
solution coverage				1			
solution consistency				1			

Note: ● indicates the existence of edge conditions; ⊗ indicates the absence of core condition; ⊗ indicates the absence of edge conditions; the space indicates that the condition can either appear or be absent, which is irrelevant.

According to the three modes of generating urban talent competitiveness, the coverage of the resource competitive mode is 0.625; this mode explains nearly 63% of the result variables. Additionally, the coverage is higher than the other two modes. More cities generate talent competitiveness through the resource competitive mode. This clearly demonstrates that the combination of talent development and talent living could promote the generation of urban talent compositeness. Additionally, the existence of an innovation leading mode and quality improvement mode, which shows the generation of urban talent competitiveness, is affected by diversification. According to the configuration of hindering the generation of urban talent competitiveness, Configurations of N1 and N2 could explain half of the result variables; the coverage is higher in other combinations, which proves that these two ways have caused a more negative impact on the generation of urban talent competitiveness.

Additionally, the variable conditions of talent innovation, talent development and talent living show that the dual effects are more significant than the others. On the one hand, in configurations that promote the generation of urban talent competitiveness, whether high level or low level, these three conditions could promote urban talent competitiveness together with other conditions. For example, in the combinations of H1, H2a, H3a and H3b, high talent development and other conditions could jointly promote urban talent competitiveness; in the combination of H2b, low talent development and other conditions could also jointly promote urban talent competitiveness. Additionally, the conditions of talent scale, talent structure and talent efficiency tend to be high level in H1, H2a, H2b, H3a and H3b. On the other hand, in configurations that hinder the generation of urban talent competitiveness, these three conditions have obvious dual effects for the result too. In the combinations of N3, N4, N5 and N6, low talent living and other conditions could jointly hinder urban talent competitiveness; in contrast, in the N1, N2 and N7 combination, high talent living and other conditions could jointly hinder urban talent competitiveness. Therefore, the study highlights the dual effects of the three conditions of talent innovation, talent development and talent living.

4.3. Stability Analysis

To ensure the robustness of the results, and further explore the generating mechanism of urban talent competitiveness, this study improves the standard of result variables; set cities of Level A are 1, cities of Level B and C are 0, analyzing the generation configuration of talent competitiveness in Level A cities. See Table 8 for the analysis results.

There are three combinations that promote the generation of urban talent competitiveness at the highest standard, they are the paths of H4, H5 and H6. Comparing Tables 6 and 8, the configurations of Level A cities still follows three modes: the resource competitive mode, innovation leading mode and quality improvement mode. Representative cities of H4 include

Beijing, Shanghai, Shenzhen, Guangzhou, Chongqing and Hangzhou; the representative city of H5 is Chengdu; the representative city of H6 is Suzhou. This proves that the result of configuration analysis is stable and effective. Significantly, talent scale and talent efficiency play a more important role in generating configurations of urban talent competitiveness in Level A cities. This illustrates that the combination of talent scale and talent efficiency could produce higher performance of urban talent competitiveness.

Table 8. Results of stability analysis.

Configuration	H4	H5	H6
TC	●	●	●
TS	●	⊗	⊗
TI		●	●
TD	●	•	⊗
TE	●	•	•
TL	●	⊗	•
consistency	1	1	1
coverage	0.75	0.125	0.125
unique coverage	0.75	0.125	0.125
solution coverage		1	
solution consistency		1	

Note: ● indicates the existence of core conditions; • indicates the existence of edge conditions; ⊗ indicates the absence of core condition; ⊗ indicates the absence of edge conditions; the space indicates that the condition can either appear or be absent, which is irrelevant.

5. Conclusions and Discussion

5.1. Conclusions

This study takes 24 Chinese cities as research cases, using the QCA method and configurative thinking, discussing the generation of urban talent competitiveness. The main conclusions are the following:

(1) Talent scale, talent innovation, talent development and talent living are significant conditions for the generation of urban talent competitiveness. In the process of producing urban talent compositeness, the conditions of talent scale, talent innovation, talent development and talent living essentially play leading roles, while the conditions of talent structure and talent efficiency produce an important supporting effect; (2) There are mainly three configuration modes for the generation of urban talent competitiveness: innovation leading mode, resource competitive mode and quality improvement mode. The three modes involve of five combinations, and each combination is the result of multiple conditions; no single condition can be the sufficiency condition for the generation of urban talent competitiveness. This finding reveals the generation mechanism of urban talent competitiveness from an general perspective; (3) The generating configuration with the highest level of performance of urban talent competitiveness is different from the results of the full sample. The reason for the difference is not a simple superimposition of influencing factors. For example, the H5 and H6 configurations add the condition of low talent structure on the basis of H2a and H2b; optimizing talent structure might not necessarily lead to stronger urban talent competitiveness in cities with a high level of performance of urban talent competitiveness. This further shows that the generation of talent competitiveness is diversified; different combinations of condition have different effects on the generation of urban talent competitiveness; (4) The configuration that hinders the generation of urban talent competitiveness is also composed of multiple elements, and the configuration that hinders the generation of urban talent competitiveness is not the reverse comparison of the generating configuration of competitiveness. For the generation of urban talent competitiveness, which is a complex system engineering, having high urban talent competitiveness or not having high urban talent competitiveness both follow a certain interactive logic.

The results of our configuration analysis are unique compared to the existing research on the generation mechanism of urban talent competitiveness. Scholars and the government have generally focused on various factors affecting urban talent competitiveness, such as talent scale, talent innovation, talent efficiency and so on, and urban managers invest lots of energy to attract talents and develop science, technology and culture. Researchers believes that the influence of the factors of talent scale, talent structure, talent development, talent efficiency and talent innovation, are effective for urban talent competitiveness; most studies focus on the correlation coefficient between talent factors and urban competitiveness [17,32,48]. However, research prefers to provide a universal solution; it hardly considers the change of situational factors, and an agreement on how to match these factors more effectively to promote urban talent competitiveness has not been reached [14,18,47]. It is difficult for this universal solution reveal the adequacy or necessity of the factors; the discussion on the effectiveness situation of influence factors still needs to be enriched. In focusing on the generation mechanism of urban talent competitiveness, this study analyzes the interactions between the influencing factors, which has found a reasonable "recipe" between the factors of urban talent competitiveness, which resonates with the findings of several studies. For example, the improvement of urban talent competitiveness not only involves talent innovation and talent efficiency, but also investment in talent development such as culture and education [47], which conforms to the configuration meaning of H2a in the quality improvement mode.

Furthermore, the impact of talent development on urban talent competitiveness improves when the impact of talent living declines; in contrast, the impact of talent living on urban competitiveness improves when the impact of talent development declines. This demonstrates the substitution effect between the two conditions. The configurations of H2a, H2b, H5 and H6 all reflect this substitution relationship. Meanwhile, in configurations H1 and H3a, talent scale and talent living also have a substitution relationship, i.e., when one of the two conditions are present, the other condition can be absent.

In addition, this study further specifies the boundary contexts in which higher level urban talent competitiveness combinations work, i.e., scale and efficiency conditions. For example, migration policy (i.e., providing jobs/increasing income/cultural recreation/environmental benefits) is beneficial in expanding the scale of talents and urban talent development [5]. This talent policy focuses on a dual function; one is the expansion of talent scale, the other is the stimulation of talent efficiency. The configurations of H4, H5 and H6 similarly found synergistic effects between the similar conditions of talent scale and talent efficiency. Additionally, talent scale and talent efficiency are used as the general conditions in urban talent competitiveness configurations of Level A cities, which corroborates the positive effect between talent scale, talent efficiency and talent competitiveness [18].

5.2. Theoretical and Practical Contributions

First, this study focuses on the analysis of the configuration effects from a holistic perspective, and finds the causal relationship between conditional configuration and results based on the case comparison. Previous studies focused on the "net effect" of each variable, analyzing urban talent competitiveness in an isolated way. This research logic may ignore the interdependence of variables and the overall effect. This study analyzes the mechanism of generating urban talent competitiveness based on the QCA method; it effectively makes up the isolation of factors caused by analytical thinking, and builds a more complete cognitive system for generating urban talent competitiveness.

Second, this study uses the QCA method to discover if there is a substitution relationship between the construction conditions of the generated configurations for urban talent competitiveness. Talent development and talent living have a substitution relationship. The educational function contained in talent development, which is closely related to the quality of talent living, makes these two conditions have a substitution relationship under certain circumstances. This finding strengthens the theoretical logic loop between "talent attraction-talent cultivation-talent development-talent retention-talent attraction". It finds

that there are two different ways to generate urban talent competitiveness for resource upgrading, which provides more paths for different cities.

Third, this paper uses the QCA method to analyze the diversity issue of the generation of urban talent competitiveness. Although previous studies have comprehensively analyzed the influencing factors of urban talent competitiveness, this universal solution does not reveal the adequacy or necessity of the factors; it also does not consider the change of situational factors. As a result, the generation theory of urban talent competitiveness cannot give specific and operational strategic suggestions, which has affected the application value of the theory. This study is based on configuration thinking and provides three configuration modes for generating urban talent competitiveness, clarifying the role of each condition in the configuration, and ensuring the effectiveness of each configuration.

Finally, cities should select the generation mode of talent competitiveness based on their own characteristics. Cities that lack educational resources and for the living environment to be improved could focus on innovation, increase investment in scientific research, attract talents through innovative development, and improve the performance of talent competitiveness. Cities with insufficient innovation strength could improve their urban living environment, enhance the quality of education and training and focus on the long-term cultivation and development of talents, gradually promoting the competitiveness of urban talents.

5.3. Research Prospects

This study has some limitations; future research needs to be explored in the following aspects: (1) Explore the generation mechanism of urban talent competitiveness according to different talent types, such as skilled talents, scientific talents and digital talents; (2) Collect more city cases, explore the multiple configurations of generating talent competitiveness in different cities.

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