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RESEARCH ARTICLE

Configuration analysis of university comprehensive development level based on qualitative comparative analysis

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ABSTRACT

The *Overall Plan for Deepening the Reform of Education Evaluation in the New Era* has introduced new requirements for developing colleges and universities. In this context, a configuration analysis of the comprehensive development level of colleges and universities is conducted to provide a reference for the high-quality development of these institutions. This study uses a fuzzy set qualitative comparative analysis to assess the comprehensive development level of universities based on six official evaluation indexes at home and abroad. The analysis identifies five configuration paths constituted by the combination of condition variables: talent cultivation, faculty size, social services, international influence, academic reputation, and achievements & benefits. These paths are categorized as talent-based, international-based, academic-based, service-based, and benefit-based. The study also explains the typical cases associated with each configuration path. The aim is to formulate a high-quality development strategy for universities based on academic reputation, talent cultivation, and social services.

KEYWORDS

University evaluation; Educational evaluation; University development; Configuration analysis; QCA approach

1 Introduction

Colleges and universities are the cornerstones of cultivating talents, the ivory tower of teaching and educating people, and the halls of preaching and teaching. They bear the important tasks of talent cultivation, outputting achievements, and facilitating scientific and technological innovation, which make them a top priority in China's education development. The *Overall Plan for Deepening the Reform of Education Evaluation in the New Era*, which was issued by the State Council in 2020, suggested linking contribution, performance, and effectiveness with talent cultivation results and building an evaluation system in line with China's reality (Ma et al., 2020). The *2021 Government*

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Report on the Work of the State Council aims to continuously improve social development, develop a fairer and higher-quality education, and better meet the spiritual and cultural needs of the people. Continuously optimizing and improving colleges and universities is necessary to better provide social services and meet social needs. College evaluation has always been regarded as a criterion for evaluating the development ability and social recognition of colleges and universities. The rankings and scores of these evaluations also affect the operation and social cognition of these institutions. However, the scientific data and indicators used by evaluation institutions in various universities need to be investigated, and many rankings are controversial, leading to considerable social criticism. Based on the existing researches, this study conducts path research and qualitative comparative analysis (QCA) of factors affecting the comprehensive development of universities from a configuration perspective, to provide suggestions and references for the development of universities with diversified and holistic thinking.

2 Literature review

The development of colleges and universities has always been a hot topic among scholars and the public in China, especially since the introduction of the "*Overall Plan*" and the "Breaking Five Only" policy. The discussion and research on the comprehensive development level of colleges and universities have become increasingly intense.

Many scholars have conducted systematic research on the evaluation elements, indicators, and methods of universities. From an element perspective, Jiang et al. (2018) constructed a university evaluation system from three dimensions: institution, knowledge & talent system, process & output. Starting from the construction elements of disciplines, majors, and curriculum, Zhou (2016) proposed that colleges and universities should reconstruct their educational concepts and accelerate the construction of the education system with Chinese characteristics. Based on the needs of objects, Luo (2017) analyzed the social construction mechanism of China's university development system with scientific research ability, undergraduate teaching, subject development, and academic points as the object. From an indicator perspective, Gu et al. (2017) conducted an objective, reasonable, and periodic evaluation of universities of the same type but with different scientific research strengths, which considers core indicators and expansion indexes. Li et al. (2020) summarized the evaluation content from the aspects of teaching attitude, teaching content, teaching methods, teaching norms, teaching organization, teaching ability, and teaching effect. They initially established the evaluation index system of universities. From a methodological perspective, Zhou et al. (2019) used a meta-evaluation of multiple ranking indicators from technical and legitimacy dimensions to determine whether a university evaluation index has Chinese characteristics for judging the university construction standards. Xia & Hamish (2019) analyzed the talent cultivation and evaluation system based on the five core abilities of the Columbia University School of Education for Chinese universities. Through the first-hand data obtained from the course combined with conducting in-depth interviews, Hu (2020) assessed the direction and purpose of the current university teaching index adjustment.

The application of configuration analysis in university evaluation mainly starts from the scientific research, talent, and achievement indicators of university construction, and then explores the development mode and path of colleges and universities. Meng et al. (2021) used a clear set QCA (cs/QCA) to study the thrust factors of cross-departmental cooperation in universities from three

dimensions: university characteristics, external environment, and promotion strategy. Zhang (2019) utilized the fuzzy set QCA (fs/QCA) method to study the improvement path of scientific research productivity in Chinese universities and obtained four influence paths to improve the productivity of scientific research in universities. Based on the theoretical model of talent cultivation mode, Wang et al. (2019) constructed a model of interdisciplinary talent cultivation. They employed the QCA method and configuration thinking to conduct an in-depth analysis of the influencing factors of "double first-class" construction for interdisciplinary talent cultivation in emerging interdisciplinary fields. Duan & Wu (2021) adopted the fs/QCA method to reveal the configuration of conditional factors affecting the efficiency of scientific and technological resource allocation from a holistic perspective. Sun & Wei (2021) applied the fs/QCA method to explore the realistic path of the transformation of scientific and technological achievements in universities under multiple concurrent factors and the complex causal mechanism.

Most of the above studies on university evaluation focus on the independent factors affecting the development of universities and the theoretical construction of the development of universities. They pay less attention to the comprehensive performance of universities in the state of multi-factor concurrent situations. The path analysis from a multi-configuration perspective is the selection basis for judging the comprehensive development level of universities in the future. This study analyzes the existing results of the comprehensive development level of the colleges and universities based on the comprehensive effect of university evaluation indices, introducing a preferred configuration path for the high-quality development of colleges and universities.

3 Study design

Given the diversity and complexity of the evaluation indicators for colleges and universities, this study selects six authoritative institutions with relatively complete ranking data at home and abroad for the design of the analysis framework and the selection of conditional variables. They are: the world university rankings released by American News and World Reports; the QS World University Rankings released by Quacquarelli Symonds company; the Shanghai Ranking's Academic Ranking of World Universities (ARWU) released by Shanghai Soft Education Information Consulting Co., Ltd.; the THE World University Rankings released by Times Higher Education; U.S. News & World Report Best Global Universities Rankings; and World University Ranking by Discipline released by the Chinese Academy of Science and Education Evaluation (Zhou et al., 2019).

The evaluation indicators for this study are selected from the leaderboards published in 2021 to ensure the homogeneity and accuracy of the analysis framework. The task of university construction and reform points out the need to build first-class teachers, train top-notch innovative talents, improve the level of scientific research, promote the transformation of achievements, build a social participation mechanism, and promote international exchanges and cooperation (Zhou, 2021). According to the task requirements of the development of colleges and universities, regarding the QCA research model proposed by Fiss (2011), the university's comprehensive performance analysis framework is constructed (Figure 1). In QCA, with presence and absence indicating the state changes of outcome variables, the "High score (presence)" means outcome variables are present, and the "High score (absence)" means outcome variables are absent. This study examines the configuration effects of the presence or absence of high scores of comprehensive performance in colleges and universities, respectively. It analyzes the combinations

of conditions that cause the presence of high scores and the combinations of conditions that cause the absence of high scores. It focuses on the groups and cases that cause the presence of high scores of comprehensive level performance in colleges and universities. Taking the six indicators in the three dimensions of internal, external, and comprehensive factors as the conditional variables, and using the first round of "double first-class" universities as the sample, the comprehensive performance scores in the six rankings are selected as the outcome variables to analyze the configuration path of the comprehensive development level of universities. Among them, internal factors include talent cultivation and faculty size, external factors encompass social services and international influence, and comprehensive factors involve academic reputation and achievement and benefits.

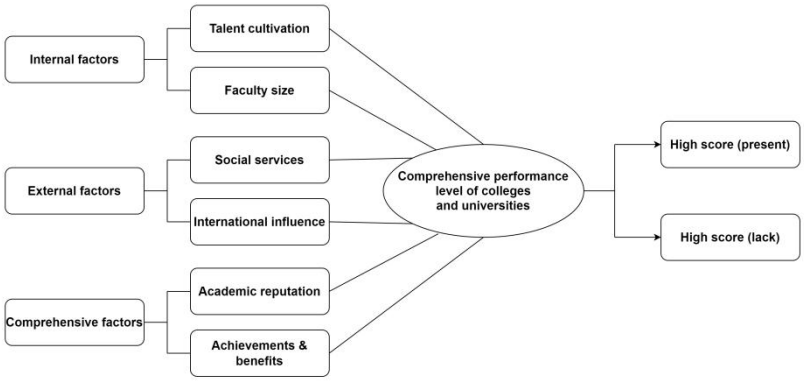

Figure 1 Comprehensive performance analysis framework of colleges and universities

Internal factors mainly refer to the division of resource allocation and input–output ratio within colleges and universities, including talent cultivation and faculty size. Whether the talent cultivation index meets the requirements of cultivating innovative talents is an important basis for evaluating the quantity and quality of talent cultivation. Whether the faculty size index meets the requirements of building a first-class teacher is the essential basis for evaluating the strength of teachers and the ratio of teachers and students. Among them, the descriptive indicators of talent cultivation are selected from education quality, alumni employment, and faculty proportion in the 2022 CWUR World University Rankings. The descriptive indicators of teacher size are selected from the teacher–student ratio, the reference rate per teacher, the proportion of international teachers, and the proportion of international students in the 2022 QS World University Rankings.

External factors mainly refer to the external environment and social influence of colleges and universities. The factors of social influence on the cognitive differences between colleges and universities include social services and international influence. Whether the social service indicators meet the goal of reform and strengthening the social participation mechanism is an important standard to investigate the social participation and contribution of universities. Whether the international influence index conforms to the goal of deepening international exchanges and cooperation is an important reflection of the national competitiveness and synergy of universities. Descriptive indicators of social services are selected from scientific and technological services and achievement transformation in the 2021 Best Chinese Universities Ranking. Descriptive indicators of international influence are selected from the degree of internationalization of the staff, students, and research included in the 2022 THE World University Rankings.

Comprehensive factors mainly refer to the centralized embodiment and display of the comprehensive level of colleges and universities. Comprehensive factors include internal and external judgment, including academic reputation and achievement & benefits. Whether the academic reputation index meets the requirements of universities to improve their academic level and ability is the key basis for judging far-reaching academic innovation. Whether the achievement benefit index meets the requirements of colleges and universities to accelerate the transformation of achievements is an important piece of evidence to evaluate the ability of colleges and universities to improve scientific and technological productivity and develop the driving force of innovation. Descriptive indicators of academic reputation are selected from the 2022 U.S. Global Academic Reputation and regional academic reputation status in the News World University Rankings. Descriptive indicators of achievements & benefits are selected from academic, economic, and social benefits in World University Ranking by Discipline in 2021.

4 Study methods and data

This study uses the QCA method to analyze the comprehensive development level of universities. The research sample consists of 34 “double first-class” universities, and the research data are derived from the indicators and scores published in six domestic and foreign university rankings in 2021 or 2022.

4.1 QCA method

This study analyzes the multi-factor path affecting the comprehensive development level of universities from the perspective of configuration and explains it through case studies. Configuration analysis is a new paradigm in social science research. It uses the QCA method to solve complex research problems in reality, especially sufficient causal and aggregate relationships between variables (Ragin, 2007), as well as the influence of combination conditions between analytical variables (Du & Jia, 2017). The configuration perspective assumes that the causes of the result are caused by multiple factors acting together, the causes of success and failure are asymmetric, and the paths to the same result are varied. At present, the variables of the university evaluation indicators often depend on each other and jointly affect the comprehensive performance of the universities, which conforms to the basic assumption of the configuration perspective. Therefore, the QCA method applies to the configuration path research of the comprehensive development level of colleges and universities.

QCA is divided into three categories: cs/QCA, fs/QCA, and multi-value set QCA. This study adopts the fs/QCA method to analyze the university evaluation problem. Fs/QCA is different from cs/QCA in that it does not strictly classify variables as “0” and “1”. Variables such as talent cultivation, achievement contribution, and social services are difficult to distinguish simply with the relationship of “belonging and not belonging.” Therefore, this study uses the continuous fuzzy set to distinguish the membership and finds three anchors to define the full membership threshold, intersection threshold, and complete non-membership threshold. After the three thresholds are obtained, the data are calibrated to the set membership using fs/QCA (Tan et al., 2019).

4.2 Data and calibration

A QCA is first necessary to determine the conditional and outcome variables. According to the requirements of the above analysis framework, this study selects parts of the six rankings and uses the evaluation indicators as the conditional variables. With the first round of 42 "double first-class" construction universities as the basic sample, this study conducts comprehensive and homogeneous screening. In comprehensive aspects, two ethnic and national defense colleges (Minzu University of Chin,a and National University of Defense Technology) are excluded. Homogeneity is maintained by excluding data from six universities with missing data (Ocean University of China, Zhengzhou University, Yunnan University, Northwest Agriculture and Forestry University, Lanzhou University, and Xinjiang University). Finally, comprehensive scores of 34 universities are selected as the result variable. In response to the requirements of the *Overall Plan*, the evaluation indicators of many authoritative university rankings have been adjusted. Thus, the indicators selected in this study are all from the university rankings and parameters released in 2021 (Table 1).

Table 1 Basic data of the 34 universities

Administrative Area		"Double first-class" Construction Universities	CWUR Rankings	QS World University Rankings	ARWU	THE World University Rankings	U.S. News & World Report Best Global Universities Rankings	World University Ranking by Discipline*
North China	Beijing Municipality	Peking University	84.00	88.80	34.50	83.90	76.20	86.58
		Renmin University of China	72.80	23.70	7.30	37.10	51.20	65.29
		Tsinghua University	84.00	89.00	39.50	84.80	80.10	87.02
		Beijing University of Aeronautics and Astronautics	76.80	29.10	19.00	36.80	60.70	73.70
		Beijing Institute of Technology	76.10	29.60	19.10	36.50	56.90	72.89
		China Agricultural University	75.70	15.90	16.20	35.20	56.20	73.77
		Beijing Normal University	76.30	36.70	17.30	45.90	59.60	74.89
	Tianjin Municipality	Tianjin University	78.00	32.20	19.80	39.80	59.10	76.27
		Nankai University	77.60	30.90	19.10	44.70	59.90	75.53
Northeast China	Liaoning Province	Dalian University of Technology	76.70	17.10	14.80	35.30	55.90	74.20
		Northeastern University	73.70	21.30	12.90	29.20	47.50	69.35
	Jilin Province	Jilin University	77.60	24.20	19.20	30.10	54.20	76.37
	Heilongjiang Province	Harbin Institute of Technology	78.50	39.60	21.90	43.50	63.70	77.07
Eastern China	Shanghai Municipality	Fudan University	81.10	82.60	28.40	66.70	67.90	81.18
		Tongji University	77.50	42.50	19.90	42.40	62.70	76.17
		Shanghai Jiao Tong University	81.70	75.60	30.90	61.80	70.30	82.87
		East China Normal University	75.50	16.50	13.70	45.50	56.50	72.66
	Jiangsu Province	Nanjin University	79.60	54.20	21.90	61.00	68.20	81.18
		Southeast University	77.40	25.30	21.90	38.90	61.20	75.74

Administrative Area		"Double first-class" Construction Universities	CWUR Rankings	QS World University Rankings	ARWU	THE World University Rankings	U.S. News & World Report Best Global Universities Rankings	World University Ranking by Discipline*
	Zhejiang Province	Zhejiang University	81.30	77.40	32.30	62.50	69.60	82.50
	Anhui Province	University of Science and Technology of China	80.30	60.10	30.20	63.40	69.90	78.64
	Fujian Province	Xiamen University	78.20	27.80	17.70	39.70	60.30	76.91
	Shandong Province	Shandong University	78.10	27.90	20.80	33.30	55.60	77.89
Central China	Hubei province	Wuhan University	78.30	40.40	21.60	47.80	63.40	79.22
		Huazhong University of Science and Technology	79.70	32.20	25.10	44.60	65.50	78.49
	Hunan Province	Central South University	77.20	19.60	21.90	45.50	62.30	77.79
		Hunan University	76.20	17.60	18.80	41.30	64.20	72.69
South China	Guangdong Province	South China University of Technology	77.60	27.80	20.20	40.10	61.40	76.14
		Sun Yat-sen University	79.90	37.40	26.90	49.80	66.80	80.64
Southwest China	Chongqing City	Chongqing University	75.50	15.40	16.20	34.20	54.20	73.29
	Sichuan Province	Sichuan University	77.80	25.80	21.80	35.90	57.10	77.14
		University of Electronic Science and Technology of China	76.00	18.10	19.80	39.70	60.60	72.33
Northwest China	Shaanxi Province	Xi'an Jiaotong University	78.50	35.10	22.70	42.90	61.20	77.54
		Northwestern Polytechnical University	75.10	19.90	19.30	37.20	54.90	71.70

*released by the Chinese Academy of Science and Education Evaluation. CWUR: the Center for World University Rankings; QS: Quacquarelli Symonds; ARWU: Shanghai Ranking's Academic Ranking of World Universities; THE: Times Higher Education

The data of the outcome variables comes from the comprehensive level scores of six authoritative university-ranking institutions. The total sample size participating in the QCA is 34 "double first-class" universities. The collected data need to be cleaned and divided due to differing scoring criteria and score thresholds across institutions. First, the SPSS software is used to normalize the different scores of the same-ranking universities. Then, the analytic hierarchy process (AHP) method is applied to obtain the index weights, and the anchor points are classified into high, medium, and low grades.

The data sources for conditional variables are the weight indicators that meet the requirements of the development and construction of colleges and universities. This study selects the talent

cultivation index from the CWUR Rankings, the teacher size index from the QS World University Rankings, the social service index from ARWU, the international influence index from the THE World University Rankings, the U.S. Academic reputation index from U.S. News & World Report Best Global Universities Rankings, and the achievements & benefits index from World University Ranking by Discipline.

Calibration in fs/QCA refers to the process where cases confer membership to collections (Du & Jia, 2017). The data values need to be calibrated to a range of 0–1 according to the existing theoretical basis and the actual situation. In this study, the anchor points are judged as completely non-subordinate, crossed, and fully subordinate based on the anchor point assignment recommendations given by Jacqueminet & Durand (2020) and the actual data standard. The specific calibration values are as follows (Table 2).

Table 2 Variable description and calibration

Variables	Metrics	Index description	Not subordinate at all	Cross point	Fully subordinate
Condition variable	Talent cultivation	Quality of education, alumni employment, and faculty strength from the 2022 CWUR World University Rankings	73.48	77.60	84.00
	Faculty size	Teacher-to-student ratio, reference rate per teacher, international teacher ratio, and international student ratio from the 2022 QS World University Rankings	15.78	29.35	88.85
	Social services	Scientific and technological services and achievement transformation from the 2022 Shanghai Ranking's Academic Ranking of World Universities (ARWU)	68.34	76.32	86.69
	International influence	Degree of internationalization of staff, students, and research from the 2022 THE World University Rankings	29.88	41.85	84.13
	Academic reputation	2022 U.S. Global academic reputation and regional academic reputation status from the U.S. News & World Report Best Global Universities Rankings	50.28	60.95	77.18
	achievements & benefits	Academic, economic, and social benefits from the 2021 World University Ranking by Discipline	11.50	20.05	35.75
Outcome variable	College comprehensive performance score	Scores of 34 universities weighted by AHP hierarchical analysis	42.76	50.63	76.10

*released by the Chinese Academy of Science and Education Evaluation. CWUR: the Center for World University Rankings; QS: Quacquarelli Symonds; THE: Times Higher Education; AHP: analytic hierarchy process

5 Data analysis and results

After the calibrated data were imported into the fs/QCA 3.0 software (Ragin, 2007), the necessary condition analysis, the conditional configuration analysis, and the interpretation case of the conditional configuration has been illustrated.

5.1 Analysis of the necessary conditions

The analysis of necessity conditions includes assessing consistency and coverage, which means evaluating the extent to which the results are produced and how well the coverage explains the results. Usually, a consistency value above 0.9 is considered necessary, and a coverage value above 0.5 is desirable.

Results in Table 3 show that the consistency of the variables related to excellent talent cultivation, excellent social service, high academic reputation, high achievements & benefits, weak faculty size, poor social services, low academic reputation, and low achievements & benefits are all greater than 0.9. This finding suggests that outstanding talent development, good social service, high academic reputation, and outcome effectiveness are necessary to explain the presence of high scores. Meanwhile, insufficient faculty size, poor social service, poor academic reputation, and low outcome effectiveness are necessary to explain the lack of high scores.

Table 3 Analysis of the necessary conditions

Condition variables	High score (presence)		High score (absence)	
	Consistency	Coverage	Consistency	Coverage
Excellent talent cultivation	0.942	0.909	0.485	0.554
Poor talent cultivation	0.571	0.503	0.897	0.933
Strong faculty size	0.874	0.936	0.598	0.612
Weak faculty size	0.584	0.570	0.934	0.871
Excellent social services	0.928	0.938	0.548	0.594
Poor social services	0.590	0.560	0.931	0.894
Strong international influence	0.933	0.902	0.517	0.590
Weak international influence	0.606	0.533	0.888	0.924
High academic reputation	0.902	0.935	0.576	0.608
Low academic reputation	0.593	0.560	0.933	0.896
High achievements & benefits	0.917	0.950	0.573	0.606
Low achievements & benefits	0.591	0.558	0.947	0.913

5.2 Conditional configuration analysis

The data are normalized using fs/QCA based on Du & Jia (2017). The consistency threshold is set to 0.1, the case threshold is 1, and the PRI threshold is 0.75, which results in simple, intermediate, and complex solutions. The intermediate and simple solutions are then subjected to conditional grouping analysis, where Fiss (2011) proposed the presentation and expression of the histogram to

illustrate the existence and importance of each condition in different histograms in graphical form (Table 4).

Table 4 Configuration analysis of comprehensive performance

Conditions	Configuration				
	L1	L2	L3	L4	L5
Talent cultivation	●	•	—	—	•
Faculty size	—	—	—	•	—
Social services	•	—	•	●	—
International influence	•	●	—	—	—
Academic reputation	—	•	●	•	•
achievements & benefits	—	—	•	—	●
Consistency	1	0.962	1	1	0.990
Original coverage	0.524	0.374	0.501	0.780	0.402
Unique coverage	0.025	0.014	0.015	0.231	0.005
Overall consistency			0.979		
Overall coverage			0.853		

● means that the core condition exists;• means that the edge condition exists; — means that the presence of the condition in the configuration is irrelevant to the result

The analysis of the results reveals five paths explaining the comprehensive performance of universities: L1, L2, L3, L4, and L5. The overall consistency of the solutions is 0.979, which is higher than the acceptable degree of consistency (0.8). The overall coverage is 0.853, which implies that the five histories largely explain the formation of “double first-class” universities. Given that the fuzzy set of cases will be cross-affiliated with different groupings and cannot be simply attributed to one, the explanation of the unique coverage cases is based on the analysis of the grouping paths (Figure 2).

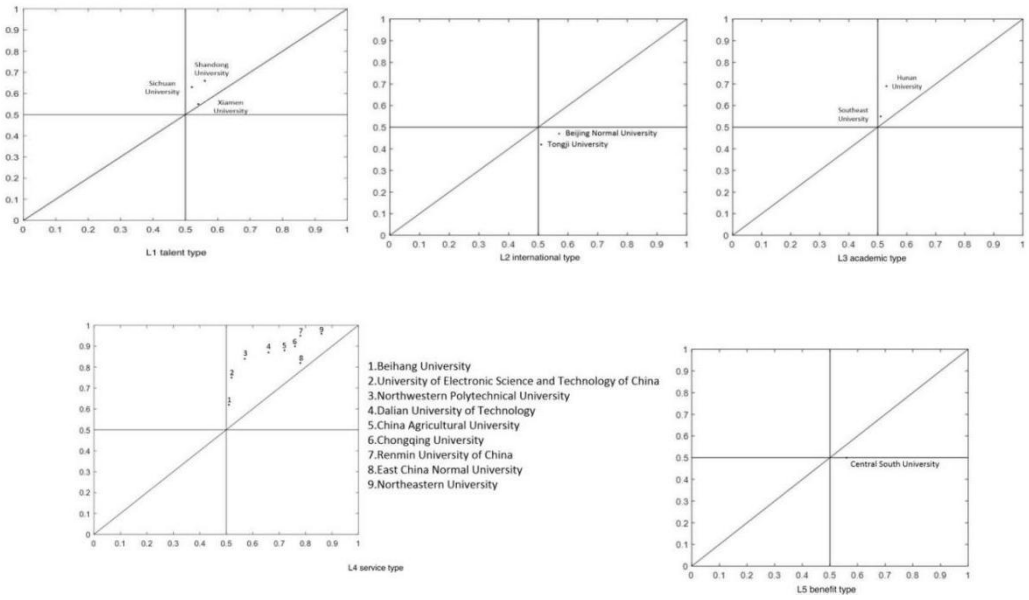

Figure 2 Interpretation case of conditional configuration

5.2.1 L1: Talent-type configuration path

Conditional configuration L1 is a talent-type path formed by the combination of "talent cultivation+ social services + international influence." A scientifically designed talent cultivation program is the basic guarantee for the development and implementation of universities to implement the strategy of strengthening the country with talent. Good social services can reap feedback and evaluation from the public in a benign society. With international influence and societal recognition, universities can become famous. Among them, talent cultivation exists as the core condition, while social service and international influence exist as supplementary conditions, which jointly affect the comprehensive performance of colleges and universities. The original coverage rate of 52.4% indicates that this reason largely explains the comprehensive performance results of universities, and the unique coverage rate indicates that 2.5% of universities can be explained by L1 as a typical case.

The configuration cases explained by L1 include the comprehensive performance of Sichuan University, Shandong University, and Xiamen University, all of which emphasize talent cultivation. Sichuan University has implemented diversion and segmented guidance for the talent cultivation direction of undergraduate and graduate students. The training of undergraduate students focuses on multi-dimensional innovation and development and pays attention to education and teaching, especially in the special period of COVID-19 occurrence, by implementing the talent cultivation route of online and offline integrated development. More attention should be paid to the establishment of scientific research integrity and the cultivation of academic literacy. Academic integrity should be considered the fundamental guarantee to improve the overall quality of education. Shandong University has outlined overall planning and task requirements in the training of interdisciplinary talents, interdisciplinary field exploration, and the construction of the new talent cultivation project base. The university is committed to building a first-class talent cultivation system. The talent cultivation program at Xiamen University constantly expands channels and caliber in terms of co-building and sharing courses, improving teaching quality, and adhering to the cultivation of virtue as the first standard to test the high-quality development of the university.

5.2.2 L2: International configuration path

Conditional configuration L2 is an international path formed from the combination of "international influence + talent cultivation + academic reputation." Among them, international influence exists as the core condition, while academic reputation and talent cultivation exist as supplementary conditions, which jointly act on the comprehensive performance of universities. As a result, the indicators and scores of university evaluation can be improved. The original coverage of 37.4% indicates that this reason explains the comprehensive performance results of universities to some extent, and the unique coverage indicates that 1.4% of universities can be explained by L2 as a typical case.

The configuration cases explained by L2 are Tongji University and Beijing Normal University, both prominent in international influence and attaching great importance to foreign exchanges and cooperation. Over the years, Tongji University has actively promoted the internationalization process of the university, which allows Chinese culture and education to benefit the world. It jointly hosts Confucius Institutes in South Korea, Japan, Germany, and other places, which enjoy an international reputation. In addition, it has signed cooperation agreements with Siemens,

Volkswagen, Bayer, and other multinational enterprises to establish multinational research centers, which has deepened the global influence in technical exchange and talent delivery. Beijing Normal University, in terms of international learning cooperation, has founded an overseas learning platform and signed a learning exchange and cooperation agreement with Britain, the U.S., Japan, South Korea, and Germany. This situation facilitates easier and faster study abroad and exchanges and cooperation for students at home and abroad, which provides more learning opportunities and increases the school's visibility and influence in the world.

5.2.3 L3: Academic configuration path

Conditional configuration L3 is an academic path composed of "academic reputation + social service + achievements & benefits." Among them, academic reputation exists as the core condition, while social contribution and achievements & benefits exist as supplementary conditions, which jointly affect the comprehensive performance of colleges and universities. The original coverage of 50.1% indicates that this reason largely explains the comprehensive performance results of universities, and the unique coverage indicates that 1.5% of the universities can be explained by L3 as a typical case.

The configuration cases explained by L3 include Hunan University and Southeast University, both of which pay special attention to academic reputation, such as peer review results, academic norms, and academic integrity requirements as important contributors to their comprehensive performance. Hunan University has established nine academic journals, among which *The Journal of Hunan University (Social Science Edition)*, *University Education Science*, and *Finance and Economics Theory and Practice* are included in the CSSCI source journals. Their outstanding academic influence and contributions are widely praised in academic circles, and the peer review results are also ideal. Southeast University attaches great importance to the evaluation and deliberation of academic value and has established an academic committee to promote the evaluation and deliberation of academic affairs. It plays an important role in the construction of academic standards and the academic atmosphere. It also promotes academic freedom and academic progress more comprehensively, which provides academic power and support for the high-quality construction of colleges and universities.

5.2.4 L4: Service-type configuration path

Conditional configuration L4 is a service-based path composed of "social service + faculty size + academic reputation." Among them, social service exists as the core condition, while the faculty size and academic reputation exist as supplementary conditions, which collectively influence the comprehensive performance of colleges and universities. The original coverage rate of 78.0% indicates that this reason greatly explains the comprehensive performance results of universities, and the unique coverage rate shows that 23.1% of universities can be explained by L4 as typical cases.

L4 can explain the configuration case of Beijing University of Aeronautics and Astronautics, University of Electronic Science and Technology, Northwestern Polytechnical University, Dalian University of Technology, China Agricultural University, Chongqing University, Renmin University of China, East China Normal University, and Northeastern University. These colleges and universities, with a focus on agriculture, forestry, and engineering, all pay attention to social services. One typical case is China Agricultural University addressing "issues of agriculture, farmer, and rural

area." It concentrates on the needs and problems under the background of rural revitalization, which utilizes technology and knowledge output to serve society. It makes significant contributions to technology promotion, talent cultivation, industrial cooperation, counterpart support, and fixed-point poverty alleviation, which showcases its outstanding performance in social services. The successfully developed passenger aircraft, helicopters, and rockets by Beijing University of Aeronautics and Astronautics have filled several gaps in China, which provides new choices and services in civil technology and military aviation. This situation ensures that scientific and technological achievements & benefits society and the public and serve the country and the people.

5.2.5 L5: Benefit-type configuration path

Conditional configuration L5 is a benefit path composed of "achievements & benefits + academic reputation + talent cultivation." Among them, the achievements & benefits exists as the core condition, and academic reputation and talent cultivation act as supplementary conditions, which jointly affect the comprehensive performance of colleges and universities. The original coverage rate of 40.2% indicates that this reason explains the comprehensive performance results of universities to some extent, and the unique coverage rate shows that 0.5% of universities can be explained by the L5 path as a typical case.

The configuration case explained by L5 is Central South University, which prioritizes achievements & benefits and application of results. Central South University, which was established by merging of the former Changsha Railway Institute, Central South University of Technology, and Hunan Medical University, is the youngest "double first-class" university. Despite its relatively short existence, it has rapidly developed and achieved outstanding achievements in the fields of metallurgy, medicine, and railway. The metallurgical engineering discipline of Central South University ranks first in the world. The national research and development, as well as the manufacturing of spacecraft and missiles, and the breakthrough in cutting-edge technology, are closely related to the research and development. Xiangya Hospital of Central South University has published academic achievements in clinical, genetic, biological, and other fields in the top journals such as *Nature, Science,* and *The Lancet*. The hospital has shown outstanding performance in integrating online and offline medical services and treating intractable diseases. It is known as the "Southern Xiangya and North Union." In recent years, the Key Laboratory of High-speed Railway Construction Technology of Central South University has undertaken research on national key projects such as high-speed rail, urban rail, and tunnel. It has made breakthroughs in infrastructure construction.

5.3 Robustness testing

Robustness testing is used to examine the reliability and scientific validity of research results, with set theory-specific tests involving changes in the consistency threshold, adjustments to the calibration threshold, and alterations in the frequency of cases (Fiss et al., 2013). In this study, a robustness test is conducted on the grouping of comprehensive performance conditions for colleges and universities by adjusting the PRI threshold following the approach suggested by domestic scholar Du et al. (2020). The groupings obtained after adjusting the PRI threshold to 0.75 are consistent with the groupings obtained in this study, which show minimal changes in the number of groupings, consistency parameters, coverage parameters, and core conditions. Only the

actual number of cases of different groupings in the truth table and a small part of the marginal conditions of the outcome groupings change slightly. This finding means that the overall change is insufficient to produce practical explanatory significance. Therefore, the results obtained in this study are considered robust.

6 High-quality development strategy based on configuration path

In the presentation and analysis of the configuration path for the comprehensive development level of colleges and universities, the academic reputation of the conditional variables appears four times in the five configuration paths, while talent cultivation and social service appear three times. The three condition variables constitute the core elements of the high-quality development of colleges and universities. Therefore, based on the results of the configuration path analysis, we will initiate guidance efforts centered on the three dimensions of academic reputation, talent cultivation, and social service. In response to the objectives outlined in the *Overall Plan*, we intend to guide different types of universities in establishing precise scientific positioning and achieving their distinct characteristics and levels. We will help universities diversify and attain high-quality development.

6.1 Building a global academic system based on academic reputation

With regard to academic reputation in the U.S., the total weight in the U.S. News & World Report Best Global Universities Rankings indicator is 25%, including peer review of academic integrity, academic creation and innovation ability, and employer rating. The degree of key occurrence and the frequency of academic reputation in L2, L3, L4, and L5 configuration pathways and their explanatory cases are very high. Its importance and representativeness in university construction cover the universities in North China, East China, and Central China, such as Beijing Normal University and Southeast University. They are the core elements of the universality and overall development of university construction. Under the current policy of “breaking the five only,” it does not imply a complete disregard for academic papers or the outright denial of the value and significance of papers. Instead, it calls for a reshaping of thinking and evaluation concepts, advocating for academic quality to replace the number of achievements, encouraging academic innovation over academic plagiarism, and promoting academic value breakthrough academic barriers, all of which require the cultivation of academic reputation. Starting from academic ability, academic norms, and academic contributions (Jiang & Wang, 2021), we will constantly break through self-imposed boundaries and cognitive boundaries. We will cultivate a new group of young talents and excellent teachers in this positive academic-oriented environment, which injects fresh impetus into the high-quality development of colleges and universities.

Academic reputation gradually forms through continuous academic exploration and long-term accumulation by generations of scholars. Academic exploration involves the interaction between man and man, between man and nature, the accumulation of human culture, and the construction of human civilization. However, regional economic and cultural differentiation, as well as unbalanced academic resources, can affect the construction of academic reputation and hinder cultural interaction and international exchanges. The formation and development of the global academic system can be promoted through the hierarchical system of regional academic

reputation (Gerhards et al., 2018). The microscopic problem-oriented explorations and differentiated exchanges for local regions will lead to common developmental construction for the whole world and all mankind. Therefore, starting from the cultivation of regional academic reputation and dividing it according to different levels of regional development, we can provide successful experiences that can be referred to and practiced by the universities in each region. In this way, the construction of academic reputation can be expanded from the individual and local to the whole and the whole situation. The cultivation of regional academic reputation can provide strong support for the subsequent vigorous development of the global academic system. Eventually, a global academic system that matches academics and culture, coexists with differences and synergies, and emphasizes reputation and literacy will be formed.

6.2 Focusing on talent cultivation to form a diversified talent growth chain

The total weight of the talent cultivation indicators in the CWUR Rankings is as high as 45%. These indicators include three secondary indicators: education quality, alumni employment, and faculty strength. Analyzing the configuration path performance and typical interpretation cases of L1, L2, and L5 shows that talent cultivation, as a conditional variable, is integral to universities in North China, Central China, East China, and Southwest China, such as Xiamen University and Central South University. talent cultivation is a basic index for university construction. talent cultivation is the basis of realizing social equity, ensuring social mobility, and implementing effective measures for digital transformation and modern innovation. Under the background of the strategy to strengthen the country through talents, talent cultivation should be promoted to cultivate individuals who can contribute to society, the country, and all mankind. The following tasks need to be conducted to achieve this goal: clarifying the target orientation of talent cultivation, reducing the unbalanced ratio of educational resources, decreasing the competitive pressures in the labor market, optimizing talent management through enhancing scheduling and allocation, and expanding an on-demand flow in intergenerational society. Breaking the closed loop between talent cultivation and discipline industry construction and exploring a new mechanism for the coordinated development of disciplined talents are imperative. Adopting a two-pronged approach to scientific research and education, which fosters interaction and cooperation, ensures that talent cultivation not only plays a role in the construction of disciplines or specialties but also promotes the harmonious integration of talent cultivation. This integration spans the institutional system, knowledge structure, and abilities and skills within the core construction of the university (Wang & Hu, 2019). Through the positive guiding role and the positive influence of moral education, the talent cultivation link has evolved from the participation of multiple subjects within the universities to the coordination of all aspects outside the universities. This transformation involves utilizing the complementarities between disciplines and industries to build a diversified talent growth chain for comprehensive innovation and development. Such endeavors provide effective human resource protection for the quality talent reserve of society and the implementation of national strategies.

6.3 Expanding the knowledge spillover effect to meet the demand for social services

Social service indicators, which include science and technology services and achievement transformation, carry a heavy weight of 48% in ARWU. In the configuration paths of L1, L3, and L4, and their typical cases, Shandong University, North China, Southwest China, and Central China are

explained. Social service is an important goal and a result of university construction. Society is the final field of academic output and talent direction in colleges and universities, and it represents the testing ground for academic effect and talent quality. Theory is integrated into practice through the transformation of achievements, and high-quality workers are provided for society through students' employment. Universities fulfill their social responsibilities and social commitments by providing social services to achieve the goal of sustainable development (Ayago, 2021). The social services provided by colleges and universities not only meet social needs but also practice the social contract. Accordingly, the cross-social classes can be concluded and connected. This situation guides and contributes to the realization of social justice (Diez Gutierrez, 2018). Therefore, colleges and universities should closely integrate social values and public interests, regard the provision of social services as a branch of public services, and ensure the mobility and sustainable development of education and teaching resources. It allows higher education, economic situation, and human society to form an objective form of sustainable development under the good rule of social services.

The rich knowledge resources of universities are the core capital for providing social services. The overflow of knowledge from universities enriches the connotation of social services and provides multi-dimensional matching and choice methods for social needs (Li et al., 2020). The increase in the social value of the university disciplines, the broadening of the academic application field, and the supplementation of talent strategic resources all constitute the reserve forces accumulated by colleges and universities to improve social services. In the era of big data with highly developed science and technology, emerging technologies should be used to improve the positive effects of knowledge spillover in universities and reduce the negative effects. Colleges and universities should prioritize meeting achievements, knowledge output, and public demand. Through the management and sharing of big data in social service, key adjustments can be made according to social demand, service object, and resource advantages. This way will help tailor the approach for social services, optimize the scope and channels of social service, and expand the knowledge spillover effect, which promotes all-round social development.

7 Conclusion

Using the QCA method, this study analyzes the configuration path of the comprehensive development level of colleges and universities. It investigates the influence of evaluation indexes on the configuration formation of universities to obtain five configuration paths. Specific interpretation cases of the configuration path are explored to provide ideas for the development and construction of universities for promoting the high-quality development of colleges and universities.

First, the importance of the evaluation index on the formation of the configuration path is determined, and the core condition variables are identified. Analysis of consistency and coverage shows that scientific talent cultivation, completeness of social service, higher academic reputation, and superior achievements & benefits are necessary conditions for the existence of high scores in colleges and universities. Conversely, insufficient faculty size, incomplete social service, poor academic reputation, and inferior achievements & benefits are necessary conditions for the lack of high scores in colleges and universities.

Second, the comprehensive performance configuration path of colleges and universities is obtained. L1 path universities pay attention to talent cultivation and social services, with a certain international influence. L2 path universities have sufficient international influence, along with excellent academic reputations and talent cultivation. L3 path universities excel in academic reputations, good output in social services, achievements & benefits. L4 path universities have prominent input and output in social services, with a large size of faculty and a strong academic reputation. The university achievements of the L5 path yield significant benefits and have good performance in talent cultivation and academic reputation.

Third, we identify key areas for the development and construction of colleges and universities. The typical cases represented by the five configuration paths provide field references for the focus and direction of subsequent university development. In response to the requirements of the *Overall Plan*, the quality and structure of national education should be continuously optimized, and high-quality development should be pursued by enhancing academic reputation, paying attention to talent cultivation, and strengthening social services.

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