

What Drives the Transformation? Unpacking China's Reforms in Doctoral Education

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Abstract This study explores the development and reform of doctoral education in China, analyzing the trends in enrollment scale, the number of students in school, and degree conferrals, as well as the diversification of doctoral education structures. These trends reflect China's growing demand for high-level research talent and strategic emphasis on promoting technological innovation. During this period, doctoral education not only achieved breakthroughs in scale but also showed new trends in discipline distribution and the expansion of professional doctoral degree categories. To ensure the quality of doctoral education, China has implemented various reforms measures, including the introduction of the "application-assessment" admission model, innovations in the supervisor appointment system, and the improvement of the quality assurance system through the collaboration of multiple stakeholders. At the same time, challenges remain, such as insufficient supervisor accountability, underdeveloped curricula, inadequate collaborative education mechanisms, and the need to enhance doctoral students' research innovation capabilities. In the future, efforts should focus on promoting regional balance, optimizing the curriculum system, and advancing the integration of industry, academia, and research to better meet the demand for high-quality innovative talent.

Keywords doctoral education, admissions reform, supervisor system, quality assurance

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Doctoral education plays a critical role in cultivating high-level talent and advancing knowledge, serving as a cornerstone for national development and global competitiveness. The rapid expansion of doctoral education in China has significantly contributed to its national research and innovation capacity. The large-scale increase in high-

er education — particularly at the doctoral level—has been a major driver of growth and innovation. Quantitative estimates suggest that China's college expansion policy accounts for up to 72% of the increase in manufacturing R&D intensity between 2003 and 2018 [Ma, 2024] reflecting the essential role of advanced-degree holders in enhancing research output and technological advancement. This surge in innovation was especially prominent in exporting firms and high-skill industries, which highlights that doctoral-level human capital serves as a cornerstone of China's innovation-driven development strategy.

In recent years, China's higher education system has transitioned from a stage of massification to one of universalization. In 2023, the gross enrollment rate in higher education increased from 40.0% in 2015 to 60.2%¹. This shift not only signifies the establishment of the world's largest higher education system but also provides a robust foundation for cultivating a diverse range of talents. This trend aligns with the global patterns observed in other countries, where the expansion of doctoral education has been strategically employed to enhance innovation and economic growth. For instance, in developed economies, the proportion of individuals attaining doctoral degrees has seen a significant rise, with an average of 1% among 25–64-year-olds in OECD countries holding such qualifications as of 2019. Projections suggest that if current trends persist, approximately 2.3% of today's young adults will pursue doctoral studies during their lifetime. This growth is driven by the increasing demand for advanced skills and knowledge in the global knowledge economy, emphasizing the pivotal role of doctoral education in fostering research and innovation capabilities [Sarrico, 2022].

The trend towards a global innovation-driven economy has intensified the demand for skills, knowledge, and higher education credentials. Graduate education, particularly doctoral programs, bears the mission of nurturing high-level talent in China. Positioned at the pinnacle of the national education system, doctoral education is closely linked to China's national innovation system, serving as the primary source of top-tier innovative talent and a reservoir for scientific research potential. It plays a vital role in enhancing comprehensive national strength and international competitiveness. High-quality doctoral education is intricately connected to China's robust national innovation system, acting as a nexus between technological productivity and innovative driving forces.

Within this context, the importance of doctoral education has become increasingly prominent. The Guiding Opinions on Accelerating the Construction of "Double First-Class" Universities issued by the Ministry of Education emphasizes the need to appropriately expand

¹ Transcript of the 2024 press conference of the Ministry of Education. Ministry of Education of the People's Republic of China: http://www.moe.gov.cn/fbh/live/2024/55831/mtbd/202403/t20240301_1117707.html (accessed 04.10.2025).

the scale of doctoral programs, highlighting their critical role in building world-class universities and disciplines. Furthermore, the Opinions on Accelerating the Reform and Development of Graduate Education in the New Era, released by the Ministry of Education, the National Development and Reform Commission, and the Ministry of Finance, explicitly state the need for proactive planning of doctoral admissions to meet the growing demand for high-level innovative talent in the country. These policies reflect the government's high regard for doctoral education and aim to drive technological advancement and economic transformation.

However, the rapid expansion of doctoral education poses challenges in maintaining high educational standards. As enrollment scales increase, China must ensure that the quality of doctoral education is not compromised. To address these challenges, the government has implemented a series of comprehensive reforms aimed at ensuring high-quality doctoral education. Moreover, in light of the national demand for high-level talent, doctoral education must not only reach a certain scale but also guarantee the quality of training. As such, it is crucial for China's doctoral programs to align with the growing expectations of the innovation-oriented economy while ensuring that graduates are equipped with the skills and knowledge necessary to contribute effectively to scientific research and national development.

This article explores the changes that occurred in China's doctoral education system from 2012 to 2022, focusing on significant growth in scale and diversification in structure. It also examines the key reforms introduced during this period, which have sought to uphold the quality of doctoral education despite the system's rapid expansion.

1. Institutional foundation of doctoral education in China

The Academic Degrees Law of the People's Republic of China was enacted on April 26, 2024, and came into effect on January 1, 2025, replacing the previous Degree Regulations, established in 1980². This law provides a comprehensive legal framework governing the national degree system, including the organization of degree awarding bodies, qualification criteria, degree conferral procedures, and quality assurance mechanisms. It emphasizes the principles of fairness, transparency, and academic integrity, aiming to strengthen the governance and standardization of degree education. By establishing clear rules and responsibilities, the law lays a solid institutional foundation for the development and quality management of doctoral education in China.

² The Central People's Government of the People's Republic of China. Academic Degrees Law of the People's Republic of China / Xinhua News Agency. 2024, April 26: https://www.gov.cn/yaowen/liebiao/202204/content_6947841.htm (accessed 04.10.2025)

1.1. Degree granting institutions and governance

China's academic degree governance is structured across three key levels to ensure comprehensive oversight and quality assurance. At the national level, the State Council establishes the Academic Degrees Committee, which leads degree work nationwide and operates through an administrative office responsible for daily management of degree and postgraduate education affairs³. This committee also establishes specialized expert groups tasked with conducting degree evaluation, quality supervision, and research consultation.

Beneath the national level, provincial and equivalent regional governments set up their own academic degree committees. These regional bodies operate under the guidance of the central committee and coordinate degree management within their jurisdictions, allowing for localized oversight while maintaining alignment with the national standards.

At the institutional level, degree-conferring entities form Degree Evaluation Committees charged with implementing degree awarding policies, reviewing the addition or cancellation of degree programs, deciding on degree conferrals or revocations, and handling disputes and complaints. This structure balances centralized policy direction with decentralized execution, fostering both uniformity in academic standards and responsiveness to institutional contexts.

1.2. Degree types and conferral procedures

The conferral of a doctoral degree must follow a rigorous review and defense process. Candidates must first undergo expert evaluation of their dissertation or practical achievement before being allowed to proceed to the oral defense stage. A doctoral defense committee must be formed, consisting of no fewer than five members, including at least two experts from outside the degree-granting institution. The defense must be conducted publicly (except when involving classified information) and decisions are made through a vote; a two-thirds majority is required for successful defense.

If the candidate fails the defense, they may, with committee approval, revise and reapply within a stipulated timeframe. Additionally, if the committee concludes that the candidate has not reached the doctoral level but has met the requirements for a master's degree — and has not yet received one in the same field — the committee may recommend awarding a master's degree.

The law classifies doctoral degrees into two categories: academic doctoral degrees and professional doctoral degrees. Academic degrees emphasize theoretical innovation and research capacity, while professional degrees focus on practical competence and the generation of applied outcomes. Regardless of the type, all doctoral candidates must do the required coursework, complete systematic re-

³ Office of the State Council Academic Degrees Committee: http://en.moe.gov.cn/about_MOE/departments/201812/t20181219_364000.html (accessed 04.10.2025).

search or practical training, and successfully defend a dissertation or professional achievement to demonstrate profound theoretical knowledge and remarkable professional skills.

1.3. Degree conferral quality assurance

The law mandates that institutions authorized to confer doctoral degrees must establish a comprehensive degree quality assurance system. This system covers all stages of doctoral education, including student recruitment, training, and degree conferral, with an emphasis on transparent information disclosure and acceptance of societal supervision to guarantee the quality of degrees awarded.

A key component in quality assurance is the supervision of doctoral students. Institutions must assign supervisors who demonstrate good moral character and possess advanced academic or professional qualifications. These supervisors, who may be faculty members, researchers, or professionals with strong academic or practical capabilities, are selected through a rigorous mechanism involving evaluation, monitoring, and dynamic adjustment to ensure optimal guidance quality. Supervision may be provided by a single supervisor or through joint/team supervision as various models exist to accommodate different disciplines and student needs [Shen, Gao, Zhao, 2018].

Doctoral supervisors are expected to fulfill their responsibilities diligently, providing close oversight throughout critical stages of training. This includes strict quality control at key milestones and ongoing mentorship aimed at enhancing students' academic and professional development.

In addition to institutional measures, government bodies play an important role in quality supervision. The Ministry of Education and provincial academic degree committees are tasked with regularly organizing expert evaluations of degree-conferring institutions and programs within their respective jurisdictions. These evaluations assess compliance with the national standards and drive continuous improvements in the quality of doctoral education.

Notably, Article 19 of the Higher Education Law⁴ allows qualified bachelor's degree holders to be directly admitted to doctoral programs, providing a legal basis for "direct-track" doctoral training in leading Chinese universities.

2. Overview of the development of doctoral education in China

China's expansion of doctoral education is driven by the nation's ambition to bolster its global competitiveness through innovation and technological advancement. This strategic initiative addresses critical societal needs, including the development of a highly skilled workforce capable of driving economic growth and addressing complex

⁴ Higher Education Law of the People's Republic of China: http://www.npc.gov.cn/zgrdw/npc/xinwen/2019-01/07/content_2070258.htm (accessed 04.10.2025)

challenges. In January 2025, China unveiled a comprehensive plan to build a “strong education nation” by 2035, emphasizing the expansion of graduate education and increasing the proportion of doctoral students to cultivate top-tier talent in the strategic areas⁵. Institutional efforts, such as the “Double First-Class” initiative, launched in 2015, aim to develop world-class universities and disciplines by providing targeted funding and resources to selected institutions. These policies reflect China's commitment to enhancing its educational infrastructure to meet the evolving societal demands.

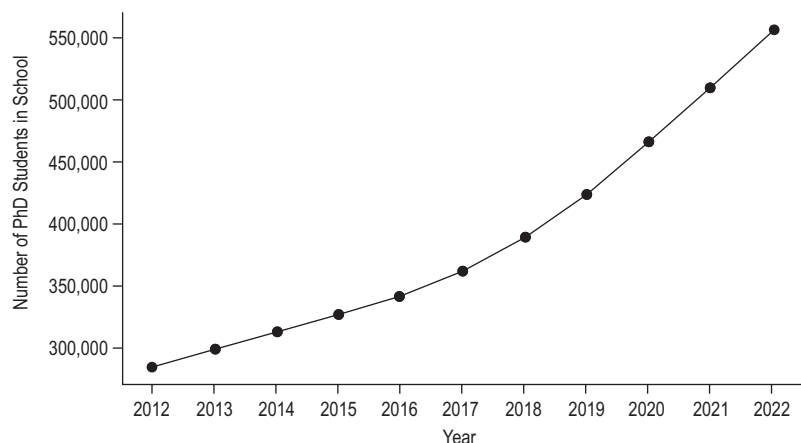
The data in the following sections are based on the findings from the Annual Report on the Development of Degree and Graduate Education in China 2021–2022 [Degree and Graduate Education Research Group, 2024].

2.1. Development of doctoral education scale (2012–2022)⁴

2.1.1. Admission and total number of doctoral students

Between 2012 and 2022, the scale of doctoral admissions in China saw significant growth. In 2012, 68,781 doctoral students were admitted, and by 2022, this number had reached 138,951, representing a 2.02-fold increase, or an additional 70,170 students (Fig. 1). In comparison, master's student admissions grew from 645,715 in 2012 to 1,103,528 in 2022, an increase of 457,813 students, or 1.71 times. Although the scale of master's student admissions remained larger, the growth rate for doctoral admissions surpassed that of master's students, demonstrating the rapid development of doctoral education in China. The total number of doctoral students in 2012 was 283,615,

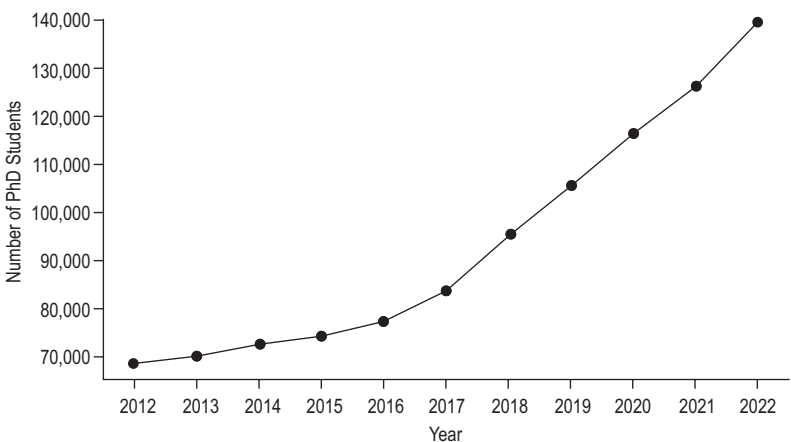
Fig. 1. PhD student admissions in China (2012–2022)



⁵ China unveils 2024–2035 plan to build ‘strong education nation’ / Reuters. 2025, January 19: <https://www.reuters.com/world/asia-pacific/china-unveils-2024-2035-plan-build-strong-education-nation-2025-01-19/> (accessed 04.10.2025).

⁶ The data in Figure 1 — Figure 5 include the numbers of professional doctorates.

Fig. 2. **Total number of doctoral students (2012–2022)**

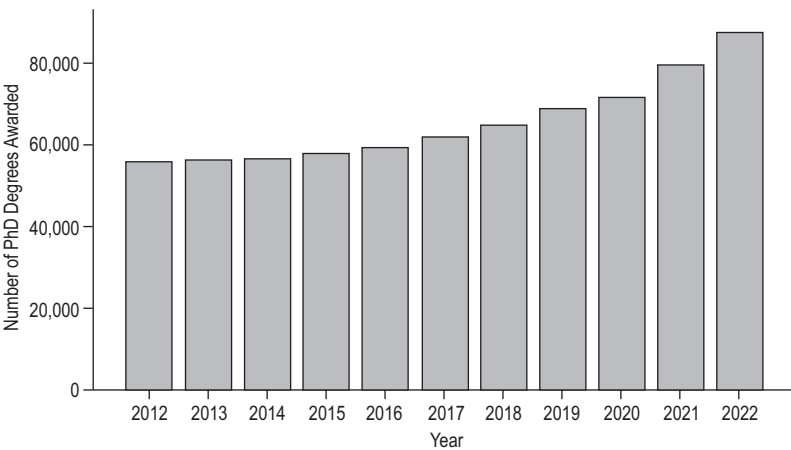


which grew to 556,065 by 2022, an increase of 272,450 students, or a 1.96-fold increase (Fig. 2). This expansion highlights the growing demand for doctoral education in China, driven by both societal needs for advanced research expertise and institutional efforts to meet these needs.

2.1.2. Doctoral degree conferral

In terms of doctoral degree conferrals, the number of degrees awarded also grew significantly during this period. In 2012, 56,338 doctoral degrees were conferred, and by 2022, the number had increased to 88,036, representing an increase of 31,698 degrees or 1.56 times (Fig. 3). This growth demonstrates the successful output of China’s doctoral education system, where a greater number of students are completing their studies and contributing to China’s research and innovation landscape. Over the past decade, China’s postgraduate edu-

Fig. 3. **PhD degrees awarded in China (2012–2022)**

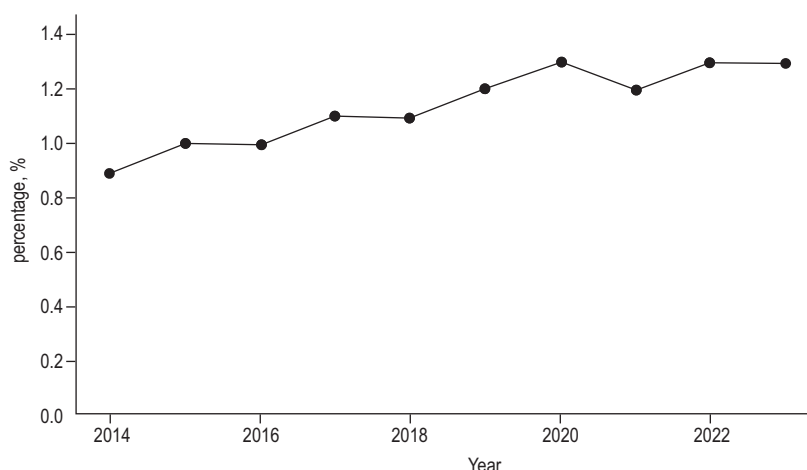


cation system has continuously expanded its training capacity, effectively supplying high-level talent to meet national strategic needs and driving scientific and technological advancement [Hong, 2023].

2.1.3. International comparison

As shown in Fig. 4, the proportion of 25 to 64-year old doctoral or equivalent degree holders in OECD countries increased steadily from 0.9% in 2014 to 1.3% in 2023, indicating gradual progress in the international expansion of advanced educational attainment. This upward trend reflects the continued global emphasis on research capacity and cultivation of high-level talent. In parallel, China has witnessed a rapid expansion in doctoral education. Between 2012 and 2022, doctoral admissions in China rose from 68,781 to 138,951, while the number of doctoral graduates increased from 56,338 to 88,036. These figures demonstrate China's growing commitment to strengthening its graduate education system. The pace and scale of this development suggest that China is aligning closely with international trends in fostering a highly educated, research-oriented workforce.

Fig. 4. OECD population (aged 25–64) with doctoral or equivalent degree (2014–2023)

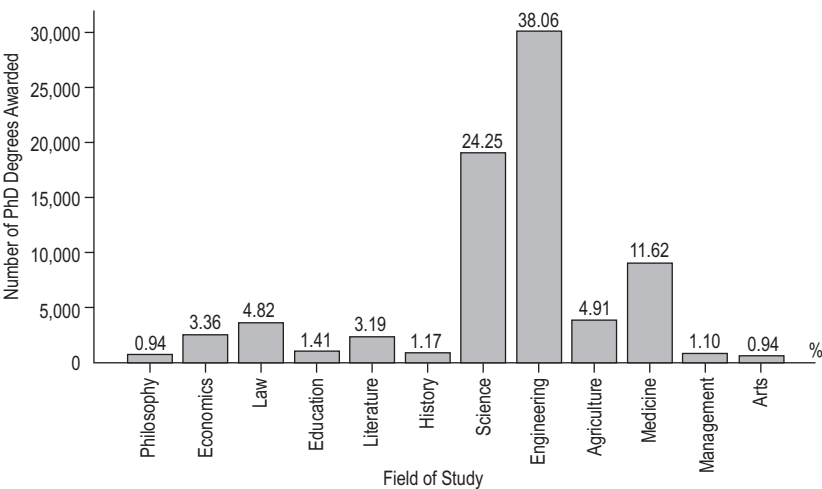


2.1.4. The distribution of doctoral education resources

2.1.4.1. Discipline distribution

In China, engineering has consistently been the largest category for doctoral degree conferrals. In 2012, engineering doctoral degrees accounted for the highest proportion of all doctoral academic degrees, representing 36.55% of the total. Together, the four primary disciplines — engineering, natural sciences, medicine, and agricultural sciences — comprised 72.15% of all doctoral degrees awarded in that year (Fig. 5). This concentration of doctoral degrees in these disciplines reflects the significant emphasis on technical, scientific, and applied fields, which are crucial to China's technological advancement and industrial development.

Fig. 5. **PhD degrees discipline distribution in China (2022)**



A decade later, in 2022, this trend remained largely unchanged. Engineering continued to dominate the doctoral education landscape; its share kept rising and reached 38.06%. The combined proportion of doctoral degrees awarded in engineering, natural sciences, medicine, and agricultural sciences increased to 78.84%. This stability in the distribution of doctoral degrees across these key disciplines further underscores China’s focus on cultivating expertise in research fields that drive innovation and support the country’s development goals. The persistence of this trend highlights the central role that STEM (Science, Technology, Engineering, and Mathematics) fields play in shaping the future of China’s education and research landscape.

2.1.4.2. Regional
disparities in
doctoral education
resources

Beijing has long been the dominant hub for doctoral education in China, serving as the central point for the country’s advanced academic and research output. In 2012, Beijing awarded the largest number of doctoral degrees among all provinces and municipalities, with a share of 30.41% of the total doctoral degrees conferred nationwide. The top five regions for doctoral degree conferrals in that year were Beijing, Shanghai, Hubei, Jiangsu, and Guangdong. Notably, while Beijing held the largest share, other provinces and municipalities each accounted for less than 9% of the total doctoral degrees awarded, underscoring the concentration of doctoral education resources in these major cities.

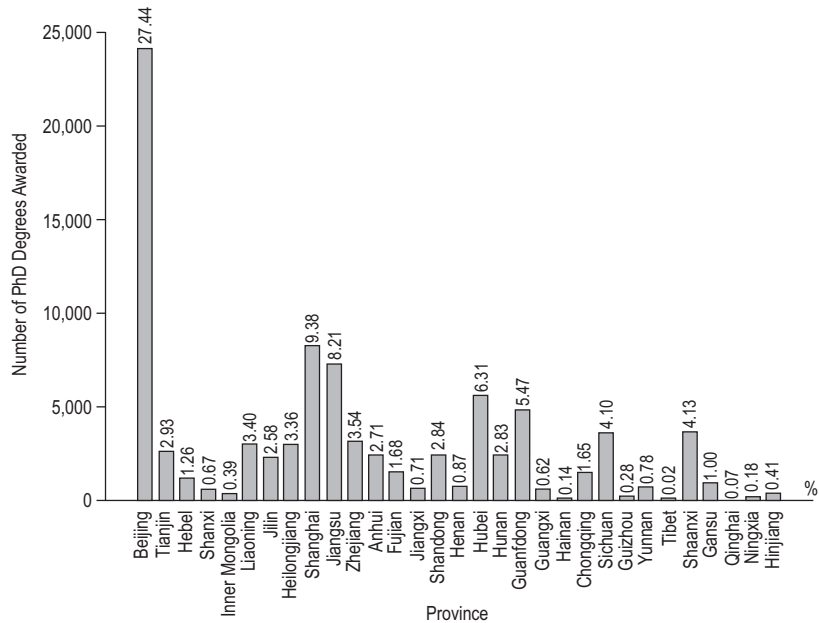
A decade later, in 2022, the concentration of doctoral education resources remained highly centralized in the same regions. The top five provinces and municipalities with the highest number of doctoral degrees awarded were Beijing, Shanghai, Jiangsu, Hubei, and Guangdong. Despite the slight decrease to 27.44% in its share, Beijing still retained the largest proportion of doctoral degrees awarded (Fig. 6). Once

again, the other provinces and municipalities each held less than 10% of the total, further highlighting the concentration of doctoral education resources in China's key academic and research centers.

This sustained centralization of doctoral degree conferrals in major metropolitan areas reflects the uneven distribution of educational resources and research institutions across the country. The major cities such as Beijing, Shanghai, and Jiangsu, continue to dominate in doctoral student admissions, boasting a significantly higher enrollment scale compared to other regions. The development of doctoral education in China's provinces exhibits certain regional commonalities. Overall, the doctoral education development across Chinese provinces demonstrates a clear pattern of "higher in the east and lower in the west". The development of doctoral education is closely related to the economic development level of each province, as well as other factors, such as political status, the history of doctoral education development, geographical location, and the state of doctoral education in the neighboring provinces. A robust economic foundation provides continuous support for the growth of doctoral education.

Additionally, economically developed provinces are able to attract and retain more doctoral graduates by offering more employment opportunities, which in turn contributes to further economic growth and enhances local technological capabilities. This mutually reinforcing relationship between economic development and doctoral education significantly strengthens the scientific and technological potential of the region [Lou, 2023].

Fig. 6. PhD degrees awarded by province in China (2022)



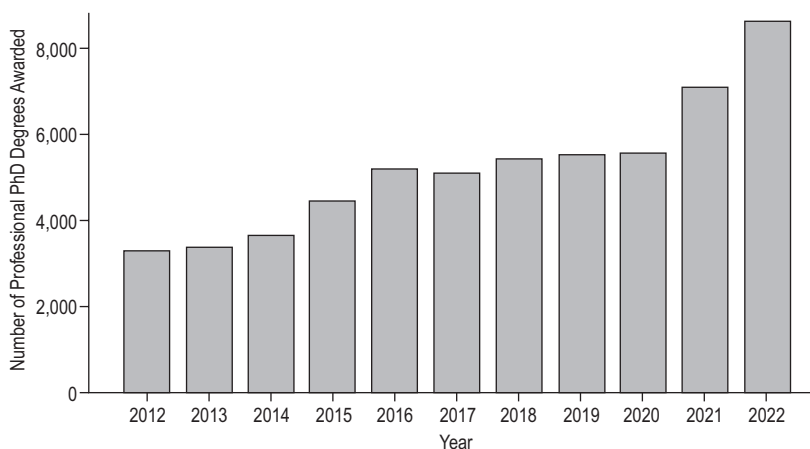
2.2. Development of doctoral education structure

2.2.1. Increase in the number of professional doctoral degrees

Professional doctorates (PDs) are distinct from traditional PhD programs in both structure and purpose, and understanding these differences is particularly important for international audiences unfamiliar with multiple doctoral pathways. Unlike PhDs, which focus primarily on producing original theoretical knowledge, professional doctorates emphasize the application of research to real-world professional practice. Candidates in PD programs are typically experienced practitioners, who aim to address complex problems within their professional contexts. The curriculum often combines coursework with a practice-oriented research project, and the assessment may include applied outputs and reflective components, rather than a purely theoretical dissertation. These programs are designed to foster “researching professionals” rather than “professional researchers”, with a strong emphasis on impact, innovation, and change within specific industries or sectors [Fink, 2006; Costley, Boud, 2020]. Having originated primarily in the United Kingdom and Australia in the 1990s, professional doctorates have since expanded internationally as a response of higher education systems to the demands of the knowledge economy and the need for advanced practitioner-led inquiry [Neumann, 2005].

Between 2012 and 2022, the number of professional doctoral degrees awarded in China saw significant growth. The number of academic doctoral degrees rose from 53,011 in 2012 to 79,399 in 2022, reflecting an increase of 26,388 degrees. In contrast, the number of professional doctoral degrees awarded grew from 3,327 in 2012 to 8,637 in 2022, a remarkable 2.60-fold increase (Fig. 7). This demonstrates the rising importance and recognition of professional doctoral education in China.

Fig. 7. **Professional PhD degrees awarded in China (2012–2022)**



In terms of proportion, the share of academic doctoral degrees fell from 94% of all doctoral degrees in 2012 to 90% in 2022. Meanwhile, the share of professional doctoral degrees increased from 6% to 10%,

highlighting the growing emphasis on professional, practice-oriented education at the doctoral level. This shift reflects the broader trend in China's higher education system towards more applied research and specialized knowledge in various fields. A notable example of this expansion can be seen in the field of engineering. In 2012, only 178 students were enrolled in professional doctoral engineering programs, but by 2021, this number had reached 8,131.

2.2.2. Expansion of professional doctoral degree categories

The growth in the number of professional doctoral degrees is paralleled by an expansion in the diversity of doctoral programs. In 1997, China introduced its first professional doctoral degree, Clinical Medicine. Since then, the number of professional doctoral degree types has grown to 36, covering a wide range of disciplines. These programs now encompass fields such as law, social work, education, sports, international Chinese, applied psychology, translation, publishing, meteorology, electronic information, mechanical engineering, materials and chemical engineering, resource and environmental management, energy and power, civil and hydraulic engineering, biological and pharmaceutical sciences, transportation, landscape architecture, agriculture, veterinary medicine, forestry, forensic medicine, public health, traditional Chinese medicine, medical technology, accounting, auditing, music, dance, drama and film, opera, and visual arts.

This diversification in professional doctoral programs reflects China's shifting educational priorities, where both specialized knowledge and practical, industry-oriented research are increasingly valued. By expanding the range of available doctoral programs, China is better positioned to address the growing demand for expertise across various sectors and industries, thus contributing to the country's innovation and development goals.

3. Reform measures of doctoral education

3.1. Reform of doctoral admissions:

The "application-assessment" system

One of the key reforms in China's doctoral education has been the introduction of the "application-assessment" system, aimed at selecting candidates who exhibit strong academic potential and innovative capabilities. Traditionally, the admissions process for doctoral programs in China relied heavily on a unified examination system, one of which combined written tests and oral assessments. This approach often resulted in a situation where a single written examination could not adequately determine a candidate's research potential and abilities. Many students selected through these public examinations were often described as "high scorers with low abilities", indicating a gap between their test performance and actual research capabilities. Studies have shown that such exam-dominant systems tend to overvalue quantifiable credentials while overlooking qualitative traits like research skills, innovation capacity, and academic motivation [Jung,

Li, Horta, 2023]. This has contributed to a decline in the quality of doctoral education, which has caused deep concern in society.

To address the shortcomings of the traditional examination-based admissions process, China has actively explored reforms in doctoral admissions. The “application-assessment” system, which draws from practices common in many Western countries, was first proposed by Peking University in 2003 as a means to shift the selection mechanism for doctoral candidates away from the purely exam-based model. In 2007, Peking University and Fudan University launched pilot programs to implement this approach. By 2020, it was reported that 274 doctoral training units had adopted this system, including all 42 of the first-class universities, showcasing a significant shift in the landscape of doctoral admissions in China.

The “application-assessment” system is characterized by two key features compared to traditional public examinations. First, it shifts the focus from the conventional written tests to application materials, which include academic transcripts, research proposals, and letters of recommendation. This allows for a more comprehensive evaluation of a candidate’s academic background and research interests. Second, it expands the autonomy of faculty mentors and research groups in the selection process, empowering them to make admissions decisions based on a holistic understanding of an applicant’s potential [Zhou, Huang, Liu, 2023].

This approach has been shown to better identify students who are not only academically capable but also exhibit strong intrinsic motivation for research and innovation. According to Zhou, Huang, Liu [2023], National surveys indicate that students admitted through this system outperform their counterparts in various dimensions, including professional foundations, motivation for learning, academic interests, and potential for scientific research development.

Moreover, the shift towards the “application-assessment” system is consistent with the broader trend in global higher education, where many institutions are moving away from purely exam-based selection processes and focusing more on candidates’ research capabilities and creativity. By empowering mentors and experts to play a central role in admissions, the system acknowledges that a candidate’s potential for groundbreaking research is often better assessed through academic experience and mentoring relationships rather than standardized testing alone [Liang, Cao, 2021]. In countries like the United States, doctoral admissions have long emphasized qualitative judgments made by faculty committees based on a range of materials, including personal statements, recommendation letters, and research experience. Studies highlight that U.S. graduate schools often rely on discipline-specific criteria and faculty discretion to ensure alignment between candidate potential and research group needs, a practice increasingly seen as effective in fostering high-quality research outcomes [Posselt, 2015;

Jung, Li, Horta, 2023]. The Chinese application-assessment system draws heavily on this model, reflecting a broader international trend toward assessing creativity, fit between the applicant and the research position, and research capacity rather than exam performance alone.

**3.2. Innovation
of the supervisor
appointment
system: Enhancing
the academic
vitality of doctoral
supervisors**

The reforms in the doctoral supervisor appointment system aim to attract scholars with diverse backgrounds and innovative approaches, thereby increasing the academic vitality of doctoral supervision teams. The inclusion of more active researchers in doctoral supervision has been associated with a greater capacity for innovation and a higher rate of interdisciplinary research, both of which are crucial for fostering an environment conducive to groundbreaking research [Zhang, 2017].

A key reform measure in this regard has been the relaxation of doctoral supervisor appointment criteria to allow more young faculty members with active research experience to assume supervisory roles. For example, since 2009, Tsinghua University has allowed the right to appoint doctoral supervisors to be decentralized to the academic committee of each department, granting more discretion to individual departments. Furthermore, the university implemented personnel reforms in 2017, allowing assistant professors to serve as independent doctoral supervisors. These changes have been instrumental in opening up new opportunities for promising young academics to participate in doctoral education, thus enhancing the overall quality of the supervision process [Yong, 2017].

The inclusion of younger faculty in supervisory roles not only reflects a shift in demographic dynamics within academia but also introduces fresh perspectives and innovative methodologies that are crucial to modern research. By incorporating these younger scholars, institutions can harness their enthusiasm and cutting-edge research ideas, which can directly contribute to a more creative and forward-thinking research environment. Young supervisors often possess recent experience with doctoral education themselves, making them relatable mentors, who can provide relevant guidance tailored to the contemporary challenges faced by PhD candidates. This mentorship model fosters an environment of collaboration and engagement, encouraging students to explore innovative ideas and interdisciplinary approaches.

As young supervisors often have a more flexible approach to research and mentoring, they are more inclined to experiment with new ideas and interdisciplinary collaborations. This openness not only enriches the academic experience of their students but also contributes to the production of research that is relevant to current societal challenges and scientific advancements.

Furthermore, by diversifying the supervisory pool, institutions can better address the needs of a wider range of doctoral candidates, encouraging inclusivity and raising the overall quality of education. This

approach aligns with global trends in higher education, where there is a growing recognition of the importance of mentorship in shaping the academic journeys of doctoral students.

3.3. Unifying multiple stakeholders to continuously improve the quality assurance system

In recent years, China has made substantial efforts to establish a robust quality assurance system for doctoral education, which integrates multiple stakeholders, including academic institutions, educational administrative bodies, academic organizations, industry sectors, and social institutions. The aim is to create a comprehensive internal quality assurance scheme, supported by external supervision mechanisms, which collectively ensure high standards of doctoral education. Such an inclusive approach not only enhances the credibility of the education system but also fosters a collaborative environment that encourages shared responsibility among stakeholders.

According to the “Opinions on Strengthening the Construction of the Quality Assurance and Supervision System for Degree and Postgraduate Education” issued by the State Council Academic Degrees Committee and the Ministry of Education⁷, China has developed a comprehensive quality assurance framework for doctoral education that addresses the unique challenges of modern higher education. The system emphasizes internal quality assurance, where degree-granting institutions are responsible for maintaining high educational standards. It encourages these institutions to establish robust self-regulation mechanisms, create a culture of continuous improvement, and align their academic programs with national educational objectives.

The framework is guided by external oversight from educational administrative departments, which play a strategic role in policy implementation and resource allocation. These departments ensure that doctoral programs across the country meet standardized benchmarks through regular quality evaluations and inspections. Additionally, the involvement of academic organizations, industry sectors, and social institutions in the process helps to enrich the quality assurance system by incorporating diverse perspectives and varied expertise. This collaboration ensures that the system is adaptable to evolving educational needs and socio-economic demands.

Quality assurance is maintained through multiple mechanisms, including degree authorization reviews, which assess the eligibility and capacity of institutions to grant degrees; periodic evaluations of degree programs to verify the relevance and rigor of the curriculum; professional degree assessments to judge the practical competencies of

⁷ State Council Academic Degrees Committee & Ministry of Education of the People's Republic of China. (2014, January 29). Opinions on strengthening the construction of the quality assurance and supervision system for degree and postgraduate education: http://www.moe.gov.cn/srcsite/A22/s7065/201402/t20140212_165554.html (accessed 04.10. 2025).

graduates; and random inspections of doctoral dissertations to detect any issues related to academic standards or integrity. These measures are collectively aimed at upholding educational quality and promoting transparency, accountability, and innovation in doctoral education.

In recent years, specific quality assurance mechanisms have been piloted for professional doctoral programs, particularly in applied fields, such as engineering. One example is the practice-based degree application model⁸. This model outlines a structured quality assurance process, which includes feasibility analysis, implementation of practical achievements, submission of a summary report, demonstration and evaluation of the outcomes, and an oral defense. Notably, each key stage of this process — such as the feasibility discussion, demonstration and evaluation, and final defense — must involve industry experts. This requirement reflects a broader shift toward incorporating enterprise input into the doctoral education system to ensure that research outcomes are both academically rigorous and practically relevant. By mandating corporate expert involvement, the process helps align professional doctoral training with real-world needs, thereby enhancing quality assurance through multi-stakeholder evaluation mechanisms.

The policy also emphasizes the need for institutions to actively monitor and improve their educational practices, including improving the quality of faculty guidance, refining curriculum development, and strengthening student assessment procedures. By promoting a comprehensive quality assurance and supervision system, China aims to ensure that doctoral education meets national standards and supports the country's goal of advancing higher education and research. Administrative Departments, such as the Ministry of Education, serve as the guiding force behind these quality assurance efforts. They set regulatory standards and oversee the implementation of quality measures across institutions, ensuring that all doctoral programs meet the requisite criteria for excellence. Additionally, academic organizations and professional associations, including discipline-specific bodies, actively participate in ensuring that doctoral education remains agreed with industry and academic developments. Their involvement helps ensure that doctoral programs are responsive to the evolving needs of both academia and society. By engaging with industry stakeholders, these organizations facilitate the integration of practical insights into academic curricula, thus bridging the gap between theory and practice.

One key feature of this quality assurance system is the comprehensive set of evaluation mechanisms that have been implemented over the years. These include degree authorization reviews, evalua-

⁸ Central People's Government of the People's Republic of China (2024, October) Implementation plan for accelerating the application of "artificial intelligence plus" actions. Available at: https://www.gov.cn/zhengce/zhengceku/202410/content_6984013.html (accessed 04.10.2025).

tions of degree programs, professional doctoral degree assessments, and random sampling of doctoral dissertations. Each of these measures serves to continuously monitor and evaluate the quality of doctoral education, ensuring that academic standards are consistently upheld. For instance, a degree authorization review assesses the capacity of an institution to offer doctoral programs, focusing on factors such as faculty qualifications, research facilities, and support services. In contrast, program-level assessments concentrate on specific academic disciplines, evaluating curriculum relevance and alignment with national and international standards. Dissertation evaluations, including random checks on doctoral theses, further ensure that the research output meets high academic standards and adheres to ethical research practices [He, 2018].

Moreover, active involvement of various stakeholders fosters an environment where feedback is not only welcomed but actively sought. This feedback loop is critical for refining quality assurance processes and adapting to emerging trends in doctoral education. For example, stakeholder consultations can reveal gaps in existing programs and highlight areas for enhancement, leading to targeted reforms that address specific challenges faced by both doctoral candidates and faculty.

4. Challenges in doctoral education

4.1. Insufficient accountability of supervisors

Insufficient accountability among doctoral supervisors is a significant challenge in China's doctoral education system. Although supervision is recognized as a critical determinant of doctoral success, the system often lacks robust mechanisms for holding supervisors accountable for their role in guiding students. A national survey involving 100 doctoral supervisors across ten Chinese universities found systemic weaknesses in supervisory training, evaluation, and institutional support [Wang et al., 2013]. The study revealed that only 59% of supervisors maintained contact with their students at least once a week, indicating limited engagement and a lack of structured supervisory support in many cases. Another finding was inconsistent expectations across institutions. Additionally, recent qualitative research highlights that students often hesitate to raise concerns due to hierarchical and paternalistic academic cultures, limiting transparency and accountability [Bahtilla, 2022]. Such issues are magnified when institutions lack structured mechanisms for evaluating supervisory performance, relying instead on informal feedback or peer review. This issue is exacerbated by an overly hierarchical relationship, where students may find it difficult to voice concerns or demand a change of supervisor for inadequate supervision due to cultural norms emphasizing respect for authority. The paternalistic leadership style commonly observed in supervisor-student relationships tends to limit constructive feedback and foster a passive learning environment, impacting the quality of doctoral training [Peng, 2015].

Furthermore, there is a need for more structured accountability frameworks, including formal evaluation tools that capture supervisors' effectiveness in guiding students' research. Current practices often rely on self-assessment or peer critique, which do not adequately address the need for systematic, student-centered evaluations [Halse, 2011]. The absence of transparent criteria for supervisory roles further contributes to inconsistent quality across institutions, highlighting the need for reforms that emphasize clearer expectations and increased accountability of supervisors.

4.2. Insufficient emphasis on curriculum development

In China, the insufficient emphasis on curriculum development presents a major challenge for the quality and effectiveness of doctoral education. Despite the vast expansion of doctoral programs, the curriculum often lacks the necessary innovation and flexibility to meet the evolving needs of the rapidly changing academic and professional landscape. The existing curriculum tends to be outdated, overly rigid, and limited in scope, with a heavy focus on mandatory courses at the expense of elective ones. Recent data from the 2024 National Survey of Graduate Student Satisfaction in China further increases these concerns. The survey found that graduate students' satisfaction with curriculum design significantly lags behind their satisfaction with the quality of teaching. While over 80% of students were satisfied with faculty responsibility (82.3%) and teaching ability (81.1%), satisfaction with curriculum system rationality, content frontier, and especially curriculum practicality was notably lower: 71.5%, 72.5%, and 68.7%, respectively [Zhou, Huang, Liu, 2024]. These discrepancies suggest a systemic underinvestment in curriculum development. The data indicates that while faculty teaching is appreciated, the structure and content of doctoral programs are perceived as outdated and insufficiently tailored to students' academic and professional needs. This resonates with earlier critiques that emphasize the urgent need to restructure China's doctoral curriculum with a view to enhancing flexibility, interdisciplinarity, and applicability. This results in fewer opportunities for students to engage in interdisciplinary studies or tailor their education to specific research interests and emerging fields. Consequently, students may not gain the diverse set of skills and experiences required to excel in research, industry, or other professional settings [Zheng, Shen, Cai, 2018].

Additionally, the lack of curriculum reform means that doctoral programs are often misaligned with the global trends and local economic demands, limiting the ability of graduates to contribute effectively to national development. While some universities have taken steps to update their programs, such efforts are not widespread or systematic enough to significantly raise the quality of doctoral education across the country. There is a critical need for curriculum reforms

that emphasize interdisciplinary training, practical skills, and the integration of new teaching methods to better prepare doctoral candidates for complex, real-world challenges [Chen et al., 2018].

Reforming the curriculum to include more elective courses, cross-disciplinary subjects, and updated teaching practices is essential for fostering a learning environment that encourages critical thinking, innovation, and adaptability. Without these changes, the effectiveness of doctoral programs in cultivating high-level talent capable of driving scientific and technological advancements will remain limited.

4.3. Incomplete collaborative education mechanism

The lack of a comprehensive collaborative education mechanism between universities, industries, and research institutions poses a significant challenge to doctoral education in China, especially for that in STEM (Science, Technology, Engineering, and Mathematics) fields. While the country has made considerable efforts to expand higher education and improve doctoral programs, the disconnect between academic research and practical industry needs remains a major obstacle. According to a bibliometric comparison of university–industry collaboration in China and the United States, only 2.7% of Chinese university publications were co-authored with industry partners, compared to approximately 6.1% in the United States [Zhou, Tijssen, Leydesdorff, 2016]. This gap results in limited opportunities for doctoral students to engage in industry-relevant research, internships, and practical training, which are essential for developing skills that yield to real-world demands. The absence of a structured system for university–industry collaboration hinders the ability to foster innovation and produce graduates who are prepared to tackle complex socio-economic challenges [Zhao, Song, 2018].

Efforts to establish collaborative educational programs often suffer from inconsistencies and a lack of long-term planning, resulting in initiatives that are sporadic rather than systematic. Although some universities have attempted to create partnerships with companies through joint research projects or training programs, these efforts frequently lack the depth and sustainability needed for significant impact. For STEM doctoral students, this lack of depth is even more pronounced as their fields demand highly specialized and up-to-date knowledge from industry. The limited involvement of industry experts in curriculum design also contributes to a misalignment between skills taught in doctoral programs and competencies required by employers [Chen et al., 2019].

Additionally, the absence of incentives for companies to engage actively in educational collaboration further limits the potential for meaningful partnerships. Companies often lack motivation to invest in long-term educational collaboration projects due to a lack of clear benefits or policy support that would make such partnerships attract-

ive. Establishing policies that provide tax benefits, subsidies, or other incentives for companies to participate in doctoral training programs could foster a more integrated approach to education-industry collaboration [Fan et al., 2019]. This is vital for STEM fields, where companies are often at the forefront of technological innovation and have much to offer in terms of practical knowledge and resources to STEM doctoral students.

Addressing these issues requires a multifaceted strategy, including policy reforms to encourage industry involvement, restructuring the current doctoral programs to include practical training, and establishing platforms that facilitate ongoing communication and joint initiatives between academia and industry. Strengthening the collaborative education mechanism is crucial for ensuring that doctoral education in China produces graduates who are not only academically accomplished but also equipped with the skills necessary to drive innovation and contribute to economic development, and this is of utmost importance for STEM doctoral students, who are expected to play a leading role in technological progress and economic transformation.

4.4. Further improvement needed in doctoral students' research innovation capabilities

The need for further improvement in research innovation capabilities of doctoral students is a critical challenge in China's doctoral education. Despite substantial progress in expanding doctoral programs, the innovative capacity of doctoral students remains a significant concern. Many students struggle with developing original research ideas and conducting groundbreaking work, often due to rigid training models and insufficient exposure to cutting-edge methodologies. The existing education framework tends to emphasize theoretical knowledge over practical application, limiting opportunities for students to engage in creative and interdisciplinary research endeavors [Dong, 2009].

One of the primary factors contributing to this issue is the traditional training model, which does not adequately prioritize the development of innovative skills. Current training practices often focus on rote learning and replicating established research methods, leaving little room for fostering creativity and originality. As a result, students may struggle to propose novel research questions or pursue unique research paths. Efforts to cultivate innovation are further hampered by limited funding for experimental research and an evaluation system that emphasizes publication quantity over research quality [Chen et al., 2018].

Moreover, there is a gap between doctoral education and industry needs, where students often lack opportunities to work on projects with direct practical applications. This disconnect restricts their ability to acquire problem-solving skills that are valuable in real-world settings. Addressing these gaps requires reforming the curriculum to include interdisciplinary training, hands-on projects, and industry

collaboration. Strengthening mentorship and providing access to resources that encourage risk-taking and innovation could also significantly improve the situation [Huo, Ge, 2010].

5. Future directions

China's doctoral education system continues to undergo substantial reforms aimed at enhancing quality, expanding access, and aligning training with national development goals. Despite the significant growth of the system, four key challenges persist: insufficient accountability of supervisors, limited curriculum development, weak university-industry collaboration, and inadequate cultivation of research innovation capabilities. The following future directions are proposed to directly address these concerns.

5.1. Strengthening supervisor accountability through structured mentorship programs

To address the challenge of insufficient accountability among doctoral supervisors, formal mentorship and evaluation mechanisms are essential. Structured mentorship programs, including peer-mentoring workshops, individual consultations, and supervisor training, ensure that doctoral students and their supervisors liaise closely [Szen-Ziemiańska, 2020]. Additionally, incorporating regular assessments of supervisory practices through structured questionnaires [Mainhard et al., 2009] are likely to provide actionable feedback and improve mentorship quality. These initiatives should promote accountability, professional development, and stronger supervisor-student relationships throughout the doctoral journey.

5.2. Advancing curriculum innovation to meet evolving needs

Given the limited emphasis on curriculum development in many Chinese doctoral programs, reforms are needed to promote curricular flexibility, interdisciplinarity, and real-world relevance. Integrating emerging fields, such as artificial intelligence and big data, into the curriculum, along with practical training in tools like Hadoop and Spark, could better prepare doctoral students for the demands of a technology-driven society [Gao, Sheng, Zhang, 2018]. Institutions should also prioritize curriculum reforms that encourage interdisciplinary connections, such as those exemplified by the BigKE project [Wu et al., 2017], and adopt AI-powered adaptive teaching models to enhance individualized learning outcomes [Yang, Huan, Yang, 2020].

5.3. Building robust university-industry collaboration platforms

To address the incomplete collaborative education mechanism, particularly in STEM disciplines, stronger partnerships between universities, research institutions, and industry are crucial. Establishing structured joint training programs, co-supervised research projects, and targeted government incentives might encourage sustained cooper-

ation. Learning from regional development models like the Special Economic Zones [Crane et al., 2018] and applying similar fiscal and administrative incentives in inland regions could stimulate industrial participation in doctoral training. This kind of collaboration is expected to provide students with industry-relevant experience while aligning academic output with national innovation priorities.

5.4. Enhancing doctoral students' research innovation capabilities

Improving the research innovation capacity of doctoral students requires a shift toward cultivating creativity and originality in training models. Institutions should increase support for experimental and interdisciplinary research and revise evaluation systems to value quality over quantity of publications [Chen et al., 2018]. Government funding ought to be strategically directed to support cutting-edge, high-risk projects, particularly in underfunded institutions [Yaisawarng, Ng, 2014]. Promoting policy experimentation [Han, 2020], such as pilot initiatives for interdisciplinary doctoral training and innovative supervision models, could help adapt training frameworks to the fast-changing global research environment.

6. Limitations

This study has provided an overview of provincial-level patterns in doctoral education development. However, as the educational landscape of China is vast and diverse, our paper only offers preliminary analysis of the issues. The interaction of the factors involved varies significantly across regions. Future research should adopt more fine-grained, data-driven approaches, such as regional case studies or spatial analysis, to better understand local dynamics. Special attention should be paid to underdeveloped areas to inform policies that promote balanced doctoral education nationwide.

While this study highlights the links between policy reforms, doctoral training, and national innovation strategies, it lacks an explicit, cohesive theoretical framework. We have implicitly drawn on concepts aligned with human capital theory — for instance, by discussing how doctoral expansion contributes to innovation-driven development and workforce upgrading. However, future research should more systematically integrate human capital theory and related frameworks to clarify the mechanisms through which doctoral education translates into innovation outcomes. This would enhance the explanatory power and theoretical depth of policy analysis in the Chinese context.

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