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Development of Higher Vocational Education in Shuangcheng Economic Circle of Chengdu-Chongqing area Evaluation and Research on Coupling and Coordination with Economic Growth

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Abstract: ***Objective: The Central Committee's meeting on the Chengdu-Chongqing economic plan highlights the role of higher vocational education in fostering technological progress and economic growth through skilled talent cultivation, aligning with the region's development opportunities. Methods: This paper uses entropy method and coupling coordination degree model to conduct empirical research on the collaborative development of higher vocational education and regional economy in Chengdu-Chongqing region from 2011 to 2020. Conclusions: 1) For Chengdu-Chongqing area, the coupling coordination degree has gradually changed from the original low level coupling coordination type to the good coordination degree.2) In order to maintain the balanced development of higher vocational education with economic and social development, our country must accelerate the transformation of government functions, promote the reform of vocational education, and promote the coordinated development of higher vocational education and regional economy.***

Keywords: Higher vocational education; Economic and social development; Coupling coordination degree; Coupling coordination type

1.INTRODUCTION

In the context of the rapid development of the global economy, technology and knowledge have become key drivers of productivity. Schumpeter believed that innovation is the essence of economic development, and education is crucial for enhancing labor productivity. Vocational education promotes economic growth by improving skills and increasing production efficiency. There is an imbalance in China's regional economic development, with the eastern coastal regions leading in both economic and educational investment, while the central and western regions lag behind [5]. There are differences in the structure and proportion of educational investment across regions, necessitating research on their synergistic effects on economic growth.

Denison's research indicates that education contributes about 35% to U.S. economic growth. After the information technology revolution, the role of education for workers has become even more critical. New growth theories posit a close relationship between technological progress and economic growth, with education and innovation capability playing significant roles in technological advancement. Domestic scholars focus on the interaction between the education system and the economic system, with rapid regional economic development providing substantial funding for education. Governments can invest a portion of economic revenue into education, improving teaching conditions and the quality of education[8].

The relationship between vocational education and the economy is complex, but research shows that educational investment has a positive effect on economic growth. There is an imbalance in China's higher education, with talent cultivation not well-aligned with enterprise needs. Vocational education is crucial for economic development, yet there are disparities in educational levels between the eastern and western parts of the country [6].The government needs to advance educational reforms to promote balanced development of vocational education. This study, based on panel data from Sichuan and Chongqing provinces from 2011 to 2020, focuses on the coordinated relationship between vocational higher education and socio-economic development. Using a coupling model, it analyzes the coupling degree and changing trends in the Chengdu-Chongqing region, studies the development of vocational higher education in the dual-city economic circle, and assesses the coordination between vocational education and economic development in the area, providing recommendations for promoting coordinated development of vocational education and high-level socio-economic development in China's regions

[9].

2.THE CONCEPT OF DEGREE OF COUPLING COORDINATION

The concept of the Degree of coupling coordination (DCC) is a pivotal analytical tool in the study of complex systems, particularly in assessing the harmonious development between different components within a system. It quantifies the level of integration and synergy, providing insights into the interdependence and mutual constraints of subsystems. The DCC model has been widely applied in various fields such as urban development, environmental management, and economic growth to evaluate the balanced progress of regions and the effectiveness of policy interventions.

The model is characterized by its ability to measure the coupling degree (C), which reflects the interaction and dynamic association between two or more systems, and the coordination degree, which indicates the extent of beneficial coupling within the system. The formula for calculating the DCC (D) is typically the product of the coupling degree (C) and a comprehensive evaluation index (T), with coefficients α and β representing the weight of the respective subsystems.

The application of the DCC model is supported by a wealth of academic literature. For instance,some s tudies indicate that The digital coupling coordination degree model effectively expresses the coordinated development of vocational education's specialty structure and industrial structure, contributing to social development [1].

3.STUDY SUBJECTS AND RESEARCH METHODS

3.1 Study subjects

According to McKinsey's data estimation, in 2020, the total demand gap for vocational education in China was 16 million related workers, which is expected to cause an economic loss of $145 billion. The shortage of skilled talents has, to a certain extent, restricted economic development. The internal logic of vocational education and economic development has a unified and coordinated effect. The development of regional economy also plays a positive role in the development of higher vocational education [2]. Effectively integrating and coordinating economic development with higher vocational education, and promoting them in tandem, is conducive to advancing the adjustment of educational structures and adjusting the positioning of elements. Only in this way can we better facilitate the coordinated development of vocational education and the economy [7].

3.2 Study Methods

3.2.1 Literature and data method

Using China network, wan fang database and related search platform,view the relevant literature, report journals and monographs, to the careful reading and targeted, summary, as paper research and review, p rovide strong theoretical support and basis for the paper.The data used in this paper are from China Ed ucation Statistical Yearbook, China Education Expenditure Statistical Yearbook and China Statistical Yea rbook. This part of the data is helpful to observe and evaluate the comprehensive development of the h igher vocational education in our country. The China Education Expenditure Statistical Yearbook provide s information on education expenditure per student and on students and teachers in the public finance b udget, with the number of graduates published by the Ministry of Education and the Ministry of Financ e. The evaluation indexes of the development level of higher vocational education involved in this pape r are all from the data of the Statistical Yearbook of China Education Funds and the corresponding ind exes are calculated.

3.2.2 Coupling coordination degree model

The Coupling Coefficient Model can determine the degree of association between different systems, but it cannot measure the coordination degree between them. The Coupling Coordination Degree Model is used to assess the coordination degree between systems, thereby better understanding the interrelationships among different systems. In this study, we will use the Coupling Coordination Degree Model to investigate and measure

the coordination degree between different systems. The model is expressed as:

$$D = \sqrt{(C \times T)}, T = \alpha U_1 + \beta U_2$$

where D represents the coupling coordination degree,T is the comprehensive evaluation index, and α,β are coefficients to be determined. Due to the varying degrees of interaction between vocational education investment and economic growth, following the research point out,α and β are assigned values of 0.4 and 0.6, respectively. The level of system coordination can be categorized based on the size of the coupling coordination degree [3], as shown in Table 1.

Table 1: Qualitative Assessment of Value Ranges

Range	Assessment
0.0–0.09	Very Low
0.1–0.19	Low
0.2–0.29	Fairly Low
0.3–0.39	Medium Low
0.4–0.49	Medium
0.5–0.59	Medium High
0.6–0.69	Fairly High
0.7–0.79	High
0.8–0.89	Very High
0.9–1.00	Extremely High

3.2.3 Indicator Selection

Considering the completeness, comparability, and accessibility of the historical data from the educational statistical yearbooks, in order to fully and objectively reflect the integrated development level of secon dary vocational education across various provinces in China, this paper, referring to the research from t he Ministry of Education's "China Education Monitoring and Evaluation Statistical Indicator System (20 20 Edition)," divides the indicators into two first-level indicators—economic scale and economic strength —and nine second-level indicators. The specific indicators are presented in Table 2.

Table 2: Indicators of vocational education input system and economic growth system

System	First-level Indicator	Second-level Indicator	Indicator Weight	Serial Number
Higher education input system	Teacher engagement	High-Tech Industrial Added Value	0.1114	X1
		High-Tech Products Export Volume	0.0912	X2
		Scientific Research Institute Personnel	0.0977	X3
		High-Technology Patent Authorization Quantity	0.0478	X4
	Facility input	International Market Share of High-Tech Industry	0.0721	X5
		Market Share of High-Tech Industry	0.1004	X6
		Trade Balance of High-Tech Industry	0.0782	X7
		Foreign Direct Investment, FDI	0.0598	X8
	Financial input	Expenditure on R&D as Percentage of GDP	0.0820	X9

		Number of R&D Personnel	0.0653	X10
		Government Funding for Science and Technology	0.0565	X11
		Contribution Rate of Science and Technology Progress	0.0481	X12
Economic growth system	Economy of scale	Number of High-Tech Enterprises	0.0895	X13
		Output of Biotechnology and New Medical Technology	0.1015	X14
		Expenditure on Private Enterprise R&D	0.0768	X15
		Revenue of Local Government	0.1055	X16
	Economic Strength	Social Fixed Assets Investment	0.0610	X17
		Total Import and Export Volume	0.2291	X18
		Expenditure on Education	0.1624	X19
		Number of Healthcare Professionals	0.0864	X20
		Urban GDP	0.0993	X21
		Consumption level of residents	0.0841	X22

4.RESULTS AND ANALYSIS

4.1 Coupled coordination analysis between Chongqing and Sichuan provinces

According to the coupling coordination degree model, the input system index (U1) of higher vocational education and the system index of economic growth system (U2) and the coupling coordination degree value (D) of the two systems in Chengdu-Chongqing Economic Circle during 2010-2020 were calculated, as shown in Table 3

Table 3: Inverse quotient evaluation grades of the survey respondents in Gannan Medical College

Province	Year	Vocational Education Investment System U1	Economic Growth System U2	C	T	D	Coupling Coordination Degree
CHONG QIN	2010	0.0714	0.2465	0.8345	0.1765	0.3837	Mild disorder
	2011	0.0752	0.2367	0.8555	0.1721	0.3840	Mild disorder
	2012	0.1278	0.1819	0.9846	0.1603	0.3972	Forced coordination
	2013	0.1316	0.3170	0.9106	0.2429	0.4703	Forced coordination
	2014	0.1397	0.2867	0.9387	0.2279	0.4625	Forced

							coordination
	2015	0.1922	0.2597	0.9888	0.2327	0.4797	Forced coordination
	2016	0.2200	0.3773	0.9647	0.3144	0.5507	Forced coordination
	2017	0.2337	0.3726	0.9734	0.3171	0.5556	Forced coordination
	2018	0.2589	0.3988	0.9771	0.3428	0.5788	Forced coordination
	2019	0.2896	0.4375	0.9791	0.3784	0.6086	Primary coordination
	2020	0.3239	0.5187	0.9729	0.4408	0.6549	Primary coordination
SI CHUAN	2010	0.4934	0.1766	0.8811	0.3033	0.5170	Forced coordination
	2011	0.5253	0.3249	0.9718	0.4050	0.6274	Primary coordination
	2012	0.5287	0.2465	0.9314	0.3594	0.5786	Forced coordination
	2013	0.5563	0.3513	0.9742	0.4333	0.6497	Primary coordination
	2014	0.6415	0.3795	0.9665	0.4843	0.6842	Primary coordination
	2015	0.7011	0.3631	0.9482	0.4983	0.6874	Primary coordination
	2016	0.7293	0.3984	0.9560	0.5308	0.7123	Intermediate coordination
	2017	0.7399	0.4880	0.9787	0.5888	0.7591	Intermediate coordination
	2018	0.7860	0.6211	0.9931	0.6871	0.8260	Good coordination
	2019	0.8719	0.6968	0.9937	0.7669	0.8730	Good coordination
	2020	0.9218	0.7393	0.9939	0.8123	0.8986	Quality coordination

4.2 Analysis of coupling coordination between Chongqing and Sichuan Province

The coupling coordination degree of Shuangcheng economic circle in Chengdu-Chongqing area can be d ivided into lagging type and synchronous type according to the development of higher vocational educat ion input system and economic growth system [4]. This helps us to understand the degree of coordinati on and development between the development of higher vocational education input system and economi c growth system.

4.2.1 The comprehensive development level of the two systems in Chongqing

Figure 2 shows the comprehensive development level of the two systems in Chongqing from 2010 to 2 020. The comprehensive development rate of the input system of higher vocational education and the e conomic growth system in Chongqing has shown a steady rising trend [10]. The overall development le vel of vocational education shows that Chongqing's higher vocational education investment system lags behind the economic growth system. From the perspective of time, the comprehensive development rate of Chongqing's economic growth system in 2010 was also low, only 0.2465, while the comprehensive development rate of higher education investment system was only 0.0714.It can be found that in recent ten years, the economic growth system index of Chongqing is higher than the input system index of h igher vocational education, and the coupling and coordination relationship between the two systems sho

ws that the input system of higher vocational education is lagging.

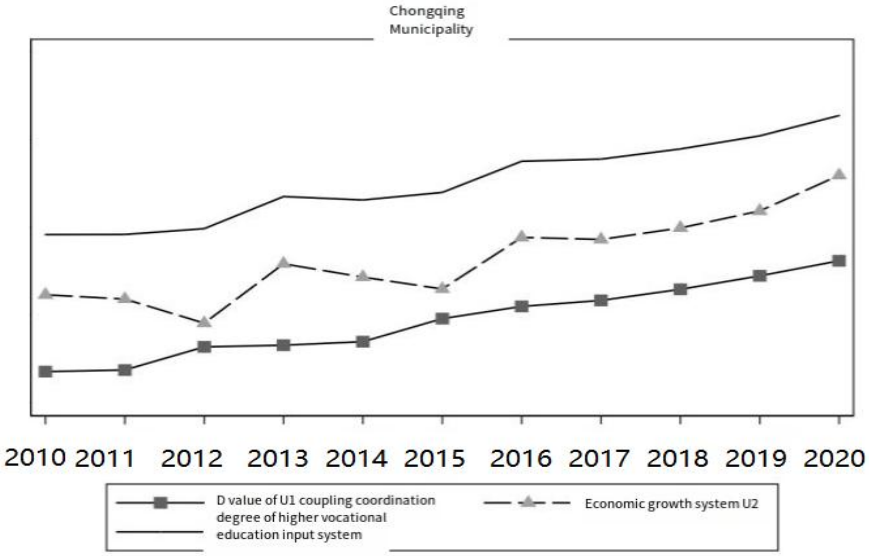

Figure 2: Investment in higher vocational education and economic growth system in Chongqing The level of comprehensive development and the degree of coupling coordination

4.2.2 The comprehensive development level of the two systems in Si Chuan

As can be seen from Figure 3, the comprehensive development level of the two systems in Sichuan Province, the comprehensive development level of the higher vocational education input system U1 and the economic growth system U2 in Sichuan Province have steadily increased between 2010 and 2020. In general, the comprehensive development level of the higher vocational education input system in Sichuan Province is superior to the economic growth system.The U1 comprehensive development index of the higher education input system in Sichuan Province in 2010 was only 0.4934, which was at the lowest level, but it continued to rise from that year to 2012. From 2010 to 2020, the input system for higher vocational education began to rise steadily. The total development index of the economic growth system U2 was also the lowest in 2010, at only 0.1766, but it has been growing overall and gradually closing the gap with the total development index of investment in higher vocational education.

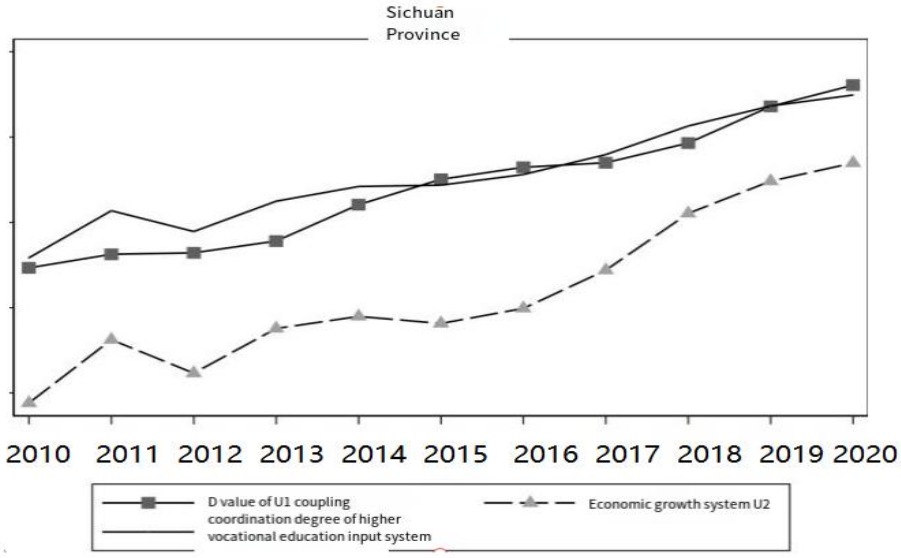

Figure 3: Higher vocational education input and economic growth system in Sichuan Province The level of comprehensive development and the degree of coupling coordination

4.2.3 The Comparison of two systems in Chongqing and Sichuan Province

According to Table 3, Figure 2 and Figure 3, it can be seen that from 2010 to 2020, the D value of linkage and coordination degree between the input system of higher vocational education and the economic growth system in Sichuan and Chongqing region continues to increase. The internal coordination between the two has been improved to some extent.

The degree of coupling coordination between the investment system of higher vocational education and the economic growth system of Chongqing from 2010 to 2020 can be roughly divided into three stages: the first stage is that the two systems are in the coupling misalignment period from 2010 to 2011. It shows that the interaction between investment in higher vocational education and economic growth is weak in 2010-2011 in Chongqing, which shows that the development of higher vocational education system lags behind. The second stage was from 2012 to 2018, when the coordination between the two systems gradually improved. Chongqing's higher education investment and economic growth are gradually recovering, and the connection and coordination between the two systems are emerging. The third stage is to further improve the coordination between the higher education investment system and the economic growth system in 2019-2020. During this period, the input of higher vocational education and the level of economic growth increased significantly, and the two systems gradually developed simultaneously.

The degree of coupling and coordination between the input system of higher vocational education and the economic growth system in Sichuan Province from 2010 to 2020 can be divided into three stages: the first stage is from 2010 to 2015, and the two systems are barely in the primary stage of coupling and coordination. During this period, the coordination level between higher vocational education input and economic development in Sichuan increased slightly and recovered, and the interaction between the two systems began to improve. The second stage, 2016-2017, the two systems are in a medium coordination period. Investment in higher vocational education and economic growth are both at a good level of development, and the synchronous development of the two systems has been further strengthened. The third stage is the period of good coordination from 2018 to 2020. During this period, the mutual promotion of the two systems was also significantly enhanced, but in general, the degree of coordination between the higher education investment system and the economic growth system in Sichuan Province was significantly higher than that in Chongqing.

5.CONCLUSION

First of all, from the overall comprehensive development index, the higher education input system and the overall economic growth system of Chengdu-Chongqing economic circle comprehensive development index show a stable growth trend. However, the overall comprehensive development level of Chongqing in the past ten years is relatively low. After 2010, the systematic development index of Chongqing's economic growth has maintained a high growth rate, but the investment system of higher education in Chongqing has not improved significantly. From 2010 to 2020, the comprehensive development rate of Sichuan's higher education investment system was higher than that of its economic growth system, and the coordination degree of the two systems was in a good coordination degree in 2018.

Secondly, from the perspective of the coupling and coordination relationship between the two systems, the coupling and coordination degree between the two systems of the Chengdu-Chongqing economic circle can be divided into the lagging system of economic growth, the lagging system of higher vocational education input and the synchronous system of higher education input and economic growth. From the perspective of local integration and coordination, in 2010, the integration and coordination degree of the two systems in Chongqing was low; From 2012 to 2020, the overall investment in higher education in Chongqing is lagging behind, and there is a big difference between the two systems. The coordination between economic growth and vocational education has not reached the ideal state. But the coupling coordination level in Sichuan province has developed from barely coordination to good coordination, and the coupling coordination level has improved significantly.

At last, from the perspective of coupling coordination, the coupling coordination of Chongqing and Sichuan systems shows an overall trend of enhancement from 2010 to 2020, and the interaction between the systems develops in a benign direction. From the perspective of coupling coordination, the coordination between higher vocational education and economic growth system has been further enhanced, and the degree of coupling coordination between higher education investment and economic growth system in Sichuan province has

changed from unbalanced period to high-quality coordination period. The degree of coordination between higher education investment coupling and economic growth system in Chongqing has gradually shifted from unbalanced and reluctant coordination period to primary coordination period. However, the coordination degree between higher education input and economic growth system in Sichuan Province is still better than that in Chongqing.

RESEARCH PROJECTS

1) Research Research Center for Collaborative Development of Higher Vocational Education in Chengdu -Chongqing Economic Circle commissioned project: Research on Collaborative and Integrated Developme nt of Higher Vocational Education under the background of construction of Shuangcheng Economic Circ le in Chengdu-Chongqing Area, project approval number: 2023WT016.

2) Chongqing Education Science Planning Project Annual planning general project, project name: Chong qing Higher Vocational Education and digital economy Coupling coordination Evaluation and developme nt research, project approval number: K23YG3210318

REFERENCES

[1] Zhan, Q., & Wang, X. (2019). A Digital Coupling Coordination Degree Model for Docking the Specialty Structure and Industrial Structure in Vocational Education. 2019 5th International Conference on Big Data and Information Analytics (BigDIA), 47-51.
[2] Zhao, H., Stoyanets, N., Cui, L., & Li, G. (2022). Strategy of vocational education adapting to social and economic development. Journal of Innovations and Sustainability.
[3] Wang, S. (2020). Design of Higher Education Aided Teaching System Based on Analysis of Economic Coupling Coordination Degree. e-Learning, e-Education, and Online Training, 340, 176 - 188.
[4] Wang, H., He, Y., & Shang, S. (2023). Measurement of the coupling between education and regional economic development levels in Western China. Proceedings of the 4th International Conference on Education, Knowledge and Information Management, ICEKIM 2023, May 26–28, 2023, Nanjing, China.
[5] Li, X. (2023). Education in China-Unbalanced Educational Development Caused by Regional Differences. Journal of Education, Humanities and Social Sciences.
[6] Mok, K., Wen, Z., & Dale, R. (2016). Employability and mobility in the valorisation of higher education qualifications: the experiences and reflections of Chinese students and graduates. Journal of Higher Education Policy and Management, 38, 264 - 281.
[7] Liu, L. (2023). The Connotation, Problems, and Practice of the Integration and Development of Vocational Education and Private Economy. Journal of Theory and Practice of Social Science.
[8] Zhou, G., & Luo, S. (2018). Higher Education Input, Technological Innovation, and Economic Growth in China. Sustainability.
[9] Peng-lin, L. (2010). A Study of Innovative Qualified Talent Training Based on School-enterprise Cooperation Coupling Model——Taking the Software College of Zhejiang University of Technology as an Example. Journal of Zhejiang University of Technology.
[10] Huang, S., & Liu, C. (2017). A Study on the Impact of Development of Vocational Education on Economic Growth in Chongqing.

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