



Evaluation of Higher Education System

Zhonglin Wang^(✉)

Ningbo University of Finance and Economics, Haishu District, Ningbo, Zhejiang, China
279032562@qq.com

Abstract. By the analytic hierarchy process. Suggestions and policies for the construction of a healthy and sustainable higher education system are put forward. Firstly, after analyzing the two evaluation models of grey comprehensive evaluation and analytic hierarchy process (AHP), the analytic hierarchy process (AHP) was selected to construct the model. Next, we selected 14 indicators related to the higher education system and conducted a data search. The weight of each index is calculated by analytic hierarchy process and the basic evaluation model is constructed. Second, we take data from 17 countries and use the model to evaluate. It is found that the final ranking is very similar to the current ranking of higher education level in the world, which verifies the correctness of the model. Then, we use multiple linear regression method to calculate the index corresponding coefficient and compare it with the weight, and find the shortcomings of the selected country, the United States. In view of the shortcomings, we put forward some policies and implementation schedule. The effectiveness of the policy is verified by model evaluation. Finally, we discussed some practical problems in the process of implementing the policy from the aspects of students, teachers, schools, communities and countries.

Keywords: higher education · analytic hierarchy process · health · sustainable

1 Introduction

1.1 Problem of Background

Higher education is a concept of education level. In a broad sense, it refers to all professional education based on secondary education [1–7].

The higher education system is an important element in a country's efforts to provide its citizens with further education beyond primary and secondary education. Thus, the higher education system not only has the value of the industry itself, but also the value of producing trained and educated citizens for the national economy. The development of globalization is not only economic cooperation, but also the integration of education. Every country not only educates its own students, but also attracts a large number of international students every year [8–15]. At the same time, the development of economy drives the progress of science and technology, people's educational ideas, living needs and so on have undergone great changes. How to make effective adjustment in the current pandemic period, taking the essence and discarding the dross, so that the higher education

system can move forward steadily with the development of The Times, is the primary consideration of all countries in the world. Countries can determine whether the higher education system is healthy and sustainable according to the specific situation of their own country [16–24]. If so, how to make it better and how to improve the current higher education system if there are still shortcomings. All these need to be implemented in a relatively long period of time.

1.2 Restatement of Problem

To address this problem, we will develop a model to measure and evaluate the national higher education system, determine a healthy and sustainable state for the higher education system in a given country, and propose recommendations and improvement measures.

Specifically, we first need a model that can assess the health of the higher education system in any country;

In addition, according to the countries analyzed, the choice of a higher education system has room for improvement;

Propose a realistic vision for the country that supports a healthy and sustainable higher education system;

Use our model to assess the state of the country. Propose targeted policies and implementation timelines to support migration from the current state to your proposed state;

Use your models to shape and/or evaluate the effectiveness of your policies;

Discuss the real-world impact of implementing the plan during the transition and final state, recognizing that change is difficult.

1.3 Overview of Our Work

First, we analyzed the questions to find out the factors affecting the health and sustainability of the higher education system and related data.

Secondly, we searched literature and considered various evaluation methods, including grey comprehensive evaluation, analytic hierarchy process, etc. And finally chose the data obtained by analytic hierarchy process. Analytic Hierarchy Process (AHP) does not separate the influence of each factor on the evaluation of higher education system. The weight setting of each level will directly or indirectly affect the result at last, and the influence degree of each factor on the evaluation in each level is quantified. The evaluation method is used to obtain the national education model. The model is applied to 16 selected countries to make country-to-country comparisons.

Then, regression fitting analysis is carried out on the data and rankings of each country to obtain the coefficients of each factor data, which are compared with the weight value to obtain the implementation status and deficiencies of each factor in each country, so as to provide some suggestions for the implementation of healthy and sustainable higher education system in the current selected countries. This paper focuses on the analysis of the United States and Mexico.

Then, using multiple linear regression method, the existing weights are compared with the obtained factor coefficients to obtain the deficiencies of the education system.

In addition, clear policies and suggestions are put forward to address the deficiencies, and the implementation schedule of migration from the current state to the proposed state is drawn.

Finally, our model is used to determine and evaluate the effectiveness of policies, and the impact of policy implementation on reality is discussed (Fig. 1).

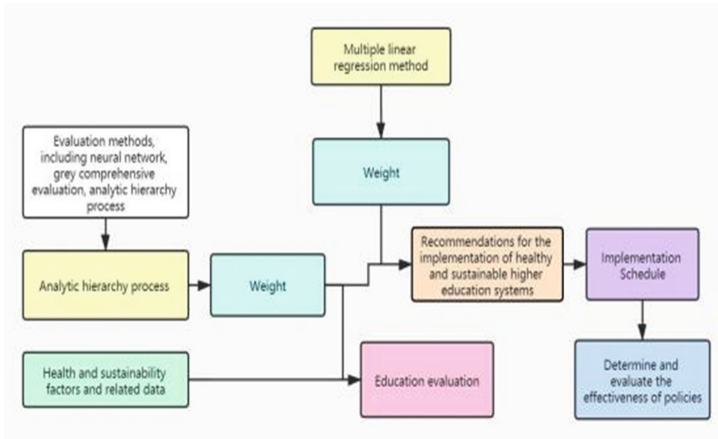


Fig. 1. The structure of our paper.

2 Assumptions

We assume that our field of study is about higher education systems. The higher education system is a global problem that touches every region, so we expect the authorities to take positive measures.

In order to facilitate the analysis, we temporarily do not consider the subjective factors such as human nature hypothesis and ethical orientation behind the evaluation.

We assume that the data obtained are accurate and reliable. We get our data from credible international websites and newspapers.

3 Establishing an Evaluation Model

3.1 Index Selection

Considering the large number of indicators to evaluate higher education, we establish a two-level index system.

As for the first-level index, it draws on the reference factors of the ranking of world universities recognized at home and abroad. Times Higher Education's world university rankings are based on the following factors:

Ranking criteria	Weight (%)
Teaching (Learning Environment)	30
Research (number of publications, revenue and reputation)	30
Citation (Research Impact)	30
Internationalization (Staff, Students and research)	7.5
Industrial income (knowledge transfer)	2.5

At the same time, the QS World University Rankings are considered. Since the ranking mainly adopts questionnaire survey, a series of academic indicators are used to measure the influence of universities in the world. The specific indicators and their weights are as follows:

Ranking criteria	Weight (%)
Academic Reputation	40
Global Employer Reputation	10
Faculty/Student Ratio	20
Citations per faculty	20
International Faculty Ratio	5
International Student Ratio	5

However, considering that the QS ranking has too many subjective indicators and commercialization indicators, many countries have a serious lack of data on reputation and commercialization indicators. Therefore, in this paper, we do not focus on the reference of this index and weight.

In addition, considering the U.S. News World University Rankings:

Ranking criteria	Weight (%)
Global Academic Reputation	12.50
Regional Academic Reputation	12.50
Papers published	10
The book	2.50
The meeting	2.50
Standardized paper citation impact index	10
Number of citations	7.50
Number of citations in the "maximum 10% of publications cited" list	12.50
Publications account for the percentage of "top 10% cited publications"	10
International collaboration	5
Percentage of total publications with international cooperation	5

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Ranking criteria	Weight (%)
The number of papers cited in the “top 1% of cited papers in all publications” representing the field	5
Publications account for the “top 1% of papers cited in all publications”	5

Combined with the query data and the first-level indicators we determined, we gave the following weights:

Ranking criteria	Weight (%)
Education level	30
Research level	30
Educational resources	15
The value of degree	15
Opportunity	10

The design of higher education internationalization evaluation index system is closely related to the internationalization goal, which is rooted in the development level and stage of regional higher education and the system form of higher education.

The index system design highlights three principles:

One is the guiding principle. In internationalization of higher education assessment, which is based on the development of higher education internationalization level on the basis of the judgment, to grasp the future development direction, target oriented, based on the data, with the facts to prove, found in the process of development of higher education internationalization, guide the institutions of higher learning for short, strong or weak, realize the innovation of higher education development and quality improvement.

Second, the principle of development. Internationalization of higher education is the process of integrating international dimension and cross-cultural dimension into the function of talent cultivation, scientific research and social service of higher education. Therefore, the evaluation process of internationalization of higher education must pay attention to the relationship among goals, processes, activities and results, and pay attention to the improvement of process and the enhancement of connotation.

Third, the principle of diversity. Different types and levels of colleges and universities have different goals, approaches and emphases of internationalization development. Therefore, it is necessary to take into account the characteristics of different types of colleges and universities' internationalization status and differences in goals, and pay attention to hierarchical and classified evaluation.

Based on this problem, we initially consider two evaluation methods – grey comprehensive evaluation method and analytic hierarchy process (AHP).

Grey comprehensive evaluation method: there will be incomplete, incomplete and insufficient information when evaluating the effectiveness of complex large-scale systems. The relevant principles and methods of grey theory are just suitable for this problem. The grey vernacular weight function clustering method is a kind of grey comprehensive evaluation method. It aggregates some observation indexes or objects into

several categories that can be defined according to the whitening weight function of the grey number. The process of classifying the system into a certain grey category is used to detect whether the objects belong to different categories set in advance. The grey whitening weight function clustering method can evaluate the efficiency of complex large-scale systems.

Analytic hierarchy process (AHP), analytic hierarchy process (AHP) is a complicated multi-objective decision-making problem as a system, the target is decomposed into multiple objectives or principles, or rules, constraints, and multiple index of several levels, through qualitative index fuzzy quantification method to calculate hierarchical single sort (weight) and total ordering, as the target (index), scheme optimization decision method of system.

Analytic hierarchy process (AHP) is a decision-making problem according to the general objective, the each layer sub-targets, evaluation criteria and the order of the specific for voting scheme is decomposed into different hierarchies, and then, by solving the judgement matrix eigenvector calculated for each element of each level on a hierarchy of an element of priority weights, finally, the method of weighted sum hierarchical merging each alternative solution on the final total target weight, the final weight so much as the optimal solution. Grey comprehensive evaluation method requires sample data and has the characteristics of time series. It only identifies the merits and demerits of the evaluation object, but does not reflect the absolute level, which is suitable for the problem of a small amount of observation data.

Based on the existing data and analysis of various aspects, we choose the analytic hierarchy process (AHP).

3.2 Analytic Hierarchy Process

3.2.1 Model Description

Analytic hierarchy process (AHP) is a complicated multi-objective decision-making problem as a system, the target is decomposed into multiple targets and multiple index (or rule, constraints) several levels, through qualitative index fuzzy quantification method to calculate hierarchical single sort (weight) and total ordering, as the target (index), scheme optimization decision method of system.

Analytic hierarchy process (AHP) is a decision-making problem according to the general objective, the each layer sub-targets, evaluation criteria and the order of the specific for voting scheme is decomposed into different hierarchies, and then, by solving the judgement matrix characteristic vector calculated for each element of each level on a hierarchy of an element of priority weights, finally, the method of weighted sum hierarchical merging each alternative solution on the final total target weight, the final weight so much as the optimal solution. Analytic Hierarchy Process (AHP) is more suitable for the decision-making problem with the objective system with stratified and staggered evaluation indexes, besides the target value is difficult to describe quantitatively.

3.2.2 Modeling

The Main Steps are as Follows:

- 1) *Build a hierarchy model.* Decision-making objectives, factors to be considered (decision criteria) and decision objects are divided into the highest level, middle level and lowest level according to their mutual relations, and the hierarchy chart is drawn. The highest level is the purpose of the decision, the problem to be solved. The lowest level refers to the alternatives when making a decision. The middle layer refers to the factors that are considered and the criteria for decision making. For two adjacent layers, the upper layer is called the target layer and the lower layer is called the factor layer (Fig. 2).

Level indicators	The secondary indicators	Level 3 indicators
Educational resources	General conditions	1.Total area of school buildings
		2.The average size of the school building per student
		3.Total amount of equipment
	Educational fund	4.The average amount of equipment per student
		5.Books in total
		6.Number of books per student
Teaching level	Teachers	7.Total educational expenditure this year
		8.Per student expenditure on education this year
		9.Phenon
	Graduate	10.Number of doctoral supervisors
		11.Proportion of the total number of teachers with senior titles
		12.Teacher-student ratio
Quality of teaching	13.Number of PhD graduates	
	14.Number of Master Graduates	
	15.One-time employment rate of graduates	
Scientific research	Research team and base	16.Number of outstanding doctoral dissertations
		17.Number of prizes won in various international competitions
		18.State key laboratories, research centers and scientific research bases
	Scientific research output	19.Proportion of full-time R&D personnel in teachers
		20.Number of patent applications and grants
		21.Number of papers indexed by SCI, SSCI, AHCI
Efficiency and benefit	22.EI, ISTP, JSSNP papers	
	23.CSTPC, CSSCI papers	
	24.Social Science Monograph (Part)	
		25.Output per capita
		26.Output rate of ten thousand yuan

Fig. 2. The table of factors

- 2) *Construction of Pairwise Comparison Matrix.* According to the established indicators, we respectively made pairwise comparison of the indicators at the unified level to construct judgment matrices at different levels.

$$A = (a_{ij}) = \begin{pmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{pmatrix}$$

where a_{ij} is the value of the i index compared with the j index.

- 3) *Consistency index and consistency test.* The eigenvector corresponding to the largest characteristic root of the judgment matrix is denoted by W after normalization (making the sum of each element in the vector equal to 1). The element of W is the ranking weight of a factor of the same level to the relative importance of a factor of the upper level. This process is called hierarchical single sorting. Consistency test is needed to confirm whether the hierarchical single ordering can be confirmed. The so-called consistency test refers to determining the allowable range of inconsistencies for A. Wherein, the unique non-zero characteristic root of a uniform matrix of order n is n ; The maximum characteristic root of the positive reciprocal matrix A of order n is $\lambda \geq n$, and A is a uniform matrix if and only if $\lambda = n$.

Since λ continuously depends on A, the more λ is greater than N, the more serious the inconsistency of A is. The consistency index is calculated by Ci, and the smaller Ci, the greater the consistency is. The eigenvector corresponding to the maximum eigenvalue is used as the weight vector of the influence degree of the factors being compared on the upper layer of a factor. The greater the degree of inconsistency, the greater the judgment error will be. Therefore, the degree of inconsistency of A can be measured by the value of $\lambda - n$.

The consistency index was defined as:

$$CI = \frac{\lambda - n}{n - 1}$$

The random consistency index RI is as follows.

n	3	4	5	6	7	8	9	10
RI	0.58	0.90	1.12	1.14	1.32	1.42	1.45	1.49

Define Consistency Ratio

$$CR = \overline{RI}$$

When Cr = 0, it indicates that the judgment matrix has good consistency.

When Cr < 0. 1, it indicates good consistency.

Otherwise, it indicates that the consistency of the judgment matrix is not good, and the values of the matrix should be modified until CR < 0. 1.

According to the importance of each index in the mind of the decision maker, the value is assigned, and the pairwise comparison of each index in the same level is made. Numbers 1–9 and their reciprocal are used as the scale. The greater the value is, the greater the degree of importance it represents. Moreover, it is judged that matrix A is A positive reciprocal matrix, with the diagonal as the axis, and the symmetric value is the reciprocal relationship.

Analytic Hierarchy Scale (Note: 2, 4, 6 and 8 are the middle values of two adjacent grades).

Meaning	Equally important	Somewhat important	Obviously important	Highly important	Extremely important
Scale value	1	3	5	7	9

By referring to literature and data, various evaluation systems are referred, and some more important factors are selected for calculation (Fig. 3).

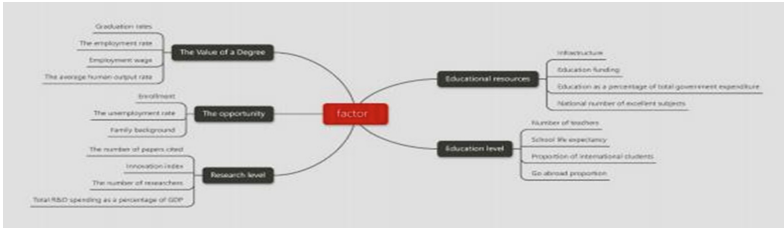


Fig. 3. The table of necessary factors.

The importance of the factors we set up was evaluated, and the results were as follows (Fig. 4):

index	significance
The percentage of education expenditure in GDP	2
The percentage education expenditure of in total expenditure	3
Government expenditure on higher education	7
Enrollment rate	6
Dropout rates	4
The number of higher education teachers	7
Innovation Index	9
The percentage of Total R&D spending in GDP	4
The number of researchers	8
Employment rate	5
Graduation rate	6
School life expectancy	4
Proportion of international students	8
Go abroad proportion	2
Employment wage	4
The average human output rate	5
Family background	3
The number of papers cited	3
Infrastructure	1
Number of national excellent papers	4

Fig. 4. .

The weight value of education system was obtained by AHP (Fig. 5):

In order to make the importance index obtained by AHP more reliable. Reference serves as a rough guide by looking at how countries rank in terms of education. We used SPSS to carry out the similarity analysis between the values of various factors of the selected countries and the negative rankings, and the results are as follows (Fig. 6):

And the importance of analytic hierarchy process is more consistent.

First-level indicators and weights	Secondary indicators	Weights
Educational resources 0.15	Education funding	0.5833
	Education as a percentage of total government expenditure	0.4167
Education level 0.3	Number of teachers	0.3333
	School life expectancy	0.1905
	Proportion of international students	0.3810
	Go abroad proportion	0.0952
The value of a degree 0.15	Graduation rates	0.5455
	The employment rate	0.4545

Fig. 5. .

index	Weight
The percentage of education expenditure in GDP	0.203
The percentage education expenditure of in total expenditure	0.311
Government expenditure on higher education	0.568
Enrollment rate	0.521
Dropout rates	0.415
The number of higher education teachers	0.541
Innovation Index	0.683
The percentage of Total R&D spending in GDP	0.361
The number of researchers	0.630
Employment rate	0.446
Graduation rate	0.583
School life expectancy	0.370
Proportion of international students	0.630
Go abroad proportion	0.260

Fig. 6. The similarity analysis.

By calculating the matrix of analytic hierarchy process (AHP) under each first-level index, the results obtained meet the consistency test. Considering that the consistency ratio of the matrix CR is very close to 0, we directly take the ratio of importance as an important index of weight. Different units and orders of magnitude are taken into account for each country’s data indicators. To facilitate calculation and reduce the impact of different units and orders of magnitude. For example, the innovation index is on the order of 10^1 , and the number of teachers is on the order of 10^4 . Even if the weights are different, direct multiplication will result in an effect of a larger order of magnitude

overriding a change in a smaller order of magnitude. So, we're going to standardize the data.

4 Evaluation of Higher Education System Evaluation Model

4.1 Example: American

In order to illustrate our model more intuitively, we choose the United States as a case.

According to the 2016 Open Doors Report released by IIE, the number of students studying in the United States reached a new high in 2016, exceeding one million for the first time. Among them, 328,547 students were from China, an increase of 8.1% year on year, accounting for 31.5% of the total number of students in the United States. According to the 2015 Chronicle of Higher Education, there are 4,810 colleges and universities in the United States, of which 3,120 are four-year colleges and universities and 1,690 are two-year colleges and universities, with 20,417,500 students. Each university has a clear position, plays its own role, depends on each other, and has its own characteristics. It shoulders the mission and responsibility of cultivating and absorbing talents, promoting social and economic development, maintaining values and exerting international influence.

We believe that the United States has one of the world's leading higher education systems (Fig. 7).

Category	Number	Percentage	Category	Number	Percentage
Teaching	719873	28.52	Community service	140621	5.79
Professional scientific research	75620	3.00			
Public services	20267	0.80	Health care workers	94899	3.76
Library management and archives	35832	1.42	Service professional	202931	8.04
Student affairs	121296	4.81	Sales and related occupations	10521	0.42
Management	252156	9.99	Administration	347181	13.76
Business and financial operations	197107	7.81	Natural resources	70156	2.78
Computer science	2194249	8.49	Production	15871	0.63

Fig. 7. Full-time faculty structure in American universities

4.2 Example: Mexico

Mexico can simply represent a developing country.

Mexico is not only the second largest economy, population and education country in Latin America after Brazil, but also the world’s largest country in higher education. At present, Mexico has 2,847 undergraduate institutions (including university campuses), with an enrollment of 2,384,800 students. Graduate education, which started earlier but developed relatively slowly, has also made great progress. There are 1,361 universities offering graduate education annually, with 150,800 postgraduate students and 280 million full-time faculty members, or 105.6 million, ranking 11th in the world. In terms of the size of higher education, Mexico ranks eighth among developing countries.

Based on the model data and the factor weight data derived from the model, the evaluation scores for American higher education were obtained as follows:

Score = $\Sigma (\Sigma (\text{Index} * \text{Secondary weights})) * \text{First - level weights} = 3.3736$ The other countries’ evaluation scores are shown below (Fig. 8):

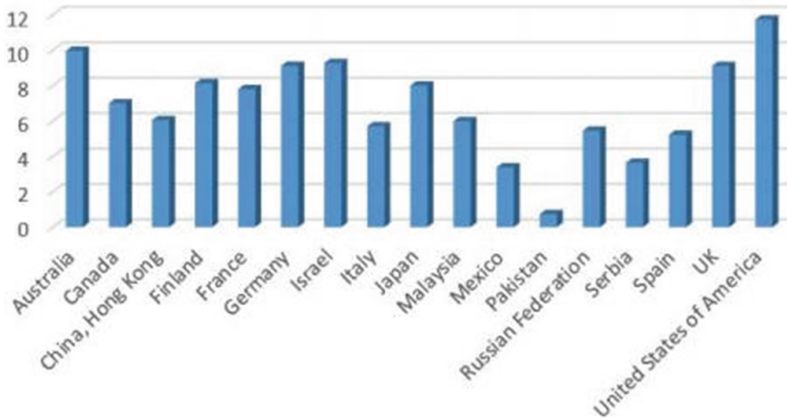


Fig. 8. All countries’s evaluation scores.

5 Attainable and Reasonable System of Higher Education for UK

5.1 Evaluation Model Design

We have established the criteria for a healthy and sustainable higher education system based on the factor weights calculated by AHP.

- (1) The level of education: as an important subject in the process of higher education, tutors are the key to the high-quality development of higher education. Good quality of teachers can provide a strong intellectual support and impetus for the development of graduate students. As the main body and personality shaper guiding students’ academic development, mentors’ own ideological and moral cultivation and

professional quality play an imperceptible role in shaping students' personalized development. A competent mentor team can effectively make up for the deficiency of single mentor training. It is very important to cultivate a team of leaders who are responsible for the cultivation of students' academic ability as well as the shaping of students' values and the leading of their thoughts.

- (2) The level of research: dissertation as students investigation and feedback of quality, is the last line of defense education checks. It includes strict requirements in the whole process of initial proposal, mid-term examination, "double-blind" evaluation and defense of the thesis, and firmly holds the red line of degree quality.
- (3) School resources: the critical path to improve the quality of students in learning links in resources platform construction and ascension. Library, management services and infrastructure, as an important factor in the training process, provide students with a good study and life logistics support and resource access platform, so that students can better devote themselves to scientific research. By improving the training mode, we can realize link connection, carrier combination and internal and external linkage, so as to continuously improve students' learning quality and participation, and further promote the improvement of teaching and training quality.
- (4) Degree value: end continuously shunt elimination mechanism, establish and improve the students time and misconduct zero tolerance mechanism. In order to overcome the tendency of "five only" among students, a new degree evaluation standard system should be established through the revision of the degree evaluation standard. According to their research characteristics, targeted classification guidance should be given to avoid professional degree graduate students from too "academic" research and deviate from reality, so as to promote the high-quality development of different types of students
- (5) Access: students, as an important subject throughout the process of education, are the starting point and foundation of high-quality development of education. A good source of students can guarantee the quality of education from the source. The methods of classified examination, comprehensive evaluation and multiple admission provide a good reference for scientific selection of graduate students. At the same time, it actively promotes the construction of practice-oriented courses, the construction of professional practice bases, and adopts diversified and targeted training models to make it more competitive when facing the main battlefield of national economy.

The ideal weight of specific factors in the higher education system is shown below:

The percentage of education expenditure in GDP	0.203
The percentage education expenditure of in total expenditure	0.311
Government expenditure on higher education	0.568
Enrollment rate	0.521
Dropout rates	0.415
The number of higher education teachers	0.541
Innovation Index	0.683

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The percentage of Total R&D spending in GDP	0.361
The number of researchers	0.630
Employment rate	0.446
Graduation rate	0.583
School life expectancy	0.370
Proportion of international students	0.630
Go abroad proportion	0.260

5.2 Evaluate the Results and Compare Them

The evaluation score was obtained by fitting the weighted value obtained by the analytic hierarchy process with the real value of the factors of the higher education system, and the evaluation score was compared with the official national higher education ranking (Fig. 9):

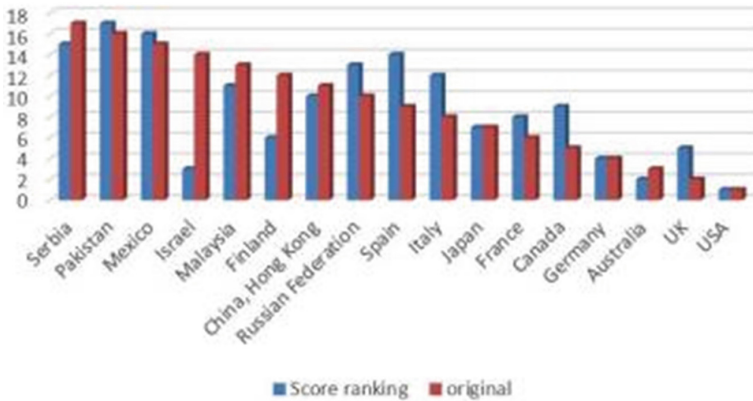


Fig. 9. Contrast.

It can be concluded that most countries' evaluation scores and rankings are consistent. In order to illustrate the feasibility and scientificity of our model more directly, we use the British higher education evaluation method as an example.

The Higher Education Quality Assurance Agency (QAA) is an educational assessment body independent of the government and institutions of higher learning. Its mission is to provide comprehensive quality assurance services to British universities to ensure and improve the quality of higher education, and to promote the continuous reform and deepening of the quality of higher education.

The assessment content of QAA covers two aspects of school quality assessment and discipline quality assessment, including six assessment indicators, which are: curriculum design, content and organization; Teaching quality and learning quality; Student

progress and achievement; Student assistance and guidance; Learning resources; Quality management and improvement. As a reference for the government to formulate education policies and implement education quality management, the evaluation results have strong authority and fairness.

The analytic hierarchy process (AHP) adopted in this paper is the same as its evaluation method, which uses multiple indicators to evaluate the higher education system in different countries. At the same time, due to the diversity of evaluation indicators and wide coverage, the model can provide different levels of evaluation services, so as to adapt to different countries with different levels and situations. It also shows that the analytic hierarchy process (AHP) we use to construct the evaluation model is scientific and adaptable.

6 Policy Proposal and Implementation Schedule

6.1 Multiple Linear Regression for the Coefficient

First of all, we use MATLAB to use multiple linear regression to figure out the coefficient before each impact factor.

Use the regress function:

```
x = data(:, 1:14); %input.
```

```
Y = data(:, 15);
```

```
X = [ones(17, 1), x];
```

```
[b, bint,r,rint, stats] = regress(Y, X).
```

The required coefficients are as follows (marked in yellow) (Fig. 10):

Education spending as a percentage of GDP	0.3	0.166667		
Education expenditure as a percentage of GDP	0.45	0.25		
Education spending	1.05	0.583333	1.8	0.10557
Enrollment rate	0.6	0.6		
Dropout rates	0.4	0.4	1	0.05865
Go abroad proportion	0.6	0.11764		
Number of teachers	2.1	0.41176		
Proportion of international students	2.4	0.47058	5.1	0.29912
Life expectancy at school	1.2	0.42105		
Graduation rate	0.9	0.31578		
Employment rate	0.75	0.26315	2.85	0.16715
Innovation index	2.7	0.42857		
R&D spending as a percentage of GDP	3.6	0.57142		
Number of researchers	0	0	6.3	0.3695

Fig. 10. The required coefficients. (Color figure online)

The 14 values on the left are the coefficients of the second-level indicators, and the 5 values on the right are the coefficients of the first-level indicators.

6.2 Multiple Linear Regression for the Coefficient

The data used to evaluate the indicators came from a number of databases, including the World Bank, UNESCO, the National Bureau of Statistics, and others.

Based on factors related to education level, we cut and integrated them. This reduces redundancy and noise due to excessive factors. International data is difficult to find, and if data is missing in an area, we do not evaluate that area in order to get the most accurate results. We got four years' worth of data from 162 countries and territories. Countries may be affected by political, natural or uncertain factors, given the different years. Educational indicators have also been affected. So we averaged the data for different countries over four years. Even if one indicator is up, fluctuating or down, averaging doesn't have much effect on the country's indicators. The indicators we selected are all positive ones, but there are dimensional differences between most of them, so we use the normalization of the interval [0, 1].

The formula should be:

$$r_i = \frac{x_i - r_{min}}{r_{max} - r_{min}}$$

r_i is the normalized value, r_{min} is the maximum and r_{max} is the minimum of the factor. Considering that the weights obtained by the original AHP are inconsistent with the orders of magnitude of the coefficients, they cannot be compared, so the weight is normalized.

Fill the following table with the normalized weight and the desired coefficient:

Impact factor	Coefficient	Normalized weights
Education spending as a percentage of GDP	0.1667	0
Education expenditure as a percentage of total expenditure	0.2500	0.1428
Government expenditure on higher education	0.5833	0.7142
Enrollment rate	0.6000	0.5714
Dropout rates	0.4000	0.2857
Number of higher education teachers	0.4117	0.7143
Innovation Index	0.4285	1.0000
Total R&D spending as a percentage of GDP	0.5714	0.2857
Number of researchers	0	0.8571
Employment rate	0.2631	0.4286
Graduation rate	0.3157	0.5714
School's life expectancy	0.4210	0.2857
Proportion of international students	0.4705	0.8571
Go abroad proportion	0.1176	0

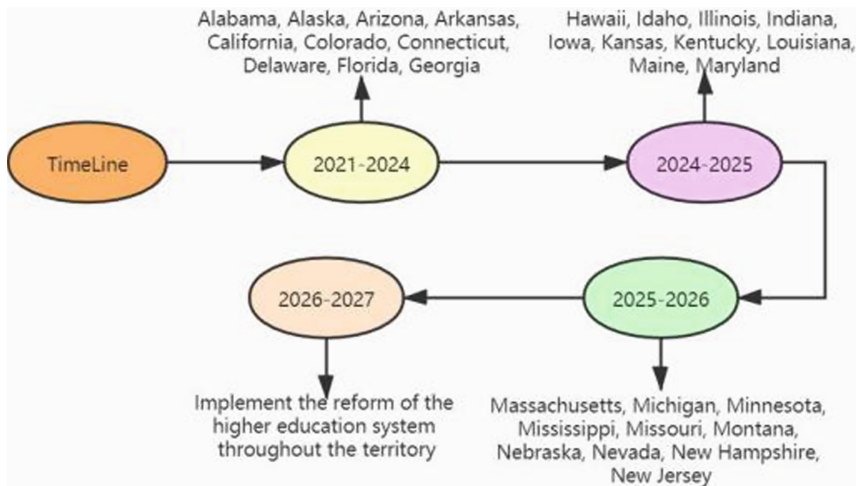
6.3 Policy Presentation

As can be seen from the table, the coefficients and weights of education expenditure, number of teachers, innovation index, number of researchers, employment rate and

proportion of overseas students are relatively low. It shows that the United States has shortcomings in these aspects, and the following policies need to be put forward to improve the higher education system:

1. Government spending on higher education increased to \$27.0 million.
2. Actively introduce foreign talents and encourage participation in the construction of higher education. It is estimated that the number of teachers in higher education will reach 1600000.
3. Encourage universities to conduct innovative research and give certain amounts of government subsidies.
4. Encourage teachers and students to participate in research and development work, and provide subsidies for research and development projects.
5. Encourage foreign talents to study abroad, and provide necessary social security, and monthly social subsidies.

6.4 Implementation Schedule



The first phase (2021–2024) is a pilot phase, which will be implemented in several states first. The second phase (2024–2025) expands the pilot scope and further expands the scope; The third stage (2025–2026) is the upgrading and reform stage, which will continue to expand the scope; The fourth stage (2026–2027) is the comprehensive implementation stage, in which policies are implemented throughout the territory to deepen the reform of the higher education system.

7 First Section Validation of Policy Effectiveness and Its Impact on Reality

7.1 Validation of Effectiveness

The implementation of these policies has greatly improved the inadequacies of the US higher education system. At the same time, the amount of the above impact factors also changed accordingly.

Repeat the operation of the second step, normalize each factor and put it into the evaluation model. The current health score of the higher education system is calculated as 12.8411, which is 1 point higher than the health score of 11.7235 before the release of the policy, proving that the release of the policy has a positive impact on the health of the higher education system in the United States.

Therefore, it can be proved that the release of the policy plays an effective role in improving the health of the higher education system.

7.2 The Impact on Reality

(1) Students

1. Preferences for foreign students studying in the United States have been enhanced.
2. As the number of overseas students increases, the competition pressure for domestic students becomes greater.
3. The employment rate of local students may decrease due to the increase of overseas students.

(2) Teachers

1. As the number of teachers introduced increases, the distribution of public education resources decreases.
2. The high subsidy for imported teachers may lead to the dissatisfaction of local teachers.

(3) School

1. The introduction of overseas students and foreign talents increases the management pressure of the school.
2. The inherent resources of the school have reached saturation.

(4) Community

1. The introduction of a large number of foreign personnel and cultural differences may increase the number of conflicts in communities.
2. The increase of personnel makes community management more difficult.

(5) Countries

1. The increase of education expenditure reduces the expenditure on industry, high technology and so on.
2. Subsidies for foreign students and teachers eat up a portion of government spending and slow down economic growth.

8 Vision of the Future

The internationalization of higher education, as a significant feature of the development of higher education in the world, has become an important way to improve the quality of national higher education, national innovation ability and international influence of culture.

University of the United Nations educational, scientific and cultural organization of the international federation of given is defined as: “the higher education internationalization is across national borders and the perspective of cross-cultural and atmosphere and university teaching, scientific research and social service and the main function of the combination of process, it is a comprehensive process, the change of the school internal, external changes and school; There are both bottom-up and top-down; And the schools themselves are changing”.

- (1) The third-party educational evaluation institutions run by the government and assisted by the public are not dependent on the government or other organizations, and are not subject to interference from any interested parties. They are conducive to carrying out the evaluation work independently and objectively and performing the function of quality assurance. This practice encourages third-party education evaluation institutions to operate independently based on market demand and provide different levels and various types of evaluation services to meet social needs, thus gaining broad credibility and more evaluation funds. This evaluation system can give full play to the professionalism and authority of the third-party evaluation agencies, while not affecting the government’s indirect guidance and management of higher education.
- (2) The scientificity of the evaluation is mainly reflected in the diversity of the evaluation indexes, the diversity of the participants, the standardization of the admittance system and the scientific technical means. The professional evaluation experts and teams are committed to the establishment of the evaluation index system, the setting of the evaluation procedures and the development and implementation of the evaluation work. They can provide different levels of evaluation services oriented by the market, so as to adapt to the various colleges and universities with different levels and different situations. This kind of “target adaptability” diversified evaluation index system is beneficial to comprehensively consider the quality of higher education and promote the smooth progress of higher education evaluation. In addition, the student participation mechanism in higher education evaluation is one of the important guarantees of higher education quality. The concept of “student-centered”

runs through the whole process of higher education evaluation. Student representatives, as members of the evaluation group, participate in the evaluation work, feedback quality information, and provide suggestions and opinions, so as to comprehensively and objectively evaluate the quality of higher education. Admittedly, sometimes the limited ability of students to understand information and literature may affect the accuracy of information feedback in educational quality assessment, but the positive effect of student participation in assessment is beyond doubt.

- (3) The public disclosure of the education quality assessment information provided by the continuous strengthening of the competition mechanism of college evaluation will directly affect the reputation, enrollment, employment and the amount of funds obtained by each university. Therefore, each university attaches great importance to the improvement of the quality of teaching and research, in order to obtain better evaluation results. This competition mechanism is conducive to the self-regulation, self-protection and self-improvement of colleges and universities, and is an effective means to promote the quality of higher education.

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