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Problems of Economics

Original article

OVERVIEW OF KEY INDICATORS OF THE DEVELOPMENT OF THE ACADEMIC INDUSTRY IN CHINA

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Abstract. The efficiency of China's economic development depends on investment in human capital, in particular investment in higher education. This article presents the main trends in the development of higher education over the past 10 years. Based on a comparative analysis of world rankings and domestic university rankings, combined with the actual situation in China, the current development of the academic industry is analyzed. According to the results of the analysis, the current performance of some universities has reached the level of world-class universities, especially in the field of basic scientific research. But there is a big gap with world-class universities in cutting-edge research, internationalization and talent development. Analyzing the key indicators of the development of the academic industry in China, the author draws attention to the need to increase the international competitiveness of China's scientific research and international public recognition. To do this, it is necessary to balance the distribution of resources between regions and universities in the field of education; evaluate the weight of scientific research achievements, the impact of scientific research and the conditions for conducting scientific research, optimize the evaluation of the effectiveness of scientific research; increase investment in the development and motivation of academic staff.

Keywords: human capital, Higher education, Gross Enrolment Ratio of Higher Education, indicators of university development, university rankings, China, Chinese universities

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ОБЗОР КЛЮЧЕВЫХ ПОКАЗАТЕЛЕЙ РАЗВИТИЯ АКАДЕМИЧЕСКОЙ ИНДУСТРИИ В КИТАЕ

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Аннотация. Эффективность развития экономики Китая зависит от инвестиций в человеческий капитал, в частности от инвестиций в высшее образование. В данной статье представлены основные тенденции развития за последние 10 лет. На основе сравнительного анализа мировых университетских рейтингов и рейтингов отечественных университетов в сочетании с фактической ситуацией в Китае, анализируется текущее развитие академической отрасли в китайских университетах. Согласно результатам анализа, текущие показатели некоторых университетов достигли уровня университетов мирового класса, особенно показатели в области фундаментальных научных исследований заняли лидирующие позиции в мире. Но существует большой разрыв с университетами мирового класса в сфере передовых исследований, интернационализации и подготовки талантов. Анализируя ключевые показатели развития академической отрасли в Китае, автор обращает внимание на необходимость повышения

международной конкурентоспособности научных исследований Китая и международного общественного признания. Для этого необходимо сбалансировать распределение ресурсов между регионами и вузами в сфере образования; оценить вес достижений научных исследований, влияние научных исследований и условия для проведения научных исследований, оптимизировать оценку эффективности научных исследований; увеличить инвестиции в развитие и мотивацию академических работников.

Ключевые слова: человеческий капитал, высшее образование, валовый коэффициент охвата высшим образованием, индикаторы развития университетов, рейтинг вузов, Китай, китайские университеты

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Current Situation of Higher Education in China

In China, higher education is divided into specialized education, undergraduate education and postgraduate education, which are mainly carried out by ordinary universities of higher education, including: regular higher education institutions, independent colleges, higher vocational institutions, and other institutions. In the past 20 years, China has issued a series of measures and policies to improve the quality of Chinese higher education [1].

Table 1[1]

The Development Process of Higher Education in China

At the beginning of China	205 colleges and universities, the gross enrollment rate of higher education was only 0.26%.
1977-1980 :	In 1977, the college entrance examination was resumed.
	In 1980, bachelor, master and doctoral degrees were established, and regulations were made in terms of degree classification, academic standards for degrees at all levels, and strict examination of degree-granting units.
2000-2018:	In 2000, China launched the "New Century Higher Education Teaching Reform Project"
	In 2007, the undergraduate teaching quality and teaching reform project in colleges and universities was carried out.
	In 2015, the state promoted the overall plan for the construction of world-class universities and first-class disciplines.
	In 2018, the Ministry of Education issued the "40 Articles of Higher Education in the New Era", which established the phased goal of building high-level undergraduate education in the next five years and the overall goal to 2035.
In 2020	In 2020, a total of 14.4187 million higher education enrollments have entered the popularization stage.

According to the statistics of the Ministry of Education of China, the overall number of regular universities in China is increasing year by year. In 2020, there are 2,738 regular higher education institutions. Among them, there were 1,270 undergraduate colleges and universities, an increase of 5 over the previous year, and 1,468 higher vocational (specialist) colleges, an increase of 45 over the previous year. Since 2011, the number of students in regular universities in China has increased year by year.

[1] According to the higher education policy issued by the Chinese government, http://www.moe.gov.cn/

In 2020, the gross enrollment rate of higher education has reached 54.4%, and there are a total of 32.8529 million students in regular higher education universities and colleges, an increase of 8.37% over the previous year. Among them, there were 3.1396 million graduate students, an increase of 9.63%; 18.2575 million regular undergraduate students, an increase of 4.28% over the previous year; 1459.55 regular higher vocational college students, an increase of 13.96% over the previous year. Since the reform and opening up, the number of full-time teachers in regular colleges and universities in China has continued to increase. In 2020, there will be 1.833 million full-time teachers in general institutions of higher learning across the country, an increase of 5.34% over the previous year. Correspondingly, the group of university graduates entering the job market has continued to expand, reaching 8.74 million in 2020, accounting for 58% of the new labor force nationwide. A series of figures show that China's higher education has entered a period of rapid development and popularization.

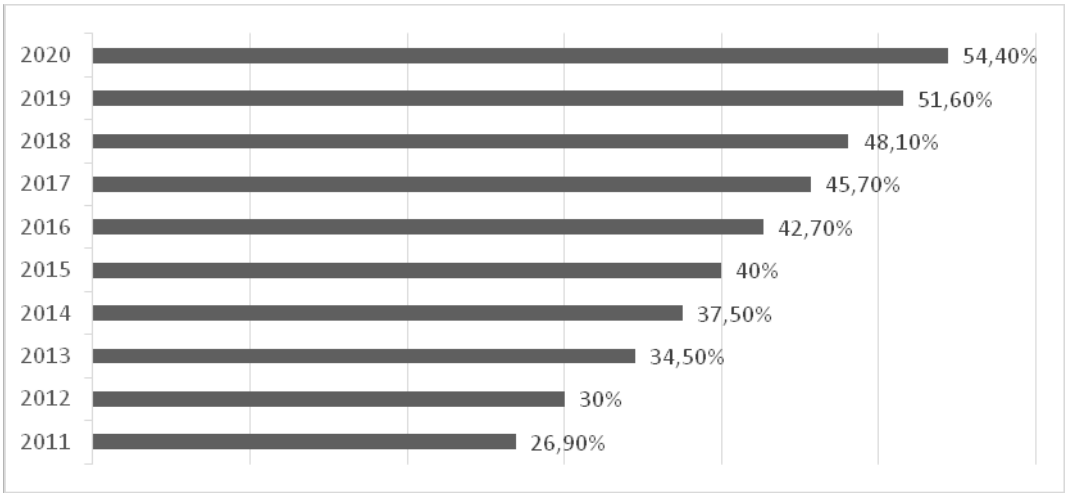

Fig 1. Gross Enrolment Ratio of Higher Education in China 2011-2020 (Higher Education the Age of 18-22)[1].

Among them, undergraduate university occupy the vast majority of China's higher education resources in terms of the number of students, the number of faculty members, and the number of full-time teachers.

Table 2[2]

Number of Schools, Faculty Members, and Full-Time Teachers in China's Higher Education Institutions in 2020

Type	Number of schools/institutions	Educational Personnel	Full-time Teachers
Institutions Providing Postgraduate Programs- Regular HEIs	594	/	/
Institutions Providing Postgraduate Programs-Research Institutions	233	/	/
Regular HEIs-HEIs Offering Degree Programs	1270	1923487	1276101
of Which: Independent Institutions	241	151993	117154
Regular HEIs-Higher Vocational Colleges	1468	744478	556424
Regular HEIs-Other institutions	21	743	457
Adult HEIs	265	32475	18951
Other Non-government HEIs	788	17911	8116

[1] Prepared by researchers in depending on https://www.yearbookchina.com/navibooklist-n3022021706-1.html
[2] Data according to yearbook of China Statistics Bureau 2020: Education Statistical Yearbook of China 2020, https://www.yearbookchina.com/navibooklist-n3022021706-1.html

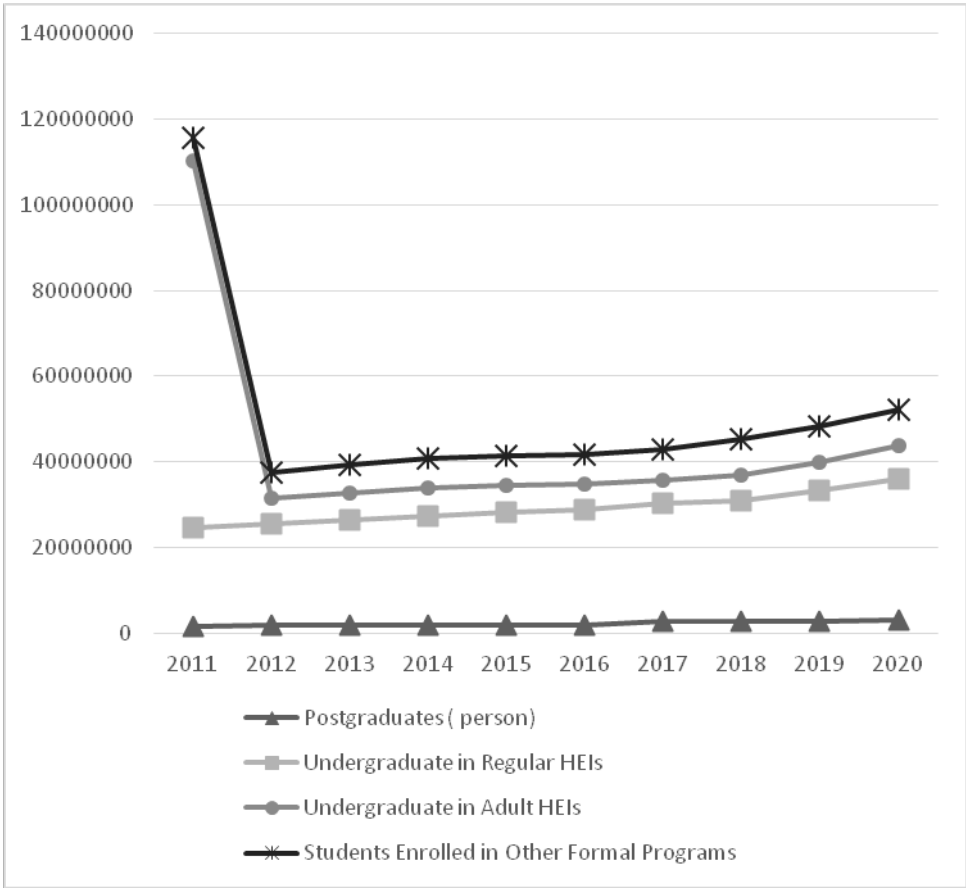

Fig 2. Statistics on the number of students in various types of higher education in China by year 2011-2020[1,2].

Chinese universities are mainly divided into public universities, private universities and Sino-foreign joint universities. Top technologies often require huge funding for research. Most of the institutions with strong financial support and strong scientific research capabilities in China are public universities, so public universities are the core of China's higher education [2]. Due to the differences in politics, economy, natural resources and technology, population, and culture among the eastern, central and western regions of China, as well as the national macro-political system, economic system, higher education management system and policies, economic development strategies, etc. There is a big difference in higher education resources.

Since the 1990s, China has adopted a policy of tilting toward key universities in the allocation of higher education resources and started construction projects such as "Project 211" and "Project 985". These university construction plans have accelerated the development of leading universities, but the Ministry of Education funding through the "Project 985" has serious policy deviations. As the leaders of Chinese universities, Tsinghua University and Peking University are far ahead in their financial allocations in 2021; there is a big difference in the resources of teachers in ordinary universities in the east, central and western regions, and the number of full-time teachers and the number of professors with senior professional titles are obviously unbalanced [3]. The country should introduce a fair competition mechanism, so that more outstanding universities could compete for key construction, narrow the regional gap, and help the development of education in the central and western regions.

[1] Prepared by researchers in depending on https://www.yearbookchina.com/navibooklist-n3022021706-1.html
[2] According to the requirements of the relevant documents of the Ministry of Education, the caliber of graduate students in 2017 has changed, and the current students include full-time, part-time graduate students and in-service graduate students studying for a master's degree.

Table 3[1]

Central Deployment University Budget Financial Appropriation, 2021

Name of university	Total budget revenue	Number of financial appropriations	Proportion of financial appropriations
Tsinghua University	221.34	44.62	20.16%
Peking University	317.28	44.49	14.02%
Zhejiang University	228.16	34.10	14.95%
Jilin University	98.36	33.60	34.16%
Huazhong University of Science and Technology	101.76	31.88	31.33%
Wuhan University	106.44	31.67	29.75%
Huazhong University of Science and Technology	116.33	31.37	26.97%
Xi'an Jiaotong University	114.68	31.08	27.10%
Shanghai Jiao Tong University	175.65	29.97	17.06%
Shandong University	118.08	28.70	24.31%

Unit: 100 million yuan

In addition, with the expansion of the scale of higher education and the growth of the number of graduates, the problems of quality matching of talents in Chinese universities are mainly manifested in high turnover rate, long adaptation period, insufficient basic skills, low employer satisfaction and low graduate employment satisfaction. In terms of quantity matching, the main problems are that there is an eastern bias in the regional distribution of graduates' employment, and the ratio of professional counterparts is low.

Ranking of universities

The World University Rankings objectively ranks the quality of universities in a quantitative manner by integrating relevant indicators. The current world-wide recognized world university rankings are ARWU, QS, THE, etc. With the development of rankings, more and more ranking agencies have proposed multiple ways to evaluate the performance of universities around the world [4]. Combining the rankings of different quantitative and qualitative indicators, we can:

- Helping government agencies, including the Chinese Ministry of Education, evaluate the performance of university and group research projects.
- Help businesses and public organizations allocate funds and grants more appropriately and competitively.
- Help university administrators assess the universities' strengths and weaknesses and develop a strategic plan
- Help students and other groups to analyze the complex and diverse quality of higher education and make their own choices.
- Helping businesses, employers and recruitment agencies select more suitable graduates for employment.

Many scholars have conducted research on the World University Rankings, and it is necessary to rely on the judgment of the indicator system and evaluation method to judge the rankings of universities. The index system is the foundation of the rankings concept and connotation. After studying the differences of rankings indicators, we can find that the evaluation standards of different systems are quite different, and the specific rankings, selected indicators and their weights are also different.

[1] Only the universities directly under the Ministry of Education and the Ministry of Industry and Information Technology are counted, and the data is the budget of each university in 2021.

ARWU includes four first-grade indicators of education quality (10%), teacher quality (40%), scientific research achievements (40%) and average performance of teachers (10%), as well as the number of alumni who have won Nobel Prizes and Fields Medals, the second-grade indicators such as the number of scientists with the most citations in the subject area, the number of papers published in Nature and Science, and the number of papers indexed by the Science Citation Index (SCIE) and Social Science Citation Index (SSCI). We can see that the rankings are more biased towards the research excellence, reflecting the performance of universities in academic research. At the same time, ARWU is also the earliest world university rankings in the world, which only considers the rankings of objective research results. From the 2021 ARWU World University Rankings, we can see that mainland China (mainland China, Hong Kong, and Taiwan are calculated separately in the rankings) occupies 83 places in the top 500 rankings. Overall, China is second only to the United States in the number of colleges and universities on the ARWU rankings in 2021. From the first release of the ARWU rankings in 2003 to 2021, the number of the top 500 mainland Chinese universities has increased by 72, and the highest-ranked universities have risen from more than 200 to 28th. After nearly 20 years of higher education development, Chinese universities have made breakthrough progress.

The QS indicator system does not subdivide second-grade indicators, but adopts Academic Reputation (40%), Employer Reputation (10%), Faculty/Student Ratio (20%), and Citations per faculty (20%), International Faculty Ratio (5%), and International Student Ratio (5%) are six comprehensive qualitative and quantitative evaluation indicators, which mainly evaluate universities from three aspects: scientific research, teaching, and internationalization. The QS World University Rankings attaches great importance to subjective indicators, focuses on employment, and has a relatively low weight on academic ability. A large number of subjective questionnaires will be conducted during the evaluation. Extensive questionnaire surveys have also made QS the most famous world university rankings in the world, but there are too many subjective factors in the QS rankings that are not objective and true enough. In the 2022 QS rankings, a total of 90 universities in China have entered. Among rankings, Tsinghua University and Peking University, as the highest-ranked universities in China, have entered the top 20 in the world.

The index system of THE rankings is more comprehensive. The rankings are usually published in the form of a questionnaire survey, and it pays more attention to the evaluation of the school's academic ability. In the evaluation process, five first-grade indicators of teaching, research, number of citations, international perspective, and industrial income were selected and refined into 13 second-grade indicators, as shown in Table 4.

Table 4[1]

THE Rankings Indicator System in 2022

First-grade indicators	Second-grade indicators	Weights	Subjective/Objective
Teaching	Reputation survey	15%	Subjective
	Staff-to-student ratio	4.50%	Objective
	Doctorate-to-bachelor's ratio	2.25%	Objective
	Doctorates-awarded-to-academic-staff ratio	6%	Objective
	Institutional income	2.25%	Objective
Research	Reputation survey	18%	Objective
	Research income	6%	Objective
	Research productivity	6%	Objective
Citations	Citations	30%	Objective
International outlook	Proportion of international students	2.50%	Objective
	Proportion of international staff	2.50%	Objective
	International collaboration	2.50%	Objective
Industry income	Industry income	2.50%	Objective

[1] THE Rankings Indicators according to report of Times Higher Education 2021: World University Rankings 2022: methodology, https://www.timeshighereducation.com/world-university-rankings/world-university-rankings-2022-methodology

THE released the latest rankings in 2021, with a total of 1,662 universities, from 99 countries and regions, which is currently the largest world university rankings. A total of 97 mainland universities in China are on the list, and Tsinghua University and Peking University are tied for 16th, creating the highest and most records in the history of mainland Chinese universities. It is worth mentioning that in the 2021-2022 rankings of THE data analysis, there are 11 institutions in mainland China that have significantly increased their citation impact scores after publishing medical papers related to Covid-19, which is the reason that the number of universities in rankings makes history.

At present, there are more than 30 different types of university rankings in China. After a comprehensive comparison and analysis of this indicator system, it is found that the indicator design of ACCSE considers the alternative indicators of teachers, students and reputation, and the indicator design considers the input and output of universities, and comprehensively interprets the functions of higher education. Therefore, author will mainly describe the composition of ACCSE indicator system. As mentioned above, Chinese higher education has the characteristics of multiple types, and the policy inclination and regional differences also cause the disadvantage of lower than uneven development. Therefore, according to the general official classification, the indicator system divides Chinese universities into three categories, namely: key universities, regular universities and private universities. Key universities and regular universities account for most of the resources of higher education, and the rankings system of private universities is not analyzed here. As can be seen from Table 5, the index system of key universities includes four first-grade indicators, 13 second-grade indicators and 50 third-grade indicators, which are comprehensively evaluated from four aspects: resources, teaching, R&D and reputation. Regular universities have less indicator systems, including 3 first-grade indicators, 12 second-grade indicators and 48 third-grade indicators. The indicators are basically the same as key universities', but the weights are different. This is because in China, the comprehensive competitiveness of regular universities is far behind that of key universities, but in terms of numbers, regular universities account for nearly two-thirds of the total number of universities in China.

Table 5[1]

Index System of Chinese Key Universities of ACCSE Rankings

Primary indicators	Secondary indicators	Tertiary indicators
Educational resources	Basic facilities	Built-up area
		Built-up area per student
		Educational instruments and equipment
		Educational instruments and equipment per student
		Library collection
		Library collection per student
	Educational expenditure	Educational expenditure
		Educational expenditure per student
	Faculty	The number of members of Chinese Academy of Science or Chinese Academy of Engineering
		The number of outstanding talents (including teachers with the title of Cheung Kong Scholars, cross-century talents and Chinese Excellent Teachers)
		Supervisors of PhD candidates
		The ratio of teachers with senior title
		Student/teacher ratio
	Advantageous disciplines	The number of institutes authorized to grant Ph.D. Degree
		The number of institutes authorized to grant master's degree
		The number of national key disciplines
		The number of characteristic majors

[1] ACCESE Ranking Indicators according to article of Network of Science & Education Evaluation in China: An Overview on the Methods and Results of Chinese Universities Evaluation, http://e.nseac.com/html/140/225285.html

Teaching level	Quality of students	Average scores of the entrance exam
		The number of PhD graduates per year
		The number of Master graduates per year
		The number of Bachelor graduates per year
		Employ rate of graduates
	Graduates & exchange students	graduates/undergraduates' rate
		exchange students/undergraduates' rate
	Teaching achievements	The number of excellent Teaching Award granted by the ministry of education
		National Excellent Courses granted by the Ministry of Education.
		The number of teachers with the title of National Distinguished Lecturer
		National Prize for the Top 100 PHD Dissertations
		The number of awards in the international and national academic race
R&D	R&D team and base	The number of excellent innovation teams
		The number of national key labs or research centers
		The ratio of teachers in full-time R&D
	The quantity of R&D output	The number of patents
		The number of papers recorded by SCI/SSCI/A&HCI
		The number of papers recorded by EI/ISTP/ISSHP
		The number of papers recorded by CSTPC/CSSCI
		The number of monographs
	The quality of R&D output	The number of national rewards
		The number of papers published on Science and Nature
		The number of outstanding scientific research achievements
		Citations in SCI/SSCI/A&HCI
		Citations in CSTPC/CSSCI
	R&D programs and expenditure	The number of research programs financed by NSFC(Natural Science Foundation of China)
		The number of research programs financed by NSSF(National Social Science Fund)
		The total number of research programs
		R&D expenditure in this year
	R&D efficiency	The rate of output per capital
		The rate of output per ￥10000
Reputation	Reputation	Academic reputation
		web influence

Table 6[1]

Comparison of Four University Rankings Taking the Top 20 Chinese Mainland Universities in QS as An Example

Name of university	QS	THE	ARWU	RCCSE
Tsinghua University	17	16	28	1
Peking University	18	16	45	1
Fudan University	31	60	77	5
Zhejiang University	45	75	52	3
Shanghai Jiao Tong University	50	84	59	4
University of Science and Technology of China	98	88	63	14
Nanjing University	131	105	101	11
Tongji University	211	301	151	17
Wuhan University	225	157	151	6
Harbin Institute of Technology	236	501	151	10
Sun Yat-sen University	260	251	89	9
Beijing Normal University	270	251	201	23
Southern University of Science & Technology	275	162	301	-
Xi'an Jiaotong University	290	401	101	13
Huazhong University of Science and Technology	334	181	101	8
Tianjin University	334	401	151	22
Nankai University	358	301	201	27
Beijing Institute of Technology	373	601	151	24
Beihang University	383	501	201	21
Shandong University	403	-	151	16

Comparing the international and domestic index systems, we can see that the university rankings of any institutions follow their own ideas, standards, and methods, and have their own unique insights. ARWU attaches great importance to research excellence, and the six major standards are objective standards; QS attaches great importance to subjective indicators and the examination of graduates' employability; THE introduces social service indicators and uses industrial income to express the transformation of higher education achievements; RCCSE takes into account the strength of teachers , alternative indicators of student status and reputation, the index design takes into account the input and output of universities, and comprehensively interprets the functions of higher education. From the table, we can see that some of the current indicators of some universities have reached the level of world-class universities, especially the basic scientific research indicators have ranked among the top in the world. Chinese universities are currently ranked at the bottom of ARWU, indicating that there is still a lot of room for improvement in research excellence. It is necessary to comprehensively consider increasing the evaluation weight of scientific research achievements, scientific research influence and scientific research environment in scientific research and optimize scientific research performance assessment; in QS and THE rankings, only Peking University and Tsinghua University are at the top of the rankings, and many universities are out of the top 200. There is still a big gap with the first-class level.

Conclusion

In terms of education, it is necessary to balance the allocation of resources between higher education regions and colleges in education; strengthen the construction and training of teachers through incentives and other methods, lay a solid foundation for talent training, and focus on the transformation of higher education achievements; cultivate students' employability and improve graduates.

[1] Data based on 2022 QS World University Rankings, 2022 THE World University Rankings, 2021 ARWU World University Rankings and 2022 ACCSE China University Rankings, the table does not include statistics on universities in Macau, Hong Kong and Taiwan.

The professional matching rate of employment solves the problem of quality matching of talents in Chinese universities. In addition, due to the differences in the rankings index systems of various institutions, colleges and universities should understand the connotation of the index system when using the rankings, analyze the fundamental reasons for the changes in the rankings of colleges and universities, and take corresponding measures.

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