

# *Study on the Synergy between Undergraduate Discipline Adjustment and Industrial Structure Evolution in Jilin Province*

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**Abstract:** The positive interaction between discipline adjustment in colleges and universities and industrial structure evolution is an influential way to develop high-quality economy and education, and undergraduate education is an essential factor affecting the scale and quality of talent supply. In this paper, entropy method and coupling coordination degree model are used to analyze the coupling relationship and evolution characteristics between the undergraduate discipline adjustment system and the industrial structure evolution system in Jilin province. It is found that both systems have changed from scale expansion to high-quality development, and the adjustment of undergraduate disciplines has experienced a phased evolution relative to the evolution of industrial structure. Based on this, in order to promote the high-level collaborative development of the two systems, this paper proposes that Jilin province should optimize the top-level design of undergraduate specialty layout, perfect the internal specialty structure of the discipline, accelerate the construction of a characteristic new discipline system, and further promote the construction of the discipline group with deep integration of industry and education.

## 1. Introduction

At present, Jilin province is in a key stage of giving full play to its unique advantages and improving its strategic position in the overall situation, of accelerating transformation and achieving high-quality development. Facing the uncertain environment at home and abroad, an infirm foundation for economic recovery, as well as the status quo of industrial upgrading lag, Jilin province must accelerate the transformation of economic development mode, which urgently needs to reform the structure of talent supply and improve the matching degree of talent training chain with the industrial chain and innovation chain. The undergraduate education is a critical factor affecting the scale and quality of talent supply. Only when the undergraduate discipline structure is consistent with the industrial structure, can the positive interaction between the supply of talents in colleges and universities and the demand for industrial talents be better realized [1, 2].

For now, numerous foreign and domestic scholars have conducted research on the relationship between higher education and industrial structure [3-6]. Some scholars hold that industry structure determines the employment market structure of college students to a large extent, and affects the choice of their subjects, majors, and educational levels [7-9]. Scholars represented by Martin Trow (1974) believe that higher education realized the coordinated development of industry by supplying talents of different types, levels, specifications and quality to industrial sectors, and the formation of the coordinated relationship between universities and industrial economy was mainly based on the dynamic balance of talent supply and demand [10, 11]. In recent years, a limited number of scholars have also discussed the situation of Jilin province. For instance, Song Xiaojie and Teng Yuhai in 2016 [12] studied the optimization strategy of higher education structure from the perspective of regional industrial structure adjustment and Zhao Shumei et al. (2021) [13] conducted an empirical study on the coordinated development of college specialty setting and local pillar industry demand. However, there is few research rooted in the undergraduate discipline structure, especially rarer is made about the achievements of Jilin province's high-quality revitalization and development strategy under the current situation. Consequently, based on the existing research findings, this paper empirically analyses the coupling relationship and evolution characteristics between the adjustment of undergraduate disciplines and the evolution of industrial structure in Jilin province by using the entropy method, coupling coordination degree and alternative models, and then discusses how to realize the higher collaborative development of the two systems. It provides empirical support for promoting the synergistic development of higher education and industrial structure optimization and carries a certain practical implication for boosting the economic development of Jilin province.

## 2. Current Situation of Undergraduate Discipline Structure in Jilin Province

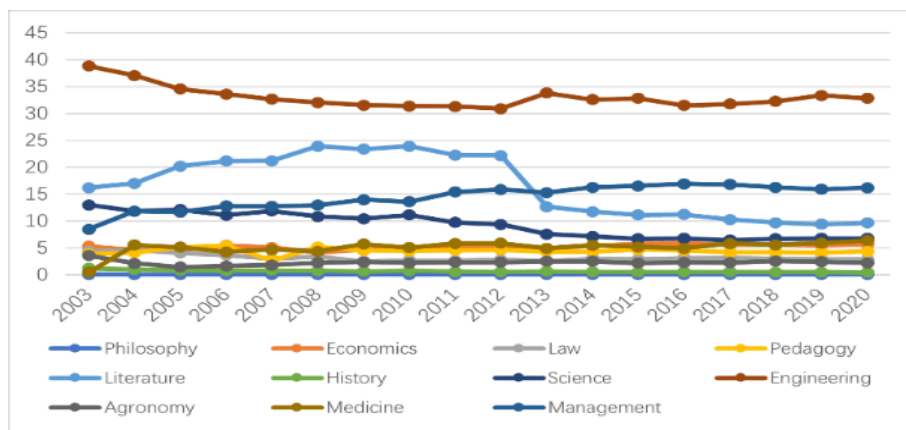


Figure 1: Structure of undergraduate graduates in Jilin province (%)

Since 1999, due to the implementation of the enrolment expansion policy in the national higher education, the undergraduate enrolment of various disciplines in Jilin province has exploded significantly. In 2020, the total number of undergraduate students enrolled in Jilin province is up to 130,311, among which engineering students take the absolute position, accounting for 34%, and management students come in second, accounting for 15%, both together making up roughly half of the total. Enrolment followed closely behind in Arts and literature, and had negligible shares as well in Agronomy, history, and philosophy. According to Figure 1, the number of engineering graduates occupies the largest part, exceeding 30% in each year, ranking first. Following literature, management, and science, they are also far ahead of other disciplines in graduates. Agriculture, philosophy, and history had the fewest graduates. Management was the only subject to see its share

of graduates way up year on year. The trend of change in literature graduates was dramatic, in which, taking 2012 as the inflection point, it had been continuously climbing before, and then fallen off to a cliff level of about 10% for the past few years. The percentage of science graduates shrank year after year, from 13 percent in 2003 to 6.8 percent in 2020. The share of graduates from other subjects fundamentally vibrated up and down from the original level, with small fluctuations.

Talent cultivation is aiming at serving the development of social economy. Therefore, according to the talent demand of the three industries, the paper regards agriculture as the discipline related to the first industry, science and engineering as secondary industry-related disciplines, and the other disciplines as tertiary industry-related disciplines. As can be seen from Figure 2, the proportion of graduates of primary industry-related disciplines barely changed during the investigation period, primarily stable at a very low level of about 2%. Because Jilin is a big agricultural province, 2% of undergraduate graduates is inconsistent with the strategic position of agriculture in the whole country. The proportion of graduates of secondary industry-related disciplines has been continuously declining since 2003, while the percentage of graduates of tertiary industry-related disciplines has been on the rise, which is coincident with the economic restructuring policy of Jilin province to control the weight of the secondary industry and vigorously develop the tertiary industry.

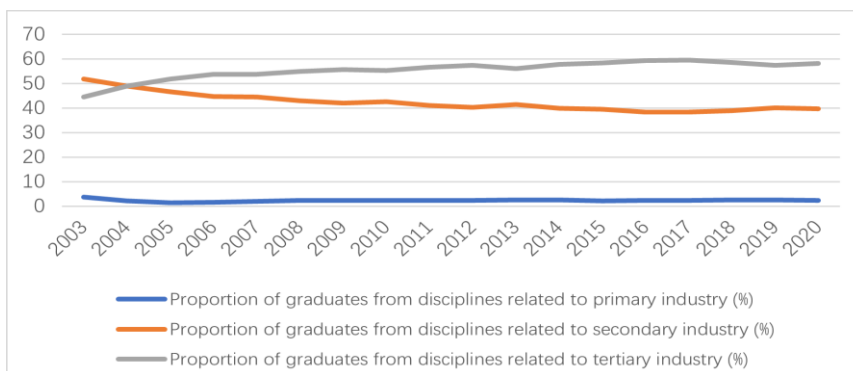


Figure 2: Division of undergraduate graduates of various disciplines in Jilin province by industrial correlation (%)

### 3. Current Situation of Industrial Structure in Jilin Province

The added value of industry is one of the factors that can directly reflect the development of industry. Figure 3 reveals that in Jilin province before 2018, the secondary industry had always occupied the dominant position and thus the economy presented a “two-three-one” development pattern. However, after that, the tertiary industry quickly overtook the secondary industry, the economic pattern shifted to the “three-two-one” distribution, and the industrial structure gradually evolved to the advanced level. From 2016 to 2018, the added value of the three industries all showed a downward trend. Although the amplitude was different in the rest years, they all showed a gradient growth. Among the three industries, the primary industry did not fluctuate significantly during the study period. However, the secondary and tertiary industries proliferated in the meantime.

In 2021, the output value ratio of the three industries in Jilin province is 11.7:36.1:52.2, showing a “three-two-one” distribution. Figure 3 illustrates that the proportion of the primary industry has been declining from 2003 to 2018, and gone up slightly after 2019, which indicates that the role of the primary industry is weakening and gradually stable. At the same time, the proportion of the secondary industry showed an oscillating trend, in which after a slight increase in 2003-2004, the data fell back, and gradually climbed year by year after 2005. By the end of 2012, the ratio reached

a peak, and then showed a decreasing trend again, hovering at a relatively stable level of around 35% in 2020. During 2003-2010, the proportion of output value of the tertiary industry was also bumpy, with frequent slight fluctuations. After 2011, it continued to climb, reaching the highest level of 53.8% in 2019, and exceeding the proportion of the secondary industry for the first time in 2018, and then gradually widening the gap. This shows that Jilin province has achieved the transformation of industrial structure to service industry.

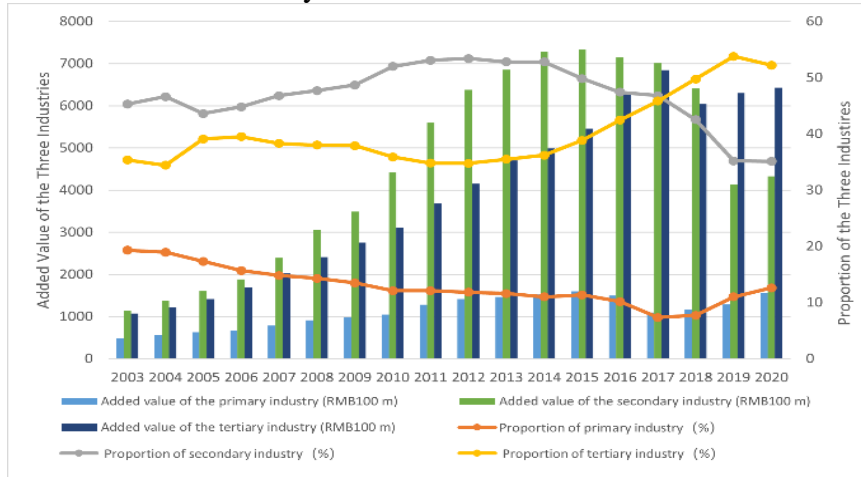


Figure 3: Added value and proportion of output value of the three industries in Jilin province

#### 4. Analysis of the Synergy between the Adjustment of Undergraduate Disciplines and the Evolution of Industrial Structure in Jilin Province

Table 1: Index system of undergraduate discipline adjustment and industrial structure evolution

System category	Measurement dimension	Indicators (unit of measurement)	Weight (%)
Undergraduate discipline adjustment system	Scale structure	Discipline specialty structure (%)	0.14
		Undergraduate admissions (person)	2.13
		Proportion of undergraduate discipline education expenditure (%)	2.21
	Achievement output	Number of R&D achievements applied projects (item)	4.43
		Number of science and technology service items (item)	5.62
		Number of scientific and technological works published (work)	3.52
		Number of patent applications (item)	6.64
		Amount of technology transfer contract for colleges and universities (thousands of yuan)	6.43
		Total amount of patent sold (thousands of yuan)	12.90
	Resource allocation capability	Number of full-time teachers and professors in colleges and universities (person)	2.23
		School space per capita (sq meters)	11.80
		Books per capita (volumes)	11.46
		Value of fixed assets per capita (ten thousand yuan)	7.65
		School property building area per capita (sq meters)	12.26
		Green cover per capita (hectares)	10.58
Industrial	Rationalization	Theil Index (/)	16.60

structure evolutionary system		Binary contrast coefficient (/)	7.80
	Advancement	Industry level coefficient (/)	10.24
		Proportion of main business income of high-tech industries in main business income of industrial enterprises above designated size (%)	17.95
	High efficiency	Efficiency level (ten thousand yuan/person)	14.43
		Energy saving level (100 million yuan/KWH)	11.96
		Environmental protection level (hectare/10,000 sq km)	21.01

#### 4.1. Index System Construction, Data Sources and Research Methods

The establishment of a reasonable index system is the prerequisite for scientific and objective measurement and evaluation of the coupling coordination degree of the two systems. This paper draws on Yang Shuiyin and Wang Lu (2022) [14] for reference to establish the undergraduate discipline adjustment system and industrial structure evolution system. Among them, the undergraduate discipline adjustment system is measured by 15 indicators from three dimensions of scale structure, achievement output and resource allocation capability. The industrial structure evolution system is measured by 8 indicators from three dimensions of rationalization, advancement, and high efficiency, as shown in Table 1.

Considering the availability and operability of the data, the data in this paper are all from 2003-2021 China Education Database, China Macroeconomic Database, China Labor Economy Database, China Environmental Database, and Jilin Provincial Bureau of Statistics.

Using the dimensionless data of each index in Table 1, this paper firstly calculates the comprehensive level of undergraduate subject adjustment system and industrial structure evolution system by using the entropy method, and then uses the coupling coordination degree model to measure the synergistic status of the two systems. Finally, we draw lessons from Sun Yongsheng [15] and Wu Xiaozhu [16] by comparing the difference between the comprehensive levels of two systems to probe the relative development degree, the coupling relationship and synchronization (leading or lagging) at different time points.

#### 4.2. Empirical Analysis and Results

##### 4.2.1. Comprehensive Level of Undergraduate Discipline Adjustment System and Industrial Structure Evolution System

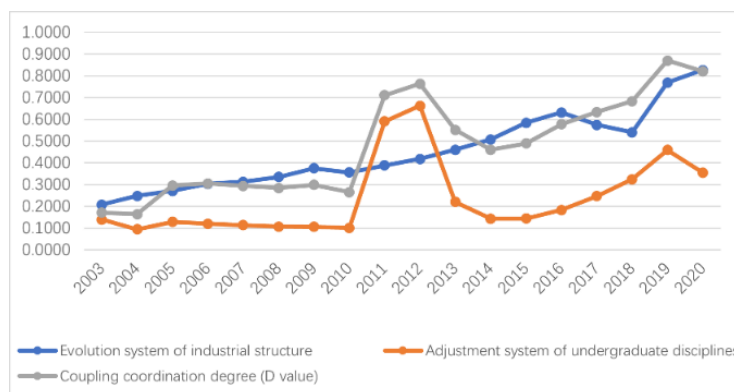


Figure 4: Adjustment system of undergraduate disciplines, evolution system of industrial structure and change of their degree of collaboration in Jilin province

As can be seen from Figure 4, the level of discipline adjustment is generally lower than that of industrial structure evolution. Both systems rise in fluctuation, shift from scale expansion to high-quality development, but the trend is different. The level of discipline adjustment has a periodically radical surge, whereas the evolution level of industrial structure showed a gradual rise. To be specific, the adjustment level of disciplines gradually increased after experiencing the “big rise” in 2011-2012 and the “big fall” in 2013. Before that, it remained at a low level. The gap between the two systems was consistently broad except for the year of 2018 and 2019, which indicates that they are in a long-term uncoordinated state. It is also found in Figure 4 that 2011 and 2012 are special nodes when the adjustment level of disciplines exceeds the evolution level of industrial structure for the first time and are also the only two years. In the remaining years, the subject adjustment level was far lower than the industrial structure evolution level. From the perspective of adjustment range, excepting the individual years, the degree of industrial structure adjustment is evidently greater than that of discipline adjustment. All these show that the adjustment of undergraduate subjects lags the evolution of industrial structure in Jilin province, and it is still a long-term and arduous task for the two systems to achieve decent coupling and interaction.

#### **4.2.2. The Overall Time Sequence Characteristics of the Coupling Coordination between the Discipline Adjustment System and the Industrial Structure Evolution System**

Overall, D value of coupling coordination degree shows an upward trend in twists and turns. Before 2010, it did not vary significantly and remained at a low level, indicating that the two systems are misaligned. From 2011 to 2012, D value suddenly surged to close to 0.8, indicating that the two systems were in a moderately coordinated state. However, due to the sudden explosion and short-term nature of the value, the paper holds that the two systems were in a pseudo-cooperative state in the phase. After two consecutive years of sharp decline, D value climbed step by step, and has stabilized at a level above 0.8 since 2019, which indicates that after irrational adjustment, the two systems have returned to rationality and entered a stage of positive coordination. From the shape of the curves, before 2010 the evolution curve of industrial structure is more consistent with that of D value, and after that it is the adjustment curve of disciplines that better matches it. It demonstrates that the adjustment of undergraduate disciplines and the evolution of industrial structure have achieved positive interaction in the process of dynamic adaptation, but high standard synergism is still some way off.

#### **4.3.3. The Phased Evolution Characteristics of the Coupling Coordination between the Discipline Adjustment System and the Industrial Structure Evolution System**

According to the relative development degree and the judgment criteria of the type of collaboration, adjustment level of undergraduate subjects in Jilin province has experienced the phased evolution characteristics of “low level lag - high level advance - middle level lag - high level lag” relative to the evolution level of industrial structure during the study period. No matter what kind of coordination, lead or lag is not conducive to the realization of synchronization and optimization of the production-education system. It further suggests that the contradiction that the talent structure of undergraduates is difficult to meet the needs of industrial structure optimization is still very prominent in Jilin province.

Stage One (2003-2010): Talent cultivation lagged, and the two systems developed at a low level and disordered. At this stage, the degree of coordination between the adjustment of undergraduate disciplines and the evolution of industrial structure fluctuated in the range of 0.16-0.30, the relative development degree of the two systems (except the year of 2003) was all greater than -0.1, showing



an expanding trend, and the evolution level of industrial structure was consistently higher than the adjustment level of undergraduate disciplines. The stage was the initial period of Jilin province's implementing the Planning Outline of Revitalizing Jilin Old Industrial Base. To build the old industrial base into an important national new one, Jilin province took "vigorously developing modern agriculture, actively developing the service industry, comprehensively improving and optimizing the secondary industry" as the main task of the stage and took the secondary industry as the focus of economic structure adjustment. As the secondary industry plays a supporting role in other industries, its rapid development has directly driven the province's economy to considerably improve and optimized the industrial structure. Therefore, the upgrading effect is obvious. Meanwhile, complying with the national policy on accelerating the development of higher education, Jilin province has also started to expand enrollment. During this period, the provincial enrollment has been maintained at an average increase of 15 percent. In 2010, the gross enrollment rate of higher education reached 35%. It is one of the provinces that entered the stage of higher education popularization earlier in China, and the scale expansion effect is obvious. However, in most colleges and universities, due to the one-sided pursuit of increase in the number of majors, emphasis on specialty setting, contempt of connotation construction and negligence of the cultivation of specialty characteristics, the phenomenon of convergence is serious. All of which, combined with lack of dominant and key majors and low comprehensive strength, made colleges and universities lack forward-looking specialty setting, discipline layout unreasonable, structural shortage and surplus of specialized talents coexist, and the talent trained unable to meet the requirements of economic development.

Stage Two (2011-2012): Talent cultivation was catching up at a rapid pace, and pseudo coordination of high level- low synergy between the two systems was formed. In this period, the adjustment level of undergraduate disciplines improved rapidly and exceeded the evolution level of industrial structure in Jilin province. The degree of cooperation between the two systems reached above 0.7, and the relative development level was maintained at about 0.2, realizing the high level-low synergy. This stage is the first year of the "12th Five-Year" plan. The emphasis of industrial structure adjustment in Jilin province is still the secondary industry, and the adjustment of agriculture and tertiary industry has been strengthened synchronously to further promote the deep integration and interactive development of the three industries. The main measures of adjustment are to formulate and implement the improvement and cultivation plan of pillar advantageous industries, characteristic resource industries and strategic emerging industries, highlight the transformation and upgrading of leading agricultural enterprises and base construction, profoundly implement the service industry leap-forward development plan, focus on the construction of 1200 projects above 30 million yuan and 30 provincial service industry cluster areas, and foster a number of large service industry enterprise groups. What could be drawn from them is that the adjustment of the three industries highlights "cultivation, construction and promotion" in this phase. Due to their nature of lag, they have not truly played their roles, coupled with the fact that the adjustment range of industrial structure is smaller than that of the previous stage, hence the upgrading effect of industrial structure is not remarkable. After 11 years of enrollment expansion, higher education has grown fast in Jilin province. However, this rapid expansion in quantity also makes some problems deep-rooted in the original higher education come to light, which critically affects the quality of education. As a result, to promote the scientific development of higher education, the state promulgated the Outline of the National Medium - and Long-Term Plan for Education Reform and Development (2010-2020) in 2010. 2011 is the year of "full implementation". At this stage, Jilin province strictly controlled the scale of enrollment, and shifted the focus of specialty construction from the pursuit of quantity to connotation construction and the adaptation of production and education. To this end, Jilin province has strengthened the adjustment of the current layout of

disciplines and majors, and dramatically compressed outdated majors. At the same time, for the purpose of making the traditional disciplines more adapt to the needs of economic development, strengthening the internal relations and mutual support among various disciplines, and endowing them with fresh vitality, local colleges and universities are encouraged to strive to build a “broad caliber, large majors, multi-direction” discipline group. Nevertheless, on account of the speed and concentration of specialty adjustment, the level of specialty-running and the quality of student training are ignored. Consequently, this paper believes that although the structure of undergraduate subjects has been optimized to some extent, it is a pseudo-collaborative phenomenon.

Stage Three (2013-2018): Talent cultivation rationally returned, and the two systems were highly running-in. In this phase, the degree of synergy between the adjustment of undergraduate disciplines and the evolution of industrial structure was between 0.46 and 0.68 in Jilin province, and the relative development degree was always less than -0.1, showing a trend of first expanding and then shrinking, all indicating that the adjustment of undergraduate disciplines still lagged the evolution of industrial structure. This stage is a critical period for the revitalization and comprehensive deepening reform of Jilin province in the new decade. During this period, the goal of industrial structure adjustment in Jilin province is to take the lead in achieving agricultural modernization, further optimize the industrial structure, and greatly improve the development of the service industry. This shows that the emphasis of industrial adjustment has shifted from the secondary industry to the tertiary industry. Together with the superimposed effect of favorable national policies, Jilin province accelerated the pace of adjustment and intensify the efforts to adjust. To realize the rapid transformation of the service industry, Jilin province launched the three-year action plan in 2014 to optimize the structure of producer services and promote the integrated development of the service industry and manufacturing industry. In 2016, it also put forward enforcement advice on accelerating the development of the service industry, giving high priority in promoting the transformation of the consumer service industry into a development-oriented and modern one, and creating a service industry agglomeration area. The secondary industry is mainly to alter the chemical, resource-based and traditional industrial structure, change the industrial system of “one pillar dominating the whole world” and the single-product structure of primary products, and implement the “Made in China 2025” and the strong industrial foundation project. In agriculture, Jilin province will continue to accelerate the transformation of the development mode and promote the transformation from a large agricultural province to a strong agricultural one. These measures have significantly improved the industrial structure, quality, and efficiency of economic development. The goal of higher education in Jilin province during the period was to further boost the development of connotation and improve the quality of education. To this end, Jilin province formulated, issued, and implemented many guidelines, strictly controlled, and dynamically adjusted the enrollment scale of each major, and tailored the specialty structure to the needs of economic and social development. However, the adjustments of discipline structure and industrial structure at this stage were not synchronized, and the fit was not high. The construction of agricultural majors was severely weak, which did not match the position of Jilin as a large agricultural province. The construction of science and technology majors was relatively surplus, especially engineering majors accounting for more than 30% of the total and the enrollment and the scale of whose graduates were far ahead. There was a big difference in the construction of the corresponding majors in the tertiary industry, among which the management and literature majors had a strong coverage and concentration and had formed a certain specialty group. Other majors such as medicine, education, and law were particularly weak. Philosophy and history were the weakest. Additionally, there were still some distinct problems, for instance, the layout of specialty structure was not balanced, the phenomenon of repeated settings was serious, and construction capacity was not strong.



Stage Four (2019-2020): Talent cultivation was still lagging, and the two systems were collaborating at a high level- low synergy. At this stage, the synergy degree of the evolution of undergraduate discipline structure and industrial structure in Jilin province is more than 0.8, but the relative development degree is still greater than -0.1, which indicates that the adjustment of undergraduate subjects is still lagging, but the two systems have entered a high-level and low-synergy stage. During this period, Jilin province encountered unprecedented challenges and took multiple measures to restore economic growth and upgrade business modes. Service industry still has the top priority in industrial restructuring. To guarantee its rapid development, Jilin province has promoted the continuous construction of 100 key projects and introduced “30 policies” to support the service industry and “14 policies” to stimulate consumption. The secondary industry helps all kinds of enterprises through these difficulties by deploying and implementing key measures to protect the industrial chain and supply chain and by reducing costs and burdens to support the real economy. Agriculture continued to advance integrated development with the other industries, promoted new technologies, new business format, and new models, and built the “three systems of modern agriculture”. As a result, agriculture achieved great development during this period. Among the three industries, output value of the tertiary industry accounted for more than 50%, higher than that of the secondary industry and there was a trend of further expansion, while the proportion of agriculture increased slightly and stabilized at about 12%. The industrial structure was more reasonable, and the economy entered the early stage of “post-industrialization”. During this period, Jilin province continued to deepen the connotative development of higher education and improved the dynamic adjustment mechanism of disciplines and specialties. In 2020, among the majors planned to increase the enrolment of undergraduate students in Jilin province, computer- and network-related majors increased the most. The majors related to machinery, education, foreign language and literature, Chinese pharmacy, plant production and electrical are also among the top, which is consistent with the construction of new engineering, new medical science, new agricultural science, and new liberal arts. Among the majors planned to reduce the enrollment in Jilin province in 2020, majors related to materials, business administration, economy and trade reduced the most, and the demand for majors in traditional engineering, agricultural science and pharmaceutical science was not big. However, it is worth noting that some traditional disciplines, such as business administration, machinery, civil engineering, and finance, still accounted for a large proportion, whereas there were extremely few schools in such key fields as artificial intelligence, energy storage technology, virology, public health, intelligent agricultural and forestry equipment, non-common foreign languages, foreign rule of law, international news, and communication. All these show that the industrial structure and discipline structure have converged in Jilin province, but there is still a lot of room for adjustment.

## **5. Suggestions to Promote the Coordinated Development of Undergraduate Discipline Structure and Industrial Structure in Jilin Province**

### **5.1. Optimize the Design of Undergraduate Specialty Layout at the Top Level**

Closely around the requirements of economic development strategy, industrial optimization and upgrading, based on the classified management and guidance system of colleges and universities, Jilin province should make an overall plan for the layout of disciplines and specialties, formulate mid - and long-term development plans, and clarify the direction and focus of development in the light of positioning, history, comprehensive strength and characteristic specialties of various local colleges and universities. And consequently, a systematic, integrated, and collaborative discipline structure with Jilin characteristics can be formed. For example, research universities should be guided to focus on the development of basic disciplines, while applied universities should

concentrate on the development of practical and applied disciplines. By optimizing the top-level design of the discipline structure of colleges and universities, Jilin province can not only better avoid the problem of repeated setting of interdisciplinary majors and waste of educational resources, but also better grasp the overall situation of industrial development and educational development to timely and accurately understand the social demand for talents, reduce or avoid the occurrence of information asymmetry between society and colleges and universities, and better avoid the structural contradiction between talent supply and demand.

## **5.2. Perfect the Structure of Specialties within Disciplines**

Based on the cooperative relationship between undergraduate discipline structure and industrial structure, Jilin province should follow the principle of “one discipline, one policy” and flexibly adopt different development strategies for different disciplines, to grasp the development direction and scale of various disciplines and better adapt to the changing trend of future industrial structure. Aiming at the goal of “taking the lead in realizing agricultural modernization and striving to be the vanguard in modern agricultural construction” of Jilin province, and the status quo of the relatively weak construction of agricultural majors, this paper holds that it is right for Jilin province to control the enrolment scale of agricultural majors, but it should accelerate the construction of discipline connotation and new agricultural majors, for instance, to set up new majors related to digital agriculture, food nutrition, ecological environment, agricultural industry, agricultural biotechnology, etc., and withdraw or reduce some traditional agricultural majors as soon as possible in order to promote the cultivation of innovatively agricultural, application-oriented higher technical personnel. For science and engineering disciplines, this paper believes that Jilin province should further reduce enrolment under the premise of continuing to adjust and optimize the internal professional structure, to accelerate the cultivation of talents urgently needed in the fields of artificial intelligence, integrated circuit, energy storage technology, energy raw materials and so on. Strong support should be given to disciplines closely related to the tertiary industry, and the scale of their enrolment can be expanded accordingly. For example, medical and literature majors should be replaced and upgraded as soon as possible in accordance with the requirements of the “Four New” construction, and the enrolment of students and investment in educational resources should be appropriately increased. The majors of economics, management and education can moderately expand their enrolment after reorienting their majors around “new industrial types & new business format” Philosophy, history, and other disciplines will stabilize the scale and continue to improve the quality of cultivation.

## **5.3. Accelerating the Establishment of a New System of Disciplines and Specialties with Distinctive Features**

Deepening the development strategy of the integration of three industries and the adjustment of industrial structure will inevitably give birth to a number of cross-disciplines or emerging disciplines to adapt to the shift of talent structure required by the development of modern industries in Jilin province. This requires colleges and universities to strengthen the horizontal connection among various disciplines, break the disciplinary barriers, set up interdisciplinary majors, develop new disciplinary growth points, and build a characteristic new disciplinary system, based on their own school-running orientation and professional strength in the pillar industry, dominant industry, emerging industry, future industry, etc. Focusing on the development and construction requirements of “six new industries” and “four new facilities”, Jilin province should reinforce and expand a batch of backbone majors in the fields of automobile, modern agriculture, ecological tourism, petrochemical industry, equipment manufacturing, and create characteristic dominant specialties in the fields of new materials, new energy, rail transportation, medicine and health, general aviation,

e-commerce and so on. Focusing on fields of people's livelihood such as health care, nursing care, public health, and food security, where talents are in short supply, Jilin province should establish a number of urgently needed specialties. Focusing on fields of industrial and agricultural infrastructure construction, such as mechanical processing, electrical equipment, and agricultural machinery equipment, Jilin province should upgrade a group of traditional majors.

#### 5.4. Further Promote the Construction of Disciplines and Professional Groups with Deep Integration of Industry and Education

To synchronize the undergraduate discipline structure with the industrial structure as soon as possible, Jilin province needs to further reform the school-enterprise cooperation mechanism and promote the integrated development of education parks, entrepreneurial parks, and industrial parks. Accordingly, Jilin province must support and guide colleges and universities to connect with enterprises and industrial parks to build disciplines groups and explore the construction of a completely new pattern of education service economy development. For example, high priority is given to build several modern industrial colleges around such fields of pillar and advantages as automobile and carbon fiber, lay out and create a few characteristic industrial colleges around fields such as ice & snow and biomedicine, etc., strengthen the construction of shared education parks and practice bases, and encourage enterprises to participate in school-enterprise cooperation by using capital, technology, facilities, management and other factors.

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