Current Status and Gaps in China's Construction of World-Class Universities from the Perspective of University Rankings—A Postprint of Comparative Analysis Based on University Groups

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Abstract

[Purpose/Significance] To clarify the gap between "Double First-Class" construction universities in China and truly world-class universities under global standards, and to provide ideas and references for the "Double First-Class" construction. [Method/Process] Based on the evaluation system of university rankings and taking university groups as the research object, this study conducts a comprehensive comparative analysis from three major aspects—talent cultivation, scientific research, and social benefits—comparing 36 "Double First-Class" construction universities in China with five typical world-class university groups, thereby revealing the advantages and disadvantages in the construction process of China's "Double First-Class" initiative. [Results/Conclusion] The analysis results show that the absolute indicator values of the 36 "Double First-Class" construction universities are all higher and significantly higher than the average values of the six university groups, while their relative indicator values are all lower and significantly lower than the average values of the six university groups. In terms of talent cultivation, this is reflected in China's large faculty size but high student-faculty ratio, with high-level talents and faculty allocation needing improvement. In scientific research, it is reflected in high research output but low paper quality, particularly with fewer outstanding achievements. In internationalization, it is reflected in insufficient international influence and degree of internationalization, with the need to further strengthen the internationalization process and international exchanges.

Full Text

Status and Gaps in the Construction of World-Class Universities in China from the Perspective of University Rankings: A Comparative Analysis Based on University Groups

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Abstract: [Purpose/Significance] This study aims to identify the gaps between China's Double First-Class construction universities and truly world-class universities under international standards, providing insights and references for the Double First-Class initiative. [Method/Process] Based on the evaluation systems of world university rankings and taking university groups as the research object, this paper conducts a comprehensive comparative analysis between 36 Double First-Class construction universities in China and five typical world-class university groups from three major dimensions: talent cultivation, scientific research, and social benefits, revealing the strengths and weaknesses in China's Double First-Class construction process. [Results/Conclusion] The analysis shows that while the absolute indicator values of the 36 Double First-Class construction universities are higher—and in many cases substantially higher—than the average of the six university groups, their relative indicator values are lower—and in many cases substantially lower—than the average. In terms of talent cultivation, China has a large faculty size but a high student-faculty ratio, with room for improvement in high-level talent and faculty allocation. In scientific research, China demonstrates high research output but low paper quality, particularly lacking outstanding achievements. In internationalization, China's international influence and degree of internationalization are insufficient, requiring further strengthening of international processes and exchanges.

Keywords: university ranking; evaluation system; university group; world-class university

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On October 24, 2015, the State Council issued the "Overall Plan for Coordinating the Construction of World-Class Universities and First-Class Disciplines," launching the Double First-Class initiative. On September 21, 2017, the Ministry of Education, Ministry of Finance, and National Development and Reform Commission (hereinafter referred to as the "three ministries") jointly released the list of world-class universities and first-class discipline construction institutions, officially commencing the Double First-Class journey. On August 8, 2018,

the three ministries jointly issued the "Guiding Opinions on Accelerating the Construction of Double First-Class in Higher Education Institutions," further accelerating the pace of Double First-Class construction.

To build world-class universities and disciplines, we must clarify the gaps between Chinese institutions and truly world-class universities under international standards. World university rankings currently serve as an effective method for scientifically evaluating universities globally, with their international comparability and influential results making them, to some extent, the de facto international standard for measuring world-class university construction. Therefore, it is necessary to identify the gaps between China's Double First-Class construction universities and world-class universities from the perspective of world university rankings.

Enhancing the development level of China's higher education cannot rely solely on the strength of one or a few universities; rather, it requires building a world-class university group. As representatives of China's first-class universities, where exactly do the 36 Double First-Class construction universities differ from world-class university groups? A comprehensive analysis of the current status of China's world-class university construction and its gaps from top world-class university groups holds important reference significance for China's Double First-Class initiative.

1.1 Research on World University Ranking Systems

Current research on world university ranking systems primarily focuses on discussions of ranking system characteristics and their influence on China's world-class university construction.

First, scholars have examined the ranking systems themselves. As an international standard and reference for world-class university construction, world university ranking systems reflect perceptions of university functions and value orientations for university development. Scholars have explored indicator composition, characteristics, and existing problems. For instance, Guo Congbin et al. analyzed the rationality of THE, QS, and USNEWS ranking systems from dimensions such as indicator diversity, weight allocation, data sources, and disciplinary coverage. Shi Yanping et al. compared ARWU with QS, THE, and USNEWS, using Southeast Asian universities for empirical research. M. Dobrota et al. analyzed ARWU's ranking system from perspectives of uncertainty and sensitivity. M. H. Huang and M. Dobrota examined QS ranking methods, identifying flaws in QS weight settings. S. Vicente analyzed the relationship between ARWU and THE ranking systems from a reputation perspective. Güleda et al. analyzed similarities among five university ranking indicator systems including ARWU and QS. Liu Ruixue et al. used interpretive structural modeling to analyze 29 evaluation indicators across ARWU, QS, THE, and USNEWS, clarifying the internal logical relationships of world-class university evaluation indicators. Yang Tianping and Zhao Guodong studied well-known domestic and

international university ranking indicator systems, summarizing their development characteristics, trends, and future improvements.

Second, research has examined the impact and implications of world university ranking systems for China's world-class university construction. Zhou Guangli believes that evaluation indicator systems of world-renowned academic evaluation institutions reflect the essential characteristics of world-class universities to a certain extent, holding important reference value for China's world-class university construction. Yang Qinghua et al. argue that while world university ranking systems embody international standards for world-class universities, they lack Chinese characteristics, making it urgent to build an evaluation system with Chinese characteristics while considering international standards. Li Penghu explores the relationship between university rankings and world-class university construction, arguing that while world university rankings and their indicator systems have rationality for existence, they must be viewed rationally. Yin Jingjing et al. propose paths for China's world-class university construction by analyzing characteristics of world university ranking systems.

1.2 Comparative Research on University Groups

Currently, limited literature has conducted comparative analyses between Chinese university groups and world-class university groups, though not from the perspective of international ranking standards. For example, Tian Ji et al. explored the overall situation and main characteristics of China's C9 League and world-class research university alliances from the perspective of informetrics, revealing gaps and features between Chinese and foreign university alliances. He Pei et al. conducted comparative analyses between China's C9 universities and research university groups in the UK, US, and Australia based on the ESI database, examining differences in paper scale, influence, and disciplinary structure.

In summary, current domestic and international research on university rankings primarily focuses on exploring ranking systems themselves and their impact on China's world-class university construction. Few studies have examined the current status and gaps in China's world-class university construction from the perspective of world university ranking systems, combining the main tasks of China's Double First-Class initiative and taking university groups as the starting point. Therefore, this paper takes university groups as the analysis object, exploring the gaps between Chinese university groups and world-class university groups based on the evaluation dimensions and perspectives of world university rankings, aiming to provide reference opinions for constructing China's world-class university groups.

2. Research Methods and Content

Based on informetrics methodology and taking university groups as the research object, this study conducts a comprehensive comparative analysis between 36

Double First-Class construction universities in China (DC36) and five typical world-class university groups: Ivy League universities (IVY8, 8 institutions), Russell Group (RG24, 24 institutions), German Excellence Universities (UEI11, 11 institutions), Australian Group of Eight (G08, 8 institutions), and Canadian university alliance (G13, 13 institutions). The study examines the overall profile and main characteristics of world-class research university groups to provide ideas for building China's own world-class university groups, while revealing gaps between Chinese and foreign university groups to identify directions for China's world-class university construction. Specifically, the research content includes: (1) analyzing evaluation indicators of world university ranking systems, their evaluation dimensions, and their relationship with Double First-Class construction; (2) based on the evaluation dimensions of world university ranking systems and the main tasks of Double First-Class construction, conducting comprehensive comparative analyses between China's 36 Double First-Class construction universities and five typical world-class university groups from dimensions including talent cultivation, scientific research, and international cooperation; (3) based on comparative analysis results, combined with the current status and gaps in China's world-class university construction, proposing reasonable recommendations.

3. Association Analysis Between World University Ranking Systems and Double First-Class Construction Tasks

Currently recognized world university ranking systems include the Academic Ranking of World Universities (ARWU), QS World University Rankings, USNEWS Best Global Universities Ranking, and Times Higher Education World University Rankings (THE). The indicator systems of the four major rankings are shown in . These four ranking systems involve seven evaluation dimensions: teaching quality, faculty quality, research output, research impact, internationalization, institutional reputation, and industry income, with a total of 36 subindicators. USNEWS involves the most evaluation indicators (13), followed by THE (12), while QS involves the fewest (only 5).

According to the evaluation dimensions and specific indicators of the four major ranking systems, combined with the description of Double First-Class construction tasks in the "Guiding Opinions on Accelerating the Construction of Double First-Class in Higher Education Institutions" jointly issued by the Ministry of Education, Ministry of Finance, and National Development and Reform Commission in August 2018, this paper attempts to establish the association between world university ranking systems and Double First-Class construction tasks from the perspectives of talent cultivation, scientific research, and international cooperation, as shown in .

It should be noted that for reputation indicators involved in the four major ranking systems, no clear mapping is established in the table because these are not explicitly addressed in Double First-Class construction tasks. Analysis of and reveals several key findings:

First, scientific research evaluation dominates the Double First-Class construction tasks within the four major ranking systems. Among the four ranking systems, 15 sub-indicators involve scientific research evaluation, with indicator weights accounting for 20%-75% of each ranking system. USNEWS shows particularly strong orientation toward scientific research evaluation, reaching 75%. Additionally, ARWU, THE, and QS also adopt research-related evaluation indicators in dimensions such as talent cultivation, such as ARWU's use of Nobel and Fields laureates and highly cited scientists to measure education and faculty quality, and THE and QS's consideration of academic reputation in their reputation evaluations.

Second, talent cultivation evaluation carries relatively low weight in the four major ranking systems. Although talent cultivation is reflected in ARWU, QS, and THE, its average proportion is only 20.69%, mainly concentrated in the ARWU ranking system where it reaches 50%. The four major ranking systems show significant differences in indicator settings for talent cultivation evaluation. ARWU primarily reflects quality evaluation through the number of high-achieving students and faculty, QS mainly reflects process indicators through student-faculty ratios, and THE's indicator settings are relatively comprehensive, covering not only process indicators like student-faculty ratios but also including doctoral degree award ratios that reflect education quality.

Third, deepening international cooperation and exchange in Double First-Class construction tasks is mainly reflected in the four major ranking systems as international collaboration paper volume and proportion, and international faculty/student proportions, accounting for 7.5%-10%. Additionally, social reputation evaluation, which is not explicitly addressed in Double First-Class construction tasks, plays a crucial role in the four major ranking systems, with reputation evaluation averaging 27% across the four systems. Except for ARWU, QS, USNEWS, and THE all involve social reputation evaluation, with QS assigning particularly high weight to reputation evaluation at 60%.

4. Comparative Analysis Between 36 Double First-Class Construction Universities and World-Class University Groups

4.1 Comparative Analysis of Talent Cultivation In the four major ranking systems, evaluation indicators for talent cultivation mainly include highly cited scientists, Nobel and Fields laureates among alumni/faculty, student-faculty ratio, and doctoral degree award ratio. Considering indicator comparability and data availability, this paper primarily analyzes highly cited scientists and student-faculty ratios. The comparative analysis of six university groups is shown in , with descriptive statistical characteristics displayed in [Figure 1: see original paper] and [Figure 2: see original paper].

The student-faculty ratio reflects university education quality, and research indicates that a lower ratio is an important characteristic of world-class universities. As shown in the data, IVY8 and RG24 have relatively low student-faculty ra-

tios, with IVY8 averaging only 4.77. China's DC36 ranks fifth with a ratio of 10.77, indicating room for improvement in faculty resource allocation. [Figure 1: see original paper] shows that G08 has the smallest standard deviation, with member universities showing little variation in student-faculty ratios. IVY8 and RG24 demonstrate relatively uniform distributions, with ratios between 4-8. UEI11 shows the largest standard deviation, with the highest ratio being 4.6 times the lowest. DC36's standard deviation ranks third (3.15), showing relatively balanced distribution but overall high ratios across member institutions, with 24 universities exceeding 10.

Highly cited scientists represent high-level talent to some extent. Based on Clarivate Analytics' 2018 list of global highly cited scientists, DC36 has 234 highly cited scientists, ranking third among the six groups, behind only IVY8 and RG24. However, analyzing this against faculty numbers reveals that DC36's proportion of highly cited scientists is only 0.20%, ranking fifth, indicating that while China has increased the absolute number of high-level talents through substantial human resources, a significant gap remains. [Figure 2: see original paper] shows IVY8 has the largest standard deviation (58.22), primarily due to Harvard's high number (186). UEI11 has the smallest standard deviation (3.08), with member universities averaging only four highly cited scientists each and showing little variation. DC36's standard deviation is moderate (6.26), but most member institutions have low numbers, with only Peking University and Tsinghua University exceeding 20, lacking leading institutions with numerous top research talents compared to other groups.

4.2 Comparative Analysis of Scientific Research In the four major ranking systems, scientific research evaluation indicators include Nature and Science papers, SCI and SSCI papers, Scopus papers, books and conference papers, citations per faculty, normalized citation impact, total citations, Top10% paper volume and proportion, and highly cited paper volume and proportion. Since two ranking systems use Web of Science data and three use five-year paper volumes, with more indicators related to Web of Science data such as highly cited papers, this paper analyzes differences among six university groups based on Web of Science data from 2014-2018, as shown in .

Regarding research output and impact, measured by paper volume, total citations, normalized citation impact, and citations per faculty, [Figure 3: see original paper] illustrates the comparison, with bubble size representing total citations. DC36 shows clear advantages in paper volume and total citations, particularly in paper volume. However, its normalized citation impact is the lowest (1.22), with significant differences from the other five groups, indicating low paper quality. Although DC36 has the highest total citations, its citations per faculty is the lowest (63), only 37.05% of IVY8's, with only five institutions exceeding the six-group average (93). This suggests that while China has greatly increased research output and impact through substantial researcher resources, it reflects the reality of high paper quantity but low quality. In con-

trast, IVY8 and RG24 show both high paper volume and total citations with relatively high normalized citation impact, performing best in research output and impact. G08, UE11, and G13 have lower paper volumes and citations but higher normalized citation impact, demonstrating small output but high quality.

Regarding exceptional research, measured by Top10% paper volume and proportion and highly cited paper volume and proportion, [Figure 4: see original paper] and [Figure 5: see original paper] show the comparison. DC36 ranks highest in both highly cited paper volume and Top10% paper volume, but both proportions are the lowest, with significant differences from the other five groups. This indicates that among China's massive research output, high-quality papers are lacking. IVY8 and RG24 show higher proportions for both indicators, performing better in exceptional research.

4.3 Comparative Analysis of International Cooperation Indicators for international cooperation in the four major ranking systems include international collaboration paper volume and proportion, and international student/faculty ratios. The comparison among six university groups in international paper cooperation is shown in [Figure 6: see original paper], while international student/faculty proportions are presented in and [Figure 7: see original paper].

As shown, DC36 ranks second in international collaboration paper volume but lowest in proportion at only 27.51%. The other five groups all exceed 40%, with RG24 performing best at 61.74%. DC36's international collaboration paper proportions range between 20%-40%, with Renmin University having the highest proportion (40%) and 25 institutions below 30%. IVY8 member universities show proportions between 33%-53%, while the other four groups exceed 47%. Overall, DC36's international cooperation is relatively low, with a significant gap from the six-group average (50.13%), requiring continued strengthening.

shows DC36's proportions of international students and faculty are far lower than the other five groups. G08 has the highest proportions for both, while RG24 also performs well with high proportions.

4.4 Comprehensive Comparative Analysis Based on indicator attributes, the above indicators are divided into absolute and relative indicators for comprehensive comparison of gaps between China's 36 Double First-Class construction universities and the other five university groups, as shown in [Figure 8: see original paper]-[Figure 10: see original paper]. Due to the large number of scientific research indicators and significant differences in data magnitude, this paper adopts proportional scoring, assigning 100 points to the maximum value for each indicator across university groups, with other groups scored according to their proportion of the maximum.

From an absolute indicator perspective, DC36 exceeds the six-group average in all indicators except international student and faculty scale. However, from

a relative indicator perspective, DC36 falls below the six-group average across all indicators. In talent cultivation, this reflects China's large faculty size but unreasonable faculty structure, requiring improvement in high-level talent and faculty allocation. In scientific research, it reflects high research output but low paper quality, particularly lacking high-quality research achievements. In international cooperation, it reflects insufficient international influence and degree of internationalization, requiring further strengthening of international processes and exchanges.

5. Conclusion and Recommendations

Through comprehensive analysis of the four major world university ranking systems and the main tasks of Double First-Class construction, this study compares China's 36 Double First-Class construction universities (DC36) with five typical world-class university groups from three dimensions: talent cultivation, scientific research, and international cooperation, revealing strengths and weaknesses in China's Double First-Class construction process. The main conclusions are: (1) In talent cultivation, DC36 has significantly larger student and faculty scales than the six-group average, but with high student-faculty ratios and low proportions of highly cited scientists, requiring improved faculty resource allocation and strengthened high-level talent cultivation. (2) In scientific research, DC36 shows significantly higher paper volume and total citations than the other five groups, but with low normalized citation impact and citations per faculty, and proportions of high-quality papers such as Top10% and highly cited papers far below the six-group average, presenting a pattern of leading quantity but lagging quality and lacking high-level research. (3) In internationalization, DC36 has low proportions of international students and faculty, and member universities show significant gaps in international collaboration paper proportions compared to other groups, with insufficient international influence and degree of internationalization requiring further strengthening.

Based on these findings, this paper recommends that China's 36 Double First-Class construction universities:

First, address the high student-faculty ratio and shortage of research top talents by strengthening high-level faculty 队伍建设 and emphasizing the cultivation of research top and leading talents. Currently, China's high student-faculty ratio relates to expansion policies that have rapidly increased student scale and strained faculty resources. Recommendations include strengthening talent introduction and internal cultivation to ensure adequate numbers of first-class faculty and strictly controlling student-faculty ratios. High-level research talent is core to producing top research achievements, and vigorously attracting and cultivating research top and leading talents has become a strategic choice for universities to gain competitive advantages and will serve as an important driver for China's world-class university construction.

Second, accelerate reform of the scientific research evaluation system to empha-

size quality contribution and excellence orientation in scientific research, given the significant gaps in exceptional research and paper quality. Chinese universities lag comprehensively in normalized citation impact, citations per paper, and proportions of Top10% and Top1% papers, related to China's current research evaluation system that "emphasizes quantity over quality" and "emphasizes assessment over scholarship." As an administratively dominated academic evaluation practice, research evaluation should respect academic laws, actively foster an atmosphere of "scholarship for science's sake," and construct an evaluation system that "highlights quality contribution," transforming "target-based" and "quantity-based" evaluation into "sustainable" and "excellence-oriented" evaluation.

Third, strengthen international exchanges and cooperation among faculty and students to enhance their international dialogue capabilities, given the low degree of internationalization. Internationalization is a fundamental characteristic of world-class universities and plays an important role in their creation. Chinese universities should further enhance open education, encourage faculty and students to actively participate in major international research projects, and strive to become leaders rather than simple participants in research outcomes, thereby improving Chinese universities' international dialogue capabilities and discourse power.

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Note: Figure translations are in progress. See original paper for figures.