

Exploring the Key Metrics and Construction Strategies for World-Class Universities

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Abstract: *To build world-class universities is necessary for social development. To do this big project, the basic connotation and key metrics of the world-class university should be first understood, and then effective strategies to achieve the construction should be determined. Through big data analysis, this paper analyzes the four world-recognized world university rankings and the specific metrics of Shanghai Ranking's Academic Ranking of World Universities, The Times Higher Education World University Rankings, QS World University Rankings and U.S. News World University Rankings. Combined with "Double First Class" Universities construction and discipline evaluation work being carried out in China, this paper draws three key metrics of world-class universities — talent training is the core; scientific research is the key; international influence and academic reputation are the output. Finally, this paper tries to discuss how to build a world-class university around these three key metrics.*

Keywords: *world-class university; key metrics; talent training; scientific research; international influence and academic reputation*

1. Introduction

World-class universities are a broad and complex topic that encompasses various aspects such as education, technology, culture, and society. In the present context of globalization, higher education in different countries is also facing unprecedented challenges and opportunities. As the core and soul of higher education, the construction and development of world-class universities will undoubtedly become an important direction and goal for higher education reform and development in various countries.

2. The Concept of a World-class University

A world-class university refers to a higher education institution that possesses the highest academic standards and the broadest academic influence globally. These universities are at the forefront in terms of teaching, research, talent cultivation, internationalization, and social impact. They have excellent faculty, high-quality teaching and research facilities, outstanding academic achievements, and a global reputation. Additionally, they are able to make significant contributions to their countries and societies^[1].

World-class universities are typically the backbone institutions of their respective countries' higher education systems. They require planning and development guided by national support, such as Russia's "National Research University Project", Germany's "Agreement between the Federation and the Federal States on the Promotion of Excellence in German Higher Education and Research", France's "Excellence in University Plan," Vietnam's "New Model University Project", Australia, Singapore, New Zealand's "Centers of Excellence Funding Program", and China's current "Double First Class" University^[2-3]. This article aims to explore the key indicators for the construction of world-class universities by analyzing several internationally recognized university ranking methodologies and combining them with China's ongoing "Double First Class" University and its discipline evaluation indicators. Moreover, this article will analyze and discuss strategies for the construction of world-class universities.

3. Metrics for World-class Universities

3.1. Analysis of Existing World University Rankings

3.1.1. Shanghai Ranking's Academic Ranking of World Universities (ARWU)

Shanghai Ranking's Academic Ranking of World Universities (ARWU) was first published by the Center for World-Class Universities of Shanghai Jiao Tong University in 2003, and it was the world's first comprehensive global university ranking system. Starting from 2009, it has been published by Shanghai Ranking Consultancy and retains all rights, with an annual release. This ranking is based on four metrics, including education quality, teacher quality, research output and per capita performance. Among them, teacher quality and research output are the most heavily weighted, both at 40%. The quality metrics for education include alumni awards. Teacher quality metrics include teacher awards and highly cited scientists. Research output metrics include N&S papers and international papers. The average performance of teachers is the average score of the above five specific indicators. For liberal arts universities, the weight of the N&S paper metric is proportionally distributed to other metrics.

In the 2022 ARWU, Harvard University, Stanford University, and Massachusetts Institute of Technology ranked in the top three. Of the top 10 universities, eight are in the United States and two are in the United Kingdom. The highest-ranked Asian university is still the University of Tokyo, which ranks 24th. Overall, ARWU focuses on the quality and quantity of academic research, reflecting the academic strength and influence of higher education worldwide.

With its objective and transparent evaluation system, the ARWU has led the wave of international university rankings and is one of the most influential and authoritative university rankings globally. It is widely reported and cited around the world, and many governments and universities analyze and compare their own situations based on this ranking, taking various measures to enhance their international competitiveness.

3.1.2. The Times Higher Education World University Rankings (THE World University Rankings)

The Times Higher Education World University Rankings (THE World University Rankings) is published annually by the Times Higher Education department of the Times newspaper in the UK, starting in 2004. The rankings are based on five indicators, including teaching, research, citation (academic reputation), international outlook and industry income. Among these indicators, teaching, research, and citation (academic reputation) have the highest weights, all at 30%. Teaching metrics include reputation surveys, student-to-faculty ratio, ratio of doctoral degrees awarded to bachelor's degrees awarded, ratio of doctoral degrees awarded to faculty members, and total university revenue. Research metrics include reputation surveys, research income, and research productivity. Citation metrics measure research impact. International outlook metrics include the proportion of international students, the proportion of international staff, and international co-authorship. Industry income metrics mainly refer to knowledge transfer income.

According to the 2023 Times Higher Education World University Rankings, Oxford University, Harvard University, and Cambridge University are ranked the top three universities. Among the top 10 universities worldwide, seven are in the US and three are in the UK, while the highest-ranked university in Asia is China's Tsinghua University, ranked 16th. Overall, the Times Higher Education World University Rankings cover universities worldwide, reflecting the level and trends of global higher education development.

THE World University Rankings is the only global performance ranking of research universities that evaluates research-based universities' performance based on their core missions, including teaching, research, knowledge transfer, and international outlook. The rankings use 13 specific metrics across five broad categories to provide comparisons between universities and are trusted by students, scholars, university leaders, industries, and governments.

3.1.3. QS World University Rankings

QS World University Rankings is published by QS (Quacquarelli Symonds), a UK-based institution, annually since 2004. The rankings are based on six metrics, including academic reputation, employer reputation, student-to-faculty ratio, citation rate of each teacher, proportion of international teachers, and proportion of international students. Among these metrics, academic reputation has the highest weight at 40%.

According to the 2024 QS World University Rankings, Massachusetts Institute of Technology,

Cambridge University, and Oxford University are ranked the top three universities. Among the top 10 universities worldwide, there are four universities from the US, four from the UK, one from Switzerland, and one from Singapore. The highest-ranked university in Asia is National University of Singapore, ranked 8th, and the highest-ranked university in China is Peking University, tied for 17th. Overall, the QS World University Rankings consider various aspects of universities and reflect multiple aspects of global higher education performance.

3.1.4. U.S. News World University Rankings

U.S. News World University Rankings is published by the U.S. News & World Report magazine annually since 1983. The rankings are divided into three categories: reputation indicators, bibliometric indicators, and scientific excellence indicators, consisting of 13 specific metrics. Reputation metrics include global research reputation and regional research reputation. Bibliometric metrics include publications, books, conferences, normalized citation impact, total citations, the number of top 10% most cited publications, the percentage of top 10% most cited publications out of the total publications, international collaboration (relative to the country), and international collaboration. Scientific excellence metrics include the number of highly cited papers in the top 1% in their respective fields and the percentage of top 1% most cited papers out of the total publications. Among these metrics, the two research reputation indicators and the publications indicator have the highest weight, each at 12.5%.

According to the 2022-2023 U.S. News World University Rankings, Harvard University, Massachusetts Institute of Technology, and Stanford University are ranked the top three universities. Among the top 10 universities worldwide, there are eight universities from the US and two from the UK. The highest-ranked university in Asia is Tsinghua University in China, ranked 23rd. Overall, the U.S. News World University Rankings consider various aspects of universities and reflect the overall strength and development trends of global higher education.

3.2. Analysis of Key Metrics for World-class Universities

Through the analysis of the four internationally recognized rankings above, we find that each ranking has its own emphasis and similarities. ARWU ranking focuses on awards and publications. THE ranking considers the proportion of doctoral degree awards and measures the facilities and infrastructure construction of universities through total revenue statistics. It also assesses research income (such as government awards), output, and research income from enterprises, but does not consider employer reputation feedback. U.S. News ranking considers publications, books, and conferences produced by university organizations and outputs, with a focus on citation of research results, but does not consider regional differences in internationalization, employer reputation feedback, and student-faculty ratio. QS ranking has a greater emphasis on academic and employer reputation.

Comparative analysis of the above internationally recognized rankings reveals that the metrics with higher weights include the teacher quality and research output in ARWU, the teaching, research, and citation (academic reputation) in THE, the academic reputation in QS, and the bibliometric and reputation indicators in U.S. News. It can be observed that international institutions place greater emphasis on reputation, teaching, and research in university rankings. In terms of reputation, this includes academic reputation, research reputation, and employer reputation. Reputation is an indicator of the global influence of world-class universities, which is not only reflected in teaching and research, but also in comprehensive talent cultivation. Only by consistently producing excellent talents can a university gain a higher employer reputation. In terms of teaching, this includes the construction of the faculty team, teaching environment, and teaching capacity. The construction of the faculty team particularly emphasizes student-to-faculty ratio and internationalization. Teaching performance is an important manifestation of talent cultivation in world-class universities. The primary mission of universities is talent cultivation, and the primary mission of world-class universities is to cultivate world-class talents, which is mainly achieved through the teaching process. In terms of research, it mainly includes the production of high-level research achievements and citation. In order to achieve top-notch teaching, a world-class university must have top-notch research support. Therefore, high-level research output at the N&S level and the recognition of this achievement by international peers that is citation, become indispensable metrics for world-class universities.

In China, the "Double First Class" University construction focuses on talent cultivation, scientific research, social services, cultural heritage and innovation, faculty and staff construction, and international exchange and cooperation. The Ministry of Education also conducts subject evaluations of Chinese universities, mainly focusing on talent cultivation, faculty and resource construction, scientific research level, and social services and academic reputation.

Based on the analysis of the above ranking metrics, we find that the core of world-class universities lies in talent cultivation. The key metrics for building world-class universities are high-quality talent cultivation, high-level scientific research, and extensive international influence and academic reputation. All other metrics serve these three major areas, such as faculty and staff construction, laboratory construction.

4. Strategies for Building World-class Universities

The strategy for building world-class universities primarily focuses on key indicators for constructing such universities and emphasizes the following three aspects.

Firstly, world-class universities should have the ability to cultivate high-quality talents. Building world-class universities should focus on strengthening talent cultivation by improving disciplinary performance (in fields such as science, engineering, life sciences, medicine, social sciences, and humanities and arts), enhancing teaching quality, and strengthening platform and faculty development.

Secondly, world-class universities should demonstrate excellent scientific research performance. Higher education should not only focus on teaching textbook knowledge, but also bring the forefront of disciplinary development and cutting-edge technology to students. It is necessary to teach students independent thinking and problem-solving abilities, which should be achieved through research. Therefore, world-class universities should also be research hubs with world-class research outputs and achievements in knowledge transfer.

Thirdly, world-class universities should have extensive international influence and academic reputation. A university becoming a world-class institution inevitably requires a high level of international influence and academic reputation. It should have a higher academic reputation compared to ordinary universities, and its graduates should also have a certain reputation in related industries. Additionally, to establish a high level of international influence and academic reputation, the cultural construction of the university is essential. Higher education is not just vocational education. It should also involve imparting knowledge, guiding students, and solving doubts. The construction of university culture will further promote the social impact and reputation of the university. At the same time, while carrying out higher education, universities should also serve the major social needs of countries and regions, in order to truly form their own influence.

5. Conclusion

In conclusion, building a world-class university requires a comprehensive understanding of the key indicators and practical strategies to achieve this goal. The key indicators of building a world-class university are high-quality personnel training, excellent scientific research results, extensive international influence and academic reputation. These indicators are interrelated, and strategies to achieve them must be implemented simultaneously and in a multi-faceted effort. By implementing strategies that target these key indicators, universities can establish themselves as leading institutions for social progress.

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