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Exploring the Reform and Safeguard Mechanisms for Performance-Oriented Ph.D. Admission Assessment Systems: A Case Study of University J

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Abstract

In recent years, China has continuously supported and encouraged doctoral institutions to pilot reforms that focus on an application-based and assessment-driven admission system for doctoral programs. This study explores the doctoral admission reform at J University, with the research objective of addressing challenges such as unscientific allocation of admission quotas, imperfect admission methods, and inadequate safeguard mechanisms. Using the Analytic Hierarchy Process (AHP), we establish a performance-driven, five-dimensional indicator system for quota allocation, encompassing authorized scale, scientific research, faculty strength, research platforms, and training quality and efficiency. Additionally, we propose a "three-phase, four-method" admission strategy to improve the admission process. From the perspective of quality management and control, we develop safeguard mechanisms that include optimizing resource allocation, monitoring training processes, and providing feedback on training quality, aiming to ensure sustainable and effective doctoral education reform.

Keywords

PhD Admissions, Performance-Driven, Admission Reform

1. Introduction

In 2013, the Ministry of Education, the National Development and Reform Commission, and the Ministry of Finance jointly issued the "Opinions on Deepening Graduate Education Reform" (Ministry of Education, 2013), proposing

an "application-assessment" system for PhD selection. This system is one of the key development tasks outlined in the "13th Five-Year Plan" for graduate education (Ministry of Education, 2017). Further, in 2020, the Ministry of Education's "Opinions on Accelerating the Reform and Development of Graduate Education in the New Era" reaffirmed the importance of deepening admission plan management reform, improving supply-demand adjustment mechanisms, and refining the doctoral "application-assessment" selection process (Ministry of Education, 2020). In 2024, the central government issued the "Opinions on Accelerating the High-Quality Development of PhD Education", emphasizing the need to reform admission management models, improve evaluation systems, and enhance the training capacity for top-tier innovative talents (General Office of the Central Committee of the Communist Party of China, 2024).

The academic community has explored the doctoral "application-assessment" system, mainly in two areas: one compares the "application-assessment" system with the previous "national exam" model and proposes design improvements for the system. For example, Zhao Wenhe et al. (2018) compared the two systems, suggesting the need for scientifically fair admission criteria, effective examination methods, and a comprehensive admission publicity system. The second area of research focuses on optimizing the "application-assessment" system. Chen Qian (2019) advocates for planning the system's development based on fairness, science, and effectiveness. He Lei et al. (2022) identified areas for improvement such as academic ranking methods and practical ability assessments for prospective graduate students. Zheng Zhao (2020) proposed the establishment of quality assurance mechanisms and supervisory systems to regulate the "application-assessment" system. Despite the literature discussing the principles and optimization of the doctoral admission system, most conclusions are theoretical and lack practical, actionable recommendations.

Doctoral admission reform has received widespread attention from universities. Since 2014, the Ministry of Education has supported and encouraged universities to implement reforms in doctoral admissions. Starting in 2015, over 70 institutions, including Peking University, Tsinghua University, and Fudan University, have piloted the "application-assessment" admission system for doctoral programs. For instance, Tianjin University introduced three shifts in its doctoral admission process under the application-assessment system: from centralized management by the graduate school to decentralized management by faculties and supervisors; from a single closed-book written exam to a combination of on-the-spot topic presentations, academic reports, and comprehensive interviews; and from a simple comparison of test scores to a holistic evaluation of candidates' research innovation abilities and academic potential (Yao et al., 2019). At Xiamen University, doctoral applicants are required to deliver academic presentations, after which supervisors select the best candidates (Doctoral Admission by Application at Xiamen University in 2014, 2013). Zhongnan University of Economics and Law has adopted strict measures, such as requiring applicants to demonstrate

"research potential" and to study full-time with complete file transfers, to ensure that the application-assessment system is both practical and free of deviations (Our University Pilots the "Application-Assessment" Doctoral Admission System, 2013).

This paper, based on the author's practical experience in recruiting and training PhD students, integrates the Ministry of Education's requirements for graduate education reform and applies performance management theory (Zhang, 2007) to explain the PhD admission plan allocation, reform measures, and safeguarding mechanisms at J University. It aims to provide specific, practical cases to guide doctoral admission reforms in China.

2. PhD Admissions Reform Strategy

In response to the new demands and tasks of postgraduate education, J University has been actively engaged in doctoral admissions reform since 2013. Starting in 2018, the university fully implemented the application-assessment admission system. Over the years, the university has continuously refined its admission mechanisms, achieving notable progress in enhancing the quality of doctoral student selection.

J University's doctoral admissions reform follows a performance-driven approach. Based on the guidelines provided by the Ministry of Education, the university aims to break down institutional and systemic barriers that hinder the selection of outstanding PhD candidates. The reform strategy is designed to optimize the allocation of doctoral admissions resources, shifting focus from a simple emphasis on input to a more balanced approach that also considers academic output, research quality, and overall training effectiveness.

The core idea behind the reform is to implement a quota allocation mechanism for doctoral admissions. The new system places greater emphasis on output such as academic achievements, research funding, and quality of training rather than on input alone (e.g., the sheer number of admissions). A dynamic mentoring system ensures that the ability and training conditions of PhD advisors are key criteria in determining eligibility for admissions, fostering a system where academic quality is the primary focus.

3. PhD Admissions Reform Measures

3.1. Performance-Driven Allocation of Admission Quotas

The doctoral admissions plan represents a vital resource for the university. Its allocation should align with the institution's strategic priorities, focusing on disciplines that reinforce the university's strengths, including those contributing to national strategic needs, fundamental research, and emerging interdisciplinary fields. Following a performance-oriented approach, the admissions plan emphasizes outcomes and results to support high-quality graduate training and the university's overarching goals, such as advancing "Double First-Class" initiatives and establishing itself as a distinctive, high-level institution. The allocation model

comprises two parts: the "basic plan", distributed to departments during the annual directory revision, accounting for approximately 80% of the previous year's total quotas (Table 1), and the "reserved and incremental plans", representing about 20% of the total (Table 2), which are distributed to secondary units before final admissions processes begin.

Basic Admission Plan Calculation

Since 2013, the formulation of the basic enrollment plan at the university has undergone iterative refinements, aligning with its strategic development goals. These updates have focused on enhancing the evaluation of research funding and effectiveness. Revisions in 2019, 2021, and 2024 aimed to strengthen assessments of graduate education quality and efficiency, ensuring alignment with the institution's discipline development needs. Grounded in extensive practical experience and guided by the Ministry of Education's *Calculation Method for the Benchmark Scale of Doctoral Students in Higher Education Institutions* (Development Planning Division of the Ministry of Education, 2012), the university's plan now integrates multiple performance factors:

1) **Authorized Degree Program Scale (A)**: Primarily reflects academic disciplines and degree categories.

2) **Scientific Research Output (B)**: Includes research projects and recognized achievements.

3) **Faculty Team Quality (C)**: Evaluates the caliber of talents and mentoring teams.

4) **Research Infrastructure (D)**: Considers research centers, key laboratories, major disciplines, provincial stations, and collaborative training bases.

5) **Training Quality and Effectiveness (E)**: Focuses on metrics such as academic publications, innovation competitions, and dissertation quality.

The weights of these factors were calculated using the Analytic Hierarchy Process (AHP), a methodology developed by Professor A. L. Saaty at the University of Pittsburgh in the 1970s (Xu, 1988). AHP combines qualitative and quantitative approaches to analyze decision-making factors systematically. Following standard AHP modeling procedures, the corresponding analytical model was developed, and MATLAB software was used to calculate the weights. Subsequently, university-wide surveys involving heads of secondary units and discipline leaders were conducted to finalize these weightings. After normalizing and refining the data for clarity and ease of application, the finalized weightings were set as follows:

- $A = 0.1$
- $B = 0.25$
- $C = 0.2$
- $D = 0.2$
- $E = 0.25$

The enrollment calculation formula is:

$$Q_n = Q \times \left(0.1 \times A_n + 0.25 \times B_n + 0.2 \times C_n + 0.2 \times D_n + 0.25 \times E_n\right) + M$$

Here, M represents an adjustment factor. If the proportion of high-quality students from the previous year is significant or the performance contribution is exceptional, M is positive, increasing the enrollment quota. Conversely, if dissertation blind reviews fall below a threshold or if randomly sampled papers are found substandard, M is negative, decreasing the quota.

The annual calculation of doctoral enrollment quotas is based on the previous year's enrollment scale for each college, following the enrollment indicator system described above. The calculation utilizes data from the past three years, which is updated annually with the latest data. To address discipline-specific needs:

$$\textit{Allocation for Each Unit} = \textit{Performance Ratio} \times 2024\ \textit{Total Enrollment} \times 0.8$$

The performance ratio calculations for 2024 at J University are shown in Table 1.

Special Quota Allocation

To leverage enrollment plans as a resource distribution tool, the university actively aligns them with strategic objectives, advancing innovation in enrollment management reforms. The institution reserves portions of the Ministry of Education-assigned quotas and incremental plans for special allocations to reward high-performing departments or advisors. Annually, approximately 20% of the doctoral enrollment plan is designated as a special allocation to support initiatives such as large-scale platforms, landmark achievements, major projects, and distinguished talents. These allocations are distributed as follows:

$$\textit{Special Allocation for Each Unit} = \textit{Special Allocation Ratio} \times 2024\ \textit{Total Enrollment} \times 0.2$$

Applications for these allocations are submitted by colleges or advisors, reviewed by the university, and then allocated to specific units or doctoral advisors. For example, data from 2024 illustrate the distribution of performance ratios and special plans across various colleges and departments, emphasizing fairness and alignment with institutional priorities (Table 2).

These mechanisms ensure that resource allocation not only incentivizes excellence but also promotes alignment with the university's overarching goals of high-quality academic and research output.

Table 1. Performance ratio calculation for J university in 2024.

Academic Unit	Authorized Degree Program Scale (0.1)	Scientific Research (0.25)	Faculty Team (0.2)	Research Infrastructure (0.2)	Training Quality & Effectiveness (0.25)	Performance Ratio (%)
School of Mechanical Engineering	11.49%	9.80%	7.77%	11.83%	6.67%	9.19%
School of Agricultural Engineering	6.66%	11.76%	6.96%	9.03%	6.85%	8.52%
School of Materials Science & Engineering	6.10%	5.49%	11.18%	8.64%	6.64%	7.61%

Continued

School of Automotive and Traffic Engineering	5.11%	5.69%	4.25%	7.83%	6.00%	5.85%
School of Energy and Power Engineering	4.16%	4.30%	3.75%	5.07%	6.05%	4.77%
Research Center for Fluid Machinery Engineering	4.16%	9.27%	9.28%	11.15%	6.82%	8.52%
School of Electrical and Information Engineering	11.21%	8.88%	6.36%	7.56%	7.52%	8.00%
School of Environmental and Safety Engineering	4.44%	4.57%	4.92%	4.17%	4.28%	4.48%
School of Food and Biological Engineering	6.10%	10.41%	10.22%	7.29%	7.00%	8.47%
School of Management	5.55%	3.55%	4.53%	2.54%	5.47%	4.22%
School of Finance	0.00%	2.46%	1.87%	1.78%	4.69%	2.52%
School of Computer Science and Communication Engineering	6.66%	2.68%	2.77%	5.37%	4.66%	4.13%
School of Mathematical Sciences	6.66%	2.45%	3.01%	2.20%	4.17%	3.36%
School of Civil Engineering and Mechanics	4.16%	1.68%	2.77%	2.03%	3.29%	2.62%
School of Chemistry and Chemical Engineering	6.66%	5.32%	6.63%	5.39%	9.37%	6.74%
School of Medicine	5.55%	3.49%	7.78%	2.72%	4.95%	4.77%
Energy Research Institute	1.00%	3.12%	2.73%	1.99%	2.03%	2.33%
Automotive Research Institute	4.33%	5.05%	3.21%	3.40%	3.56%	3.91%

Table 2. Special plan allocation for J university in 2024.

Academic Unit	Major Platforms	Major Achievements	Major Projects	Distinguished Talent	Special Allocation Ratio (%)
School of Mechanical Engineering	0.00%	9.09%	14.29%	12.50%	8.89%
School of Automotive and Traffic Engineering	0.00%	9.09%	14.29%	0.00%	4.44%
School of Energy and Power Engineering	9.09%	9.09%	28.57%	0.00%	8.89%
Research Center for Fluid Machinery Engineering	9.09%	18.18%	0.00%	12.50%	11.11%
School of Electrical and Information Engineering	9.09%	9.09%	0.00%	25.00%	13.33%

Continued

School of Environmental and Safety Engineering	9.09%	0.00%	0.00%	6.25%	4.44%
School of Food and Biological Engineering	9.09%	9.09%	28.57%	6.25%	11.11%
School of Management	9.09%	0.00%	0.00%	0.00%	2.22%
School of Mathematical Sciences	0.00%	18.18%	14.29%	0.00%	6.67%
School of Civil Engineering and Mechanics	9.09%	0.00%	0.00%	6.25%	4.44%
School of Chemistry and Chemical Engineering	0.00%	0.00%	0.00%	18.75%	6.67%
School of Medicine	18.18%	18.18%	0.00%	6.25%	11.11%
Energy Research Institute	9.09%	0.00%	0.00%	0.00%	2.22%
Automotive Research Institute	9.09%	0.00%	0.00%	6.25%	4.44%

3.2. Multi-Phase and Multi-Method Admission Reform

The goal of the doctoral admission examination reform is to establish an admission system that reflects the characteristics and needs of doctoral education. J University has implemented a "three-phase, four-method" admission system, which includes the following phases:

Phase 1: Direct admission for undergraduate students and master's-to-PhD programs.

Phase 2: Standard admissions for domestic applicants and exceptional independent mentor-based admissions.

Phase 3: Special admissions for key candidates identified for major research projects or interdisciplinary areas.

The doctoral admissions system also includes the option for exceptional mentors (e.g., national-level talents, leading professors, etc.) to independently select one top-tier student for direct doctoral admission each year.

4. Safeguard Mechanisms in PhD Admissions

To ensure the effective implementation of the application-assessment system, J University has developed a set of safeguard mechanisms focused on three key areas: resource allocation optimization, monitoring training processes, and providing feedback on training quality. These mechanisms, illustrated in **Figure 1**, are rooted in a three-stage quality management control strategy (Juran, 1987).

Resource Optimization Mechanism

The goal is to optimize the quality and structure of doctoral candidates. Key measures include prioritizing direct PhD and master's-to-PhD candidates, limiting the number of part-time PhD students, and further promoting the master's-to-PhD pathway as the main admission route.

Figure 1. Doctoral student admission guarantee mechanism.

Training Process Control Mechanism

Given the "wide entry, strict exit" nature of the application-assessment system, there is a strong focus on quality control throughout the training process. The university enforces strict academic and training standards, including regular evaluations and setting academic research milestones. A robust mentoring system ensures that PhD advisors maintain high-quality supervision.

Training Quality Feedback Mechanism

A feedback loop is created to connect the training quality with the admissions process. This includes monitoring academic achievements, publication records, and compliance with national education standards. The feedback mechanism aims to continually improve the quality of PhD education and address any shortcomings through a dynamic resource allocation system.

Over more than a decade of doctoral enrollment system reform, J University has achieved significant progress. The quality of admitted students has improved, and the integrated master-to-doctoral pathway has become the primary mode of doctoral enrollment. The proportion of students enrolled through this pathway has increased from less than 50% to 85%. The number of high-quality papers published annually has risen from an average of 1990 to 2939, while the number of provincial excellent doctoral dissertations has increased from an annual average of 3 to 7. Similarly, the number of university-level excellent doctoral dissertations has grown from an annual average of 40 to 70. Doctoral students have become an important and dynamic force in the university's scientific research endeavors. A report titled "*Exploration of Performance-Oriented Doctoral Enrollment Reforms and Guarantee Mechanisms at J University*" was presented at the 9th National Symposium on Graduate Education in Engineering. The reform measures, particularly in the areas of enrollment quota calculation and allocation, as well as enrollment method innovation, have garnered significant attention and adoption by other universities.

5. Conclusion

The performance-driven application-assessment system represents a significant shift in doctoral admissions, emphasizing quality over quantity. It aligns with the broader goals of nurturing top-tier talent and ensuring that doctoral education

meets high standards. The implementation of such a system requires continuous improvement, particularly in developing safeguard mechanisms to optimize resource allocation, control the training process, and ensure high-quality outcomes. As J University's experience demonstrates, the performance-driven application-assessment system is a necessary reform that addresses the evolving needs of higher education.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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