

Coordination between University Discipline Structure and Industrial Structure

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Abstract—Employing the Pearson correlation coefficient and the statistical data of Hubei Province from 2005 to 2017, this paper analyzed the development status of industrial structure, higher education discipline structure and the coordination between higher education structure and industrial structure of Hubei province. The study found that the disciplines of science, economics, law, philosophy are less coordinated with the development of industrial structure, and the remaining disciplines, such as agronomy, engineering, and pedagogy, can basically meet the requirements of industrial structure. In order to improve the coordination of regional higher education discipline structure and industrial structure, we should differentiate the scale and development speed of various disciplines with the new demand of human capital for industrial restructuring and upgrading, and accelerate the training of urgently needed talents and new-type talents. By optimizing the structure of higher education discipline, the supply-side structural reform of human capital can be vigorously promoted.

Keywords—higher education; discipline structure; industrial structure; supply-side structural reform

I. INTRODUCTION

To build a modern economic system, it is necessary to deepen the supply-side structural reforms and support the optimization and upgrading of traditional industries, so as to promote China's industry to the high end of the global value chain. However, whether it is to deepen the supply-side structural reform or the improvement of the industrial value chain, it needs the support of high-level human capital, and the human capital structure is greatly affected by the discipline structure of higher education [1]. Therefore, higher education should actively adapt to economic and social development, optimize the talent supply structure, accelerate the cultivation of urgently needed talents, and serve the industrial structure adjustment and upgrading more effectively. It is particularly necessary to study the coordination, relevance and dynamic adjustment mechanism of the discipline structure of higher education and industrial structure under the new normal.

II. THE INTERACTION MECHANISM BETWEEN THE DISCIPLINARY STRUCTURE OF HIGHER EDUCATION AND INDUSTRIAL STRUCTURE

The discipline structure of higher education has an effect on the industrial structure by influencing the structure of human capital. The discipline structure of higher education refers to

the type of disciplines in higher education and the proportion of talents in various disciplines [2]. The discipline structure of higher education determines the professional direction, talent scale and talent quality of higher education talents, and then affects the satisfaction and matching degree of human capital supply and industrial structure, national and regional economic and social development needs in the industrial labor market.

The industrial structure affects the discipline structure of higher education by affecting labor market demand and post income structure [3]. The industrial structure refers to the internal composition and output ratio of each industry in the national economy; it is the external manifestation of the division of labor in social production [4] [5]. The industrial structure is the external driving factor for the change of the discipline structure. It affects the employment demand and the salary structure to affect the number of students in different disciplines in higher education institutions, and ultimately affects the development of the discipline structure. Generally, those disciplines, which have large social needs, high incomes, and meet the needs of industrial structure development, develop faster [6]. So it is necessary to pay attention to the inherent laws of the development of disciplines and the external laws of the fit of discipline structure to industrial structure and socio-economic development when researching subject structure optimization.

III. DEVELOPMENT STATUS

It is helpful for the rational allocation of higher education resources and the optimization of personnel training structure to analysis of the status quo of education structure and industrial structure development in Hubei Province, correlation coefficient and coordination, using data from 2005-2017 in Hubei Province.

A. Current Situation of Discipline Structure in Hubei Province

In 2017, there were 128 colleges and universities in Hubei Province, with 427,845 fresh graduates. The numbers of graduates from various disciplines since 2005 are shown in Table I.

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TABLE I. DISTRIBUTION OF GRADUATES

Year	Philosophy	Economics	Law	Education	Literature	History	Science	Engineering	Agronomy	Medicine	Management
2005	293	7228	6382	2833	15248	432	11575	43361	2386	8688	16283
2006	425	10191	9735	4242	19171	622	13700	52406	2789	9213	22743
2007	386	11709	10385	4580	21001	649	15155	51854	2964	9407	20573
2008	490	15610	10373	4983	26963	778	16679	60003	3060	7187	27644
2009	538	11484	8348	5657	29318	802	18450	61015	3051	9842	24834
2010	513	11250	8402	5228	29730	743	16207	60287	3164	9518	24325
2011	590	11987	9334	6386	33494	882	17975	66443	3405	10866	27355
2012	536	12768	9406	6966	36493	934	18577	70876	3767	10904	29673
2013	494	13113	10252	7287	39655	938	15585	77841	4000	12643	33055
2014	403	15003	9667	8042	41831	849	15309	84862	4117	13498	37101
2015	442	15079	9925	9074	44553	1031	19708	85712	4306	14416	38776
2016	409	15453	10425	9440	45603	972	19639	86734	4339	15071	41657
2017	405	14980	10058	8525	46907	885	15892	86103	4284	15646	32763

Source: "Yearbook of Hubei Education" collated 2007--2017 literature disciplines include foreign language and artistic

From Table I, we can see that the discipline structure of higher education in Hubei Province is sound and can provide certain support for the development of various industries. The number of graduates from different disciplines varies greatly. With the development of industrial economy and the change of social demand for human capital, the number of graduates from different disciplines varies greatly. The changing trend of the number of graduates from various disciplines in Hubei Province from 2005 to 2017 is shown in Figure 1.

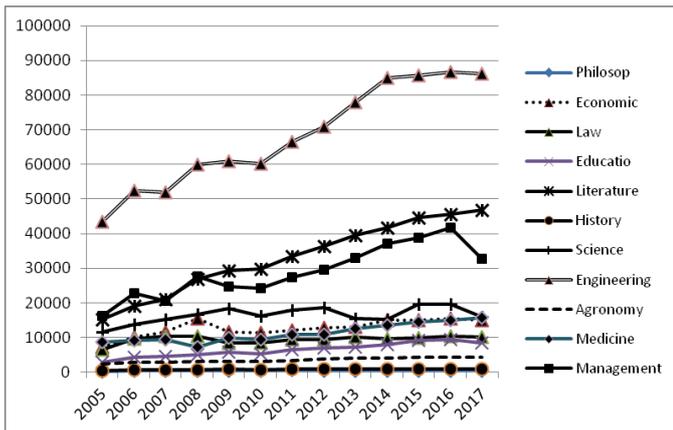


Fig. 1. The variation trend of the number of graduates figure

On the whole, the scale of college graduates in Hubei Province is relatively large and is still on the rise, which shows that the overall level of human capital in society is improving. Among them, engineering graduates are the largest, followed by literature and management. From 2005 to 2014, the number of graduates from most disciplines showed an upward trend, and the growth rate of literature and education was fast. After 2015, engineering tends to be stable and science declines. Although management fluctuated before 2016, it increased as a whole, but the number of graduates dropped dramatically in

2017. These changes and economic development have a certain relationship with the demand for human capital.

B. Current Situation of Industrial Structure Development in Hubei Province

The Petty-Clark Theory points out that with the development of economy and the increase of per capita national income, the proportion of labor force and national income in the primary industry decreases, while the proportion of national income and labor force in the secondary industry increases, and then the proportion of national income and labor force in the tertiary industry increases [7] [8]. The phenomenon of labor force transfer is closely related to the difference of industrial structure income [9]. Table II shows that from 2005 to 2017, the proportion of primary industry in Hubei Province declined continuously, and in 2017 it dropped to 10.29%. The proportion of secondary industry increased steadily from 2005 to 2012, but began to decline after 2012, and dropped to 44.52% in 2017. The proportion of tertiary industry declined slightly from 2008 to 2012. After 2012, the proportion increased year by year, accounting for 45.19% in 2017. For the first time, it surpassed the secondary industry and became the leading industry in Hubei Province.

TABLE II. GDP AND THREE MAJOR INDUSTRIES IN HUBEI PROVINCE

Year	GDP	Primary industry	Proportion	Secondary industry	Proportion	Tertiary industry	Proportion
2005	6590.19	1082.13	16.42%	2852.12	43.28%	2655.94	40.30%
2006	7617.47	1140.41	14.97%	3365.08	44.18%	3111.98	40.85%
2007	9333.40	1378.00	14.76%	4143.06	44.39%	3812.34	40.85%
2008	11328.92	1780.00	15.71%	5082.07	44.86%	4466.85	39.43%
2009	12961.10	1795.90	13.86%	6038.08	46.59%	5127.12	39.56%
2010	15967.61	2147.00	13.45%	7767.24	48.64%	6053.37	37.91%
2011	19632.26	2569.30	13.09%	9815.94	50.00%	7247.02	36.91%
2012	22250.45	2848.77	12.80%	11193.1	50.31%	8208.58	36.89%
2013	24668.49	3098.16	12.56%	12171.56	49.34%	9398.77	38.10%
2014	27379.22	3176.89	11.60%	12852.4	46.94%	11349.93	41.45%
2015	29550.19	3309.84	11.20%	13503.56	45.70%	12736.79	43.10%
2016	32665.38	3659.33	11.20%	14654.38	44.86%	14351.67	43.94%
2017	36522.95	3759.69	10.29%	16259.86	44.52%	16503.40	45.19%

Unit: 100 million Yuan

Source: Hubei Statistical Yearbook and the official website of the National Bureau of Statistics

Compared with the development of tertiary industry in 2017, the added value of tertiary industry in the United States accounted for 80.05% of GDP, the proportion of tertiary industry in Beijing and Shanghai was 80.60% and 68.97% respectively, and the proportion of tertiary industry in China was 51.63%. The data show that the proportion of tertiary industry in Hubei Province is not only lower than that of developed countries and cities with faster domestic economic development, but also lower than that of the whole country. Therefore, it is imperative for the corresponding national industrial restructuring policies in Hubei Province under the current situation.

IV. COORDINATION ANALYSIS

According to the nature of various disciplines of higher education and the needs of industrial structure development, this paper assumes that agriculture serves the primary industry, science and engineering serve the secondary industry, and philosophy, economics, law, pedagogy, literature, history, medicine and management serve the tertiary industry[10]. SPSS23.0 software was used for data statistical analysis. Through the test of K-S normal distribution of single sample for the above data, the data of the development of each discipline and the data of the three major industries are significant at the significant level of 0.05, which shows that each single sample data conforms to the normal distribution; moreover, all variables belong to continuous variables, so this paper chooses Pearson correlation analysis to analyze the coordination between discipline structure of higher education and industrial structure. The results are as follows.

A. Agronomy and Industrial Structure

TABLE III. AGRONOMY AND INDUSTRIAL STRUCTURE

	Primary Industry	Secondary industry	Tertiary industry
Agronomy Pearson Correlation	.978**	.973**	.950**
Sig. (2-tailed)	.000	.000	.000
N	13	13	13

** .Correlation is significant at the 0.01 level (2-tailed).

The data in Table III show that the correlation coefficients between agriculture and the three industries are 0.978, 0.973 and 0.950, respectively, with a significant correlation at the level of 0.01. It shows that agronomy is highly related to the three industries. At present, agronomy in higher education can provide good support for the development of the three industries and maintain the current state of development.

B. Science, Engineering and Industrial Structure

TABLE IV. SCIENCE ,ENGINEERING AND INDUSTRIAL STRUCTURE

	Primary Industry	Secondary industry	Tertiary industry
Science Pearson Correlation	.590*	.551	.501
Sig. (2-tailed)	.034	.051	.081
N	13	13	13
Engineering Pearson Correlation	.974**	.968**	.954**
Sig. (2-tailed)	.000	.000	.000
N	13	13	13

*.Correlation is significant at the 0.05 level (2-tailed).

** .Correlation is significant at the 0.01 level (2-tailed).

Table IV shows that the correlation between science and the primary industry is only significant at 0.05 level, the correlation with the industrial structure is low. These data show that the coordination between science and industry development is not good. The correlation coefficients between engineering and the three industries are 0.974, 0.968 and 0.954 respectively, which are significantly correlated at the level of 0.01. This shows that engineering and industrial structure are highly coordinated. The fact that the increasing proportion of engineering graduates declined and the proportion of secondary industry in the three industries declined also proves this result.

C. Other Disciplines and Industrial Structure

TABLE V. OTHER DISCIPLINES AND INDUSTRIAL STRUCTURE

	Primary Industry	Secondary industry	Tertiary industry
Philosophy Pearson Correlation	.157	.133	-.032
Sig. (2-tailed)	.608	.665	.918
N	13	13	13
Economics Pearson Correlation	.760**	.719**	.739**
Sig. (2-tailed)	.003	.006	.004
N	13	13	13
Law Pearson Correlation	.482	.452	.459
Sig. (2-tailed)	.096	.121	.114
N	13	13	13
Education Pearson Correlation	.964**	.955**	.945**
Sig. (2-tailed)	.000	.000	.000
N	13	13	13
Literature Pearson Correlation	.989**	.982**	.956**
Sig. (2-tailed)	.000	.000	.000
N	13	13	13
History Pearson Correlation	.871**	.847**	.770**
Sig. (2-tailed)	.000	.000	.002
N	13	13	13
Medicine Pearson Correlation	.910**	.930**	.957**
Sig. (2-tailed)	.000	.000	.000
N	13	13	13
Management Pearson Correlation	.940**	.922**	.930**
Sig. (2-tailed)	.000	.000	.000
N	13	13	13

*.Correlation is significant at the 0.05 level (2-tailed).

** .Correlation is significant at the 0.01 level (2-tailed).

Table V shows that education, literature, history, medicine and management are significantly related to the three industries at the 0.01 level. These disciplines are highly coordinated with the current industrial structure development and can effectively serve the development of related industries. Economics has a higher coordination with the primary industry and the tertiary industry, and a slightly lower coordination with the secondary industry. Philosophy and are not in harmony with the industrial structure, so we need to adjust the enrollment of the two disciplines according to the current industrial structure [11].

V. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

The scale of higher education in Hubei Province is large, and it provides powerful human resources guarantee for economic development. But the research results show that the coordination between discipline structure and industrial structure of higher education is poor [12].

- The cultivation of talents in philosophy and law has not played an effective role in the development of industrial economy and needs to be improved urgently.
- The correlation between science, economics and history and industrial structure is low and needs to be optimized.
- Agriculture, engineering, education, literature, medicine, management have a high degree of coordination with industrial structure.

- With the continuous advancement of industrial restructuring and optimization, new trends will emerge in human capital demand. These disciplines need to make corresponding adjustments in order to achieve better service for the corresponding industrial development.

B. Recommendations

Based on the research results and the development concept of deepening the supply-side structural reform, three points should be considered in the adjustment and optimization of the discipline structure of higher education in Hubei Province.

1) *There should be differences in the adjustment schemes and training levels of various disciplines.* Disciplines with high coordination with industrial structure can closely follow the needs of industrial structure development to fine-tune to meet the fluctuating demand of industrial structure. Those disciplines which are moderately or lowly related to industrial development need to be adjusted vigorously to improve effective supply to better adapt to industrial development. Considering the direction of economic development in Hubei Province, we should also focus on the increase of the proportion of matching professionals in tertiary industry.

2) *Multi-sectoral collaboration to scientifically predict talent demand.* Due to the time lag of the adjustment of the discipline structure of higher education and the effective service to the development of industrial structure, it is required that the government's economic development planning and decision-making departments, industry associations, industry vocational education and teaching guidance committees and other departments work in depth to predict the scale, quality and level requirements of talent demand scientifically and effectively [13]. Through these ways, we can provide scientific guidance for the adjustment of discipline structure of higher education, avoid the disconnection between talent cultivation and social needs, and avoid the waste of educational resources.

3) *Those talents who are in urgent need in social development and new-type talents should be trained quickly.* In the process of promoting industrial restructuring and deepening supply-side reform, the demand for new talents and compound talents will increase, and the emergence of new disciplines and interdisciplinary science will inevitably occur, higher education should face this phenomenon squarely. According to the needs of talents in "Made in China 2025", it is possible to strengthen core technical disciplines in universities with stronger strengths and improve the quality of manufacturing talents in ordinary colleges and universities.

Improve the scale of personnel training in strategic industries such as energy conservation and environmental protection, next-generation information technology, high-end equipment, new energy, and biology; Strengthen the quality of personnel training in emerging disciplines, modern service industries and modern agriculture to provide a solid human capital guarantee for current economic policies and future economic development.

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