



# Research on Evaluation Model of Coordinated Development of Human Resources and Regional Economy in Colleges and Universities Based on AHP

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**Abstract.** Through the discussion on the operation status and existing problems of the coordinated development of human resources and regional economy in Colleges and universities, this paper establishes an index system, constructs an evaluation model of the coordinated development of human resources and regional economy in Colleges and universities through analytic hierarchy process, takes a university as an application example, carries out qualitative and quantitative research, and obtains more objective and fair evaluation results, So as to enhance the vitality of the coordinated development of human resources in Colleges and universities and regional economy, and provide a guarantee for the sustainability of the coordinated development of human resources in Colleges and universities and regional economy.

**Keywords:** Analytic Hierarchy Process · Human Resources in Colleges and Universities · Regional Economy · Coordinated Development

## 1 Introduction

With the accelerated pace of building an innovative country and the rapid development of regional economy, local colleges and universities are playing an increasingly important role in regional economic and social development. Firstly, local colleges and universities provide important human resources and talent support for regional economic and social development [1]; Secondly, local universities are the gathering place of first-class talents and build a highland of first-class talents. Local colleges and universities can make full use of their advantages in teaching, scientific research and management, accelerate the transformation of scientific and technological achievements into real productive forces, promote the transformation of regional industrial transformation and economic development mode, and make contributions to regional economic and social development [2].

Local colleges and universities are organized by local governments according to the local economic and social development and meeting the needs of people in the region to receive higher education. The administrative subordination relationship is local, the

enrollment and employment are local, and the science and technology and knowledge services are local. Therefore, the human resources development of local colleges and universities can only find the service path, base on the local and serve the local, Coordinated development with regional economy and society can be recognized by local governments and have better living space and development vitality. It is also the responsibility and obligation of colleges and universities to give full play to the advantages of human resources in Liaoning colleges and universities and serve regional economic and social development. The human resources of colleges and universities mainly include two aspects: the talent flow of teacher resources and the talent training of student resources. For a region, these values, beliefs, ways of thinking and communication in the region will have a significant impact on the enterprise's employment philosophy and management form.

As far as Liaoning is concerned, the regional economy and society are in a critical period of transformation and development. The position of human resources development in Colleges and universities is becoming more and more prominent in economic and social development. Human resources have become a key factor in the economic and social development of Liaoning [5]. Promoting the development of human resources in Colleges and universities can not only meet the current demand for talents in Liaoning's economic and social development and promote regional economic development, but also optimize the talent structure required by Liaoning's economic and social development and improve the competitiveness of regional talents.

At present, in order to promote the economic development of our province and give full play to the function of local colleges and universities in serving regional economic and social development, colleges and universities in the province focus on cultivating high-quality applied skilled talents [4]. Carry out positive interaction with local governments and relevant enterprises, promote the transformation of regional economic mode, the transformation and upgrading of industrial structure, and provide stable, sustainable and urgently needed high-quality applied talents. Due to the influence of multiple factors such as politics, economy, history and culture, there is an imbalance in the promotion of regional economic development by human resources in Colleges and universities. Some development often stagnates at the level of strategic cooperation, so it is difficult to make substantive breakthroughs. The evaluation system of coordinated development has not been established, and the degree of development cannot be objectively evaluated, making it impossible to specifically point out the problems existing in the coordinated development of human resources in Colleges and universities and regional economy. This paper analyzes the human resource management of colleges and universities, analyzes the relationship between human resources of colleges and universities and regional economic development, constructs the index system of coordinated development of human resources of colleges and universities and regional economy, establishes the evaluation model of coordinated development through analytic hierarchy process, gives an objective evaluation of the coordinated development of human resources of colleges and universities and regional economy, and aims at the problems found, Giving more targeted opinions and suggestions is of great significance to promote the coordinated development of local higher education and economy and society [6].

## **2 Evaluation Principles of Coordinated Development of Human Resources and Regional Economy in Colleges and Universities**

The theoretical framework of the evaluation index system of the coordinated development of human resources and regional economy in Colleges and universities should follow certain basic principles. Based on the coordinated development of human resources in Colleges and universities and regional economy, comprehensively consider all aspects of the design of index system such as evaluation objectives, evaluation indicators, evaluation process, evaluation methods and evaluation conclusions, and build a scientific, reasonable and instructive evaluation index system in line with the actual situation of human resources in colleges and universities and regional economic development. Specifically, the following principles need to be followed:

### **2.1 Scientific Principle**

To establish an evaluation index system for the coordinated development of human resources and regional economy in Colleges and universities requires that the construction of the index system has a certain theoretical basis and a theoretical analysis framework recognized by the society. At the same time, the connotation and scope of each selected index should be as specific and accurate as possible, with scientific basis, so that the data has high credibility and strong persuasion, and can make a correct judgment on the coordinated development of human resources in Colleges and universities and regional economy.

### **2.2 Systematic Principle**

Systematicness requires that the evaluation index system be comprehensive and complete, and there should be an internal logical relationship between the indexes, with a reasonable structure, which can reflect the overall picture of the coordinated development of human resources in Colleges and universities and regional economy. At the same time, the evaluation of the coordinated development of human resources in Colleges and universities and regional economy adopts the combination of quantitative evaluation and qualitative evaluation. On the basis of obtaining quantitative indicators, supplemented by a certain qualitative description, it makes a systematic evaluation of the coordinated development of human resources in Colleges and universities and regional economy.

## **3 Evaluation Index of Coordinated Development of Human Resources and Regional Economy in Colleges and Universities**

Building an evaluation index system for the coordinated development of human resources in Colleges and universities and regional economy, strengthening the monitoring of human resources in Colleges and universities and regional economic development, and promoting the quantitative evaluation of the coordinated development of human resources in Colleges and universities and regional economy have always been important measures to promote the reform and development of higher education at home

and abroad [3]. At present, China has strengthened the monitoring of the coordinated development of human resources in Colleges and universities and regional economy. The representative evaluation index system is the evaluation index system of higher education quality. The coordinated development of human resources in Colleges and universities and regional economy is essentially the coordination between the supply of high-tech and high skilled applied talents and the demand of regional economic development. Starting from the three dimensions of student resource coordination, specialty coordination and cooperation quality coordination of the coordinated development of human resources and regional economy in Colleges and universities, this paper constructs an evaluation index system of the coordinated development of human resources and regional economy in Colleges and universities composed of 10 specific indicators from the background, process and results of each dimension.

### **3.1 Indicators of Student Resource Coordination**

The coordination of student resources is to coordinate the number of talents trained by local colleges and universities with the needs of regional economic development. For the measurement of the coordination between the number of talents cultivated by colleges and universities and the needs of regional economic development, this paper uses the index of “coordination degree of student resources”, that is, the ratio of the scale of students cultivated by local colleges and universities to the scale of regional economic development. The scale of training students in local colleges and universities can be expressed by the number of students and fresh graduates in local colleges and universities. Therefore, the coordination degree of student resources includes two kinds: one is the coordination degree between the scale of students and regional economic development, which is recorded as the coordination degree of students’ resources; Second, the coordination degree between the scale of fresh graduates and regional economic development is recorded as the coordination degree of fresh students’ resources. The meaning of the two indicators is slightly different. The coordination degree of student resources indicates the talent scale that higher education can deliver to the regional economy in the next 3–4 years, including expected factors; The coordination degree of fresh student resources is the talent scale that can be transported to the regional economy in that year.

### **3.2 Indicators of Professional Coordination**

Professional coordination is the coordination between the professional structure of cultivating talents in Colleges and universities and the development of industrial structure of regional economy. On February 21, 2020, the Ministry of Education announced the catalogue of undergraduate majors in Colleges and universities (2020 Edition) (hereinafter referred to as the catalogue), which is based on industry and industry classification and takes into account discipline classification for specialty division and adjustment. In principle, the catalogue makes the major categories of general higher education correspond to industries, major categories correspond to industries, and majors correspond to occupational post groups or technical fields. According to the catalogue, the professional structure corresponding to the three industrial classifications of the national economy can be calculated. Similar to the degree of student resource coordination, there are two

ways to measure the degree of professional coordination, namely, the degree of professional coordination of freshmen enrollment and the degree of professional coordination of fresh graduates. Similarly, the coordination degree of freshman enrollment professional structure includes expectations, which implies the ability of fresh graduates of undergraduate higher education in the next 3–4 years to meet the needs of regional economic development. The professional coordination degree of fresh graduates is based on the present, reflecting the degree to which current undergraduate higher education graduates meet the needs of regional economic development.

### 3.3 Indicators of Cooperation Quality Coordination

Cooperation quality coordination refers to the interaction quality between human resources of local universities and regional economy, that is, the talents cultivated by local universities meet the needs of regional economic development in terms of ability and quality, the flow of talents of local university teacher resources and regional enterprises, the cooperation between schools and enterprises, and the promotion of regional economic development by scientific research achievements of local universities. The goal of undergraduate higher education is to improve the quality of workers, and the scientific and technological achievements of teachers serve the development of regional economy. Therefore, the quality of local higher education and the benefits of school enterprise cooperation should be tested by social practice (i.e. the needs of regional economic development), and the main consideration index is social recognition. Specifically, the social recognition of the education and scientific research level of local colleges and universities is reflected in two aspects: one is the ability or level of local colleges and universities to serve enterprises. Relevant indicators include: (1) the proportion of the number of specialties with cooperative enterprises in the total number of specialties; (2) The proportion of the number of order trainees of major cooperative enterprises in the number of full-time students; (3) The proportion of the number of courses jointly developed by schools and enterprises in the total number of courses offered; (4) Income from technical services provided by the school to enterprises; (5) The school trains employees for cooperative enterprises. The second is the ability of talents cultivated by local colleges and universities to be transformed into talents needed for regional economic development. Its main indicators include students' employment rate, employment counterpart rate and employment stability. The social recognition of local colleges and universities or the employment of students are mainly restricted by the educational quality of local colleges and universities. The factors affecting the education quality of local colleges and universities mainly include the level of school infrastructure, the level of teachers, teaching means, specialty setting, curriculum system and so on. These factors are transformed into measurable indicators, that is, the average student project fund income, the proportion of fund expenditure used for talent training related projects, the proportion of double qualified teachers, etc.

#### 4 Evaluation Modeling of Coordinated Development of Human Resources and Regional Economy in Colleges and Universities

Analytic hierarchy process (AHP). AHP is a practical multi scheme or multi-objective decision-making method proposed by Professor T.L. Saaty, a professor of mathematics at the University of Pittsburgh in 1970. It is mainly based on linear algebra and graph theory. The concept of graph theory is used to analyze the problem and establish the hierarchy of the problem, and the weight of each selection scheme is calculated by using the matrix concept of linear algebra. AHP method can help decision-makers to clarify the beginning and end of the problem and analyze the problem layer by layer, and obtain the relative importance (i.e. its weight) of several alternative schemes, which can be used as a reference for decision-makers. Its main feature is that it reasonably combines qualitative and quantitative decision-making, and hierarchizes and quantifies the decision-making process according to the law of thinking and psychology. The main idea is the systematic idea of decomposition before synthesis, sorting out and synthesizing people's subjective judgment, so as to organically combine qualitative analysis and quantitative analysis and realize quantitative decision-making. Firstly, the problem to be analyzed is hierarchized. According to the nature of the problem and the overall goal to be achieved, the problem is decomposed into different constituent factors. According to the mutual relationship and subordinate relationship between the factors, the factors are aggregated and combined according to different levels to form a multi-layer analysis structure model. Finally, it comes down to the weight or relative order of the relative importance of the lowest level (scheme, measure, index, etc.) relative to the highest level (overall goal).

The basic steps of constructing the evaluation model of coordinated development of human resources and regional economy in Colleges and Universities Based on AHP method:

- (1) Establish a hierarchical model. According to the previous research, the highest level is set: the evaluation of the coordinated development of human resources in Colleges and universities and regional economy; Middle tier: student resource coordination A1, specialty coordination A2, cooperation quality coordination A3; The lowest level: the coordination degree of student resources a11, the coordination degree of fresh student resources A12, the professional coordination degree of freshmen enrollment A21, the professional coordination degree of fresh graduates A22, the number of majors of cooperative enterprises A31, the number of students trained by cooperative enterprises A32, the number of courses jointly developed by schools and enterprises A33, the income from the transformation of scientific and technological achievements of colleges and universities A34, the number of talents exchanged between college teachers and cooperative enterprises A35 The per student project fund income is A36.
- (2) Construct judgment (pairwise comparison) matrix. When determining the weight of each factor at each level, the consistent matrix method is adopted, that is, all factors are not compared together, but compared with each other; At this time, the relative scale is adopted to reduce the difficulty of comparing various factors with different properties as much as possible, so as to improve the accuracy. The judgment matrix represents the comparison of the relative importance of all factors

in this layer against a factor in the previous layer. The elements  $A_{IJ}$  of the judgment matrix are given by the 1–9 scale method.

- (3) Hierarchical single sorting and its consistency test. For each pairwise comparison matrix, the maximum eigenvalue and its corresponding eigenvector are calculated, and the consistency is tested by consistency index, random consistency index and consistency ratio. If the test passes, the eigenvector (after normalization) is the weight vector; If not, the pairwise comparison matrix needs to be reconstructed.
- (4) Hierarchical total ranking and its consistency test. Utilize the total sort consistency ratio:

$$CR = \frac{A_1CI_1 + A_2CI_2 + A_3CI_3}{A_1RI_1 + A_2RI_2 + A_3RI_3} \tag{1}$$

Check the CR. If  $CR < 0.1$  is passed, the decision can be made according to the result represented by the total ranking weight vector. Otherwise, the model needs to be reconsidered or the pairwise comparison matrix with large consistency ratio CR needs to be reconstructed.

### 5 Case Analysis

According to the evaluation model for the coordinated development of human resources and regional economy established earlier, take a local university as an example for evaluation calculation, as shown in Table 1, the highest level judgment matrix and weight,  $CR = 0.0048$ , passed the consistency test. As shown in Table 2, the judgment matrix and weight CR of middle layer A1 = 0.00012, which passed the consistency test. As shown in Table 3, the judgment matrix and weight CR of middle layer A2 = 0.00012, which passed the consistency test. As shown in Table 4, the judgment matrix and weight of middle layer A3,  $CR = 0.0182$ , passed the consistency test.

Finally, the evaluation index weight system of the coordinated development of human resources and regional economy in Colleges and universities is obtained. Through the

**Table 1.** Middle layer judgment matrix and weight

A	A1	A2	A3	weight
A1	1	1/2	1/5	0.1283
A2	2	1	1/2	0.2764
A3	5	2	1	0.5954

**Table 2.** Lowest judgment matrix and weight

A1	A11	A12	weight
A11	1	1/3	0.25
A12	3	1	0.75

**Table 3.** Lowest judgment matrix and weight

A2	A21	A22	weight
A21	1	1/5	0.167
A22	5	1	0.833

**Table 4.** Lowest judgment matrix and weight

A3	A31	A32	A33	A34	A35	A36	weight
A31	1	1/2	1/2	1/7	2	1/5	0.0566
A32	2	1	1	1/5	4	1/3	0.1043
A33	2	1	1	1/5	4	1/3	0.1043
A34	7	5	5	1	9	2	0.4438
A35	1/2	1/4	1/4	1/9	1	1/5	0.0354
A36	5	3	3	1/2	5	1	0.2557

evaluation index weight system of the coordinated development of human resources and regional economy in Colleges and universities, we can quantitatively evaluate the level of the coordinated development of human resources and regional economy in Colleges and universities, and make up for the shortcomings, so as to effectively promote the coordinated development of human resources and regional economy in colleges and universities.

## 6 Conclusion

The establishment of the evaluation model of the coordinated development of human resources in Colleges and universities and regional economy through AHP method can accurately and reasonably reflect the characteristics and weight of various indicators, and adjust policies through the evaluation results to comprehensively promote the coordinated development of human resources in local colleges and universities and regional economic and social innovation.

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