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Structural mismatches and integration mechanisms between postdoctoral researchers and industry: A comparative analysis of domestic and international literature

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Abstract: Postdoctoral researchers play a growing role in regional industrial development, but a structural mismatch persists between academic training and industrial demands. This paper compares domestic and international literature on postdoctoral researchers and industry. International studies focus on the misalignment between research capabilities and industrial transformation, academic experience and research output, factors influencing Postdoctoral researchers' transition to industry, and calls for stronger collaboration. Domestic studies examine postdoctoral stations, training models, industrial innovation, talent-industry alignment, and collaborative training. Findings show that postdocs often lack practical application experience, while traditional evaluation systems overemphasize academic outputs. Disparities also exist between academic stations and corporate workstations. Key gaps include insufficient integration, scarce empirical and region-specific studies, weak linkage between corporate and university programs, and underexplored micro-level issues such as interdisciplinary collaboration and cultural adaptability.

Keywords: postdoctoral researchers; industry-academia-research collaboration; structural mismatch; integration mechanisms

1 Introduction

The role that postdoctoral researchers (i.e.postdocs) play in fostering coordinated regional industrial development is increasing. In recent years, scholars both domestically and internationally have conducted multidimensional explorations on key issues, including the establishment of postdoctoral training platforms, the development of collaboration mechanisms, and the implementation of models for deep integration of industry, academia, and research.

2 International research

2.1 Mismatch between postdoctoral research and industrial application capabilities

Foreign scholars paid more attention to the gap between the academic capabilities of postdocs and industrial demands. Through research, Hayter and Parker (2019) found that while postdocs possess strong competencies in mastering scientific concepts and applying research methodologies, they lack experience in practical fields—particularly in knowing how to effectively translate their research ideas into commercial opportunities [1]. This finding highlights a structural mismatch between postdoctoral academic training and industrial demands. Academia emphasizes independent research, theoretical depth, and methodological rigor; industry values teamwork, rapid iteration, and practical outcomes. Postdocs must

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therefore reconcile academic rigor with the flexibility of industry projects.

2.2 The impact of postdoctoral academic experience on research achievements

Research by Su demonstrates that, compared to peers who hold only a doctoral degree, scholars with postdoctoral experience tend to achieve higher academic accomplishments [2]. This finding strongly supports the value of the postdoctoral system in terms of academic productivity. It shows that the postdoctoral stage is not only a time for accumulating knowledge. It is also a key period for improving research skills. However, the study also points to a problem. Traditional evaluation systems focus too much on academic outputs. They pay too little attention to postdocs' ability to collaborate with industry. They also pay too little attention to their awareness of turning research findings into practical applications. This can lead postdocs to ignore the practical needs of industry during their training. As a result, the gap between academia and industry may grow wider.

2.3 Factors influencing postdoctoral researchers' transition to industry

Lin and Chiu, as well as Germain-Alamartine et al. have systematically examined the factors that influence postdocs' decisions to enter the industrial sector [3]. These studies explore the conditions and barriers to postdocs' transition into industry from multiple dimensions—individual motivation, organizational environment, and institutional support. At the individual level, such factors include entrepreneurial inclination, risk tolerance, and identification with industrial culture. At the organizational level, they include incentive mechanisms, supervisor support, and the closeness of university-industry partnerships. At the institutional level, they include government policies for industry-academia-research collaboration, clear intellectual property rights, and smooth talent mobility.

2.4 An integrated call for industrial collaboration

Some scholars emphasize that postdoctoral training should not be confined solely to academic research; instead, it should adopt the perspectives of enterprises and social practice, carefully examining the objective demands of enterprises regarding "efficiency" and "productivity". It is essential to forge integration between the resource provider—i.e.enterprises—and the producer of research outcomes—i.e.postdocs—thereby achieving mutual benefits and win-win outcomes for both parties [4]. This view highlights a key challenge: How to break down the barriers between academic and industrial cultures.

3 Domestic research

3.1 Function and development of postdoctoral research stations

Postdoctoral research stations in Chinese universities were established in 1985 and have consistently been committed to providing high-quality platforms for postdocs within higher education institutions or research organizations. Huang Rong and Zhou Xinguo argue that higher education institutions are core sites for knowledge production and innovation. They should fulfill traditional functions such as academic management, teaching support, social services, and cultural innovation. They should also strengthen coordination within their internal management. On this basis, higher education institutions should expand the functions of postdoctoral research stations. This will help cultivate more high-level innovative talents. In turn, postdoctoral research stations must address diverse needs. These needs include scientific frontiers, industry and sectoral demands, regional development, and cultural inheritance and innovation. In this way, they can play a key role in talent cultivation and scientific and technological innovation [5].

For universities, the role of postdocs extends beyond generating scientific research output. Studies show that universities mainly recruit postdocs for practical "personnel utilization". By attracting and cultivating postdocs, universities can effectively expand their faculty size, optimize their faculty structure, and enhance their overall research capabilities [6]. In this sense, the postdoctoral community constitutes an important "talent reservoir" for universities, facilitating the healthy

development and rational mobility of their faculty [7]. Tong Linjie further emphasized that providing a transition period and a research platform for university postdocs is the original intent of establishing the postdoctoral system [8]. Chen Qian argued that, with scientific management and guidance, such a system can cultivate innovative talents for the nation while ensuring rigorous quality control in talent selection.

3.2 Comparison of training models between academic stations and workstations

In his 2020 study, Liu Yang conducted a systematic comparison between two postdoctoral training models—joint training via corporate workstations and independent training via academic stations. The findings revealed that, whether in terms of hardware conditions (e.g., research capabilities, faculty strength, and R&D platforms) or soft conditions (e.g., recruitment scale, salary and benefit packages, and ease of publishing research outcomes), academic stations demonstrated significantly superior performance compared to corporate workstations [9]. This finding shows that postdoctoral training capacity differs across hosting institutions. It also shows that postdocs in corporate workstations face resource limits. Corporate workstations do have natural advantages in industry alignment. However, they often cannot match academic institutions in basic research resources, academic atmosphere, and high-quality supervisors. This imbalance limits the overall development of postdocs in corporate settings.

3.3 The role of postdoctoral research stations in industrial innovation

Wu Jian argues that postdoctoral research stations, as important platforms for innovation, can effectively attract diverse resources, vigorously facilitate the commercialization and industrialization of innovative achievements, and thus serve as an effective pathway for developing strategic emerging industries [10]. This view fully recognizes the unique value of corporate postdocs in tackling key industrial technology challenges. However, as noted earlier, these stations still face many matching problems. For example, corporate needs may not match postdoctoral research directions. Communication between enterprises and postdocs may be inadequate. The path from research outcomes to industrial application may also be unclear. These problems undermine the innovation performance of these stations, which are expected to deliver.

3.4 The interactive relationship between postdoctoral researchers and strategic emerging industries

Lin Shijue and Liu Wanna examined how to match innovative talent with industry needs. They argued that China should accelerate the aggregation of a large number of outstanding young postdocs with innovative capabilities. It should also actively recruit "highly skilled, sophisticated, and in-demand" talent in strategic emerging sectors. These sectors include next-generation information technology, artificial intelligence, high-end equipment manufacturing, new materials, and biomedicine [11].

In their study on the aggregation of postdoctoral talents in Jiangsu Province, Wang Xiulai et al. found that a steady increase in postdoctoral talent boosted the development of strategic emerging industries in the region. It also made the region more attractive to postdocs. These two effects formed a virtuous cycle. This shows a positive interaction between postdocs and regional industries: talent gathering and industry growth reinforce each other [12].

However, the issue of insufficient matching also persists. In their study, Wang Chao et al. found a mismatch between postdoctoral research in Jiangsu Province and the innovation needs of enterprises and society. This structural misalignment has restricted the postdoctoral workforce's role in industrial upgrading within manufacturing [13]. An empirical analysis conducted by Zhou Yingwen, focusing on emerging enterprises in Shanghai, revealed that these enterprises still face a significant shortage of personnel specializing in emerging technology R&D. This shows a clear mismatch between talent supply and demand [14]. Together, these studies point to one core issue. The structural mismatch between talent supply and industrial demand is especially severe at the postdoctoral level.

3.5 Exploration of an industry-academia-research collaborative training model

In response to these mismatches, domestic scholars have explored diverse collaborative cultivation models. Changzhou University has adopted an industry-university-research collaborative training model. It carried out pilot programs to train high-level professionals for the photovoltaic industry. These programs achieved positive practical results [15]. Wang Liangfen and Zhao Sainan proposed a "five-in-one" talent cultivation model. It includes government, industry, academia, research institutions, and end-users. The model stresses joint participation and close coordination among multiple actors. These actors include government agencies, industries, universities, research institutes, and enterprises. They work together to support coordinated talent development [16]. Zhao Zhe argued that universities should leverage their supply-side advantages—such as knowledge, talent resources, platforms, and technological capabilities—to achieve precise connection with the demand-side needs of enterprises, thereby promoting development between universities and strategic emerging industries [17].

4 Conclusion

The international and Chinese literature reviewed above shows that research on the coordinated development of postdoctoral talents and industry has distinct emphases at home and abroad.

International studies follow four main lines:

1. Mismatch between postdoctoral research capacity and industrial translation. Postdocs are strong in grasping scientific concepts and applying research methods, but they lack applied experience. Traditional academic environments emphasize individual independence, theoretical depth and methodological rigor. Industry values teamwork, rapid iteration and practical outcomes.

2. Effects of postdoctoral experience on research achievement. Scholars with postdoctoral experience generally outperform peers with only a doctoral degree. However, traditional postdoctoral evaluation systems overemphasize academic outputs. They pay insufficient attention to industry collaboration capacity and commercialization awareness.

3. Factors influencing postdocs' entry into industry. Studies analyze conditions and barriers at three levels: individual motivation (entrepreneurial intention, risk tolerance, identification with industrial culture), organizational environment (incentives from station-hosting institutions, supervisor attitudes, university-industry collaboration intensity), and institutional support (industry-university-research policies, intellectual property ownership, talent mobility facilitation).

4. Integrated calls for industrial collaboration. Postdoctoral training should not be confined to academic research. It should examine enterprises' demands for "efficiency" and "products" from the perspective of industrial practice and social practice, strengthen organic integration between enterprises (resource providers) and postdocs (output producers) and break down barriers between academic and industrial cultures.

Chinese studies concentrate on five aspects:

1. Functions and development of postdoctoral academic stations. This line reviews the platform functions of academic stations since their establishment in 1985. It notes that postdocs serve as a "talent reservoir" for universities by expanding faculty size, optimizing faculty structure and enhancing research capacity. It also examines the original purpose of the faculty-preparation postdoctoral system in providing a buffer period and an assessment platform.

2. Comparison of training models between academic stations and workstations. Academic stations are clearly superior to workstations in hardware conditions such as research strength, faculty teams and R&D platforms. They are also superior in soft conditions such as enrollment scale, salary and ease of publishing results.

3. Role of postdoctoral research workstations in industrial innovation. Workstations are recognized as innovation carriers that promote technology transfer and industrialization and support strategic emerging industries. At the same time,

they face matching problems: low fit between enterprise needs and research directions, poor communication mechanisms and unclear industrialization paths.

4. Interaction between postdoctoral talents and strategic emerging industries. On the one hand, studies confirm a virtuous cycle in which postdoctoral talent growth and regional strategic emerging industries reinforce each other. On the other hand, they reveal a structural mismatch between postdoctoral research activities and the innovation needs of enterprises and society. Emerging enterprises face substantial R&D staffing gaps.

5. Exploration of industry-university-research collaborative training models. These include collaborative training, the "government-industry-university-research-application" five-in-one model, and precise coordination between universities' supply-side advantages and enterprises' demand-side requirements.

Overall, existing studies at home and abroad have produced relatively rich findings on postdoctoral system design, training models, talent mobility and industry-university-research collaboration. International studies pay more attention to the mismatch between individual postdoctoral capabilities and industry needs and its influencing factors. Chinese studies focus more on institutional comparisons between academic stations and workstations, the interaction between postdocs and regional industries, and practical exploration of collaborative training models.

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Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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