

# A bibliometric and visual analysis of Chinese and international postgraduate employment in the last decade: developments, hotspots, and trend directions

Yaqi Hu<sup>1,a,\*</sup>, Xuebo Zhu<sup>2,b,\*</sup>

<sup>1</sup>School of Public Health and Management, Wenzhou Medical University, Wenzhou, China

<sup>2</sup>Academic Affairs Office, Wenzhou Medical University, Wenzhou, China

<sup>a</sup>huyq325@163.com, <sup>b</sup>xuebo.zhu@wmu.edu.cn

\*Corresponding author

**Abstract:** The continuous expansion of postgraduate education and the structural bias of the job market have brought much attention to the employment of postgraduate students. To better understand the employment gap between Chinese and international postgraduate students and effectively advance future research, this research selects China National Knowledge Infrastructure and Web of Science as data sources to conduct a quantitative scientometric assessment of the literature from 2011 to 2021. According to the survey, Chinese publications mostly focus on the discipline of higher education, whereas overseas journals are more diverse. There is no systematic network of inter-author and inter-institutional cooperation in China and internationally. Research hotspots have some convergence, but with slightly different focuses. There is still a rich field of employment for graduate students in China and overseas that has yet to be explored. In the future, we should enhance the breadth and depth of research and cooperation and strengthen academic innovation and interdisciplinary research.

**Keywords:** postgraduate; employment; knowledge mapping; visualized analysis

## 1. Introduction

Postgraduate education is a crucial foundation for social transformation and innovation, especially given the growing demand for different competencies[1]. Employment is the 'exit' from graduate school and it is the benchmark against which the quality of training is assessed. However, postgraduate employment is not always smooth sailing. Particularly today, governments are increasingly recognising the importance of postgraduate education and are strongly promoting and funding the development of postgraduate education to produce highly qualified personnel who are competitive in the global economy[2], [3]. In addition, the desire of students to go beyond bachelor's degree status is expanding as a result of status attainment and variables related to it[4], all of which contribute to the ongoing growth of postgraduate students. According to the Council of Graduate Schools (CGS), the average growth rate of postgraduate students was 9.5% over the decade from 2009-10 to 2019-20[5]. The expansion of postgraduate students will inevitably affect their employment. Degree value declines, underemployment, and a mismatch between training and labour demand are all current issues in some nations[6].

Postgraduate employment is also under serious threat from the global economic downturn. According to the World Economic Outlook 2022, the Russian invasion of Ukraine, cost of living issues from ongoing and escalating inflationary pressures, and the economic slowdown in China are having a long-term impact on the global economy[7]. Global economic growth will fall from 3.2% in 2022 to 2.7% in 2023, with a 25% possibility of sliding below 2%[7]. Furthermore, the COVID-19 pandemic has affected countries all over the world, resulting in significant social, economic, and educational consequences[8]. In this circumstance, postgraduate students experience several pressures and progressively lose faith in their chosen career path. International Labour Organization(ILO) study estimates that 207 million people will be unemployed worldwide in 2022, with an unemployment rate of 5.9%[9]. All these factors make postgraduate employment a crucial issue that postgraduate education must address.

In Asia, unemployment is a significant problem as well; in 2022, East Asia will have the highest unemployment rate worldwide[9]. And China, the largest developing country in East Asia, began postgraduate education later than other European and American countries. China has adopted a variety of initiatives to enhance the postgraduate education sector's catch-up development in order to support

economic expansion and advance national prosperity. The number of postgraduate students enrolled has increased from the commencement of the university expansion programme in 1999, from 92,200 in 1999 to 1,177,000 in 2021[10], an average growth rate of 4.72%. Employment concerns are undoubtedly brought up by the postgraduate enrolment boom, especially given the nation and world's current unpredictable and complicated development environments. This merits the attention of scholars worldwide.

Searching the Chinese and international literature on postgraduate employment, we discovered that in recent years, Chinese scholars have primarily focused on the current employment situation[11], employment guidance[12], and employment quality[13]. Foreign researchers have investigated topics including employment discrimination[14], career choice[15], and work satisfaction[16], but none examine the Chinese and foreign databases and analyse the differences between each study. Only a few scholars have studied the literature on college graduates. For instance, [17] used the world systems theory to review the literature on the employment of higher education graduates in East Asia; [18] visualized and examined the industrial structure and employment structure of graduates from higher education. Visual knowledge mapping, as a descriptive tool of knowledge elements and organizational relationships, can clearly show the flow process of knowledge elements. Based on this, this study uses CiteSpace and VOSviewer to visualize and analyse relevant literature on Chinese and international postgraduate employment between 2011 and 2021 to reveal the differences in the current development status, research hotspots, and development trends in this field.

The rest of the paper is organized as follows. The 'Materials and Methods' explains the research tools and data collection procedure. The 'Results and discussion' presents a comprehensive overview of the development of publications in the research field and the significant findings in the knowledge above domains. Finally, the 'Conclusion' highlights the study's key findings and proposes implications for future research.

## **2. Materials and Methods**

### **2.1. Data source**

The Chinese Social Science Citation Index (CSSCI) database literature included in China National Knowledge Infrastructure (CNKI) is the source data. The search was conducted with 'graduate students' & 'employment', 'graduate students' & 'job hunting', 'graduate students' & 'career choice' as the subject search terms. The period was from January 1, 2011, to December 31, 2021, and the document type was 'Article'. Two hundred seventeen documents were retrieved, excluding duplicates and other non-relevant documents.

Foreign literature was collected from the Social Science Citation Index (SSCI) database in the Web of Science database as the data source. The search was conducted using the terms 'postgraduate employment', 'graduate employment', 'postgraduate' & 'career', 'postgraduate' & 'job' as the subject search terms. The period was from January 1, 2011, to December 31, 2021, and the document type was 'Article'. Two hundred six valid documents were found, excluding irrelevant documents and duplicates.

### **2.2. Research Methodology**

CiteSpace and VOSviewer are bibliometric visualization software developed by Professor Chao-Mei [19] at Drexel University and the Centre for Science and Technology Research at Leiden University[20] respectively. They can demonstrate the trends and structural relationships of scientific development knowledge.

This study analyses the journals, authors, institutions, and keywords for Chinese and international postgraduate employment through visualization tools. It confirms the hot topics, structural relationships, and development trends of postgraduate employment research in combination with a secondary literature review.

### 3. Results and Discussion

#### 3.1. Analysis of the basic features

##### 3.1.1. Distribution of core journals

Journals are crucial channels for exchanging academic information, yet just a few core journals publish most of a field's critical literature. Core areas can be calculated based on the number of Bradford core journal areas proposed by Belgian intelligence scientist Egghe, i.e.

$$R = 2 \ln(e^E \times M). \quad (1)$$

Where E is the Euler coefficient (0.5772), M is the number of articles contained in the journal with the highest number of publications, and R is the number of core areas[21]. The top 9 journals in China are core journals, with 142 papers accounting for 65 % of the total number of pieces. It shows that the journals in postgraduate employment in China are relatively concentrated and show a trend of stable journal groups. Overseas, the top 6 journals are core journals, with 46 articles accounting for 22% of the total number of pieces. The distribution of journals is more scattered, showing the characteristic of 'small aggregation and large dispersion'. In addition, according to the academic orientation of the journals and their features, higher education is the dominant force in the study and development of postgraduate employment in China and overseas, gradually penetrating other disciplines. The distinction is that while there are slightly more Chinese articles overall than from other nations, the range of topics covered is narrower, there is comparatively little interaction within disciplines, and the distribution is monolithic overall, as shown in Table 1.

Table 1: Chinese and International Postgraduate Employment Core Journals.

	No.	Journal	Articles
Chinese	1	Academic Degrees & Graduate Education	51
	2	Journal of Graduate Education	30
	3	China Higher Education Research	18
	4	Research in Educational Development	10
	5	China Youth Study	9
	6	Journal of Higher Education	8
	7	Journal of National Academy of Education Administration	4
	8	Higher Education Exploration	4
	9	Modern Education Management	4
international	9	Heilongjiang Researches on Higher Education	4
	1	Studies in Higher Education	11
	2	Higher Education	10
	3	Higher Education Research & Development	6
	4	Higher Education Policy	6
	5	Plos One	5
	6	Research Evaluation	4

##### 3.1.2. Author Distribution

Price's law[22] states that a group of highly prolific writers (N) should produce 50% of the papers on a particular subject, and the number of productive authors in that group is roughly equal to the square root of the total number of authors in the field. The formula for calculation is

$$N = 0.749 * \sqrt{n_{max}} \quad (2)$$

Where  $n_{max}$  is the number of articles published by the most prolific author in a field. According to the search, the most prolific Chinese author in the analyzed literature is Yingzhi Luo, with ten publications. The most prolific foreign scholar is Cathelijn J. F. Waaijer, with six publications. Thus, High-yield authors in China published at least three articles, and there are 19 high-producing authors with a total of 84 publications, accounting for 18.5% of the total. International high-producing authors published at least two papers, and there are 44 high-producing authors with a total of 95 publications, accounting for 16.3% of the total. Both Chinese and foreign high-producing authors' publication ratio is somewhat different from the standard of 50% of Bryce's law, which indicates no stable core group of authors in the field of postgraduate employment.

In addition, Mapping author collaboration in postgraduate employment in China and internationally using CiteSpace, where the larger nodes, the more publications, and the connecting lines represent the collaboration between scholars (Figures 1 and 2). Both Chinese and international postgraduate employment cooperation networks show an ‘overall dispersion and local concentration trend’. There are two major collaborative teams in China. The first one is the research team of Peking University, with scholars such as Wenqin Shen and Hongjie Chen as the core, which focuses on the graduation destination of doctoral students. The second one is composed of the cooperation of scholars such as Fengliang Li, Yonghong Ma, and Guangxi He, which mainly explores the employment promotion path of professional masters. An emerging research team primarily exists abroad recently, with scholars such as Krasna and Czabanowska as the core, tracking the employment status of public health postgraduate students and exploring the influencing factors behind it. Other authors are generally less connected, with a predominance of individual co-linear or independent point situations between two authors, indicating that there are few collaborative teams of authors in the field of postgraduate employment and weak levels of cooperation. Furthermore, the connection between scholars in this field is mainly an academic relationship.



Figure 1: Chinese authors' co-occurrence knowledge map

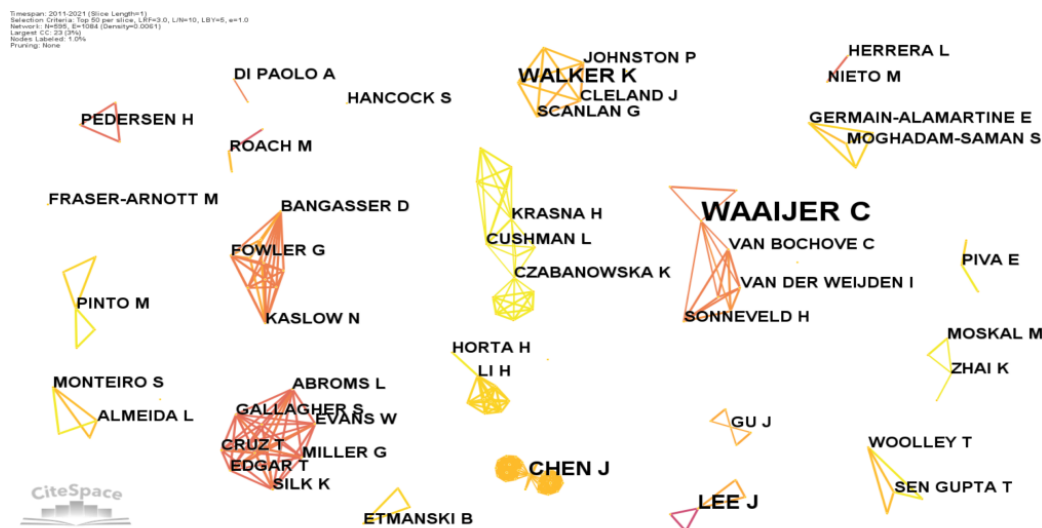


Figure 2: International author co-occurrence knowledge map

### 3.1.3. Institutional Distribution

CiteSpace is used to map the institutional cooperation in postgraduate employment in China and internationally (Figures 3 and 4). The research institutions are relatively single, mainly concentrated in institutions of higher learning. The primary distribution is in developed areas. Peking University is the institution with the most publications in China. Maybe exist a positive correlation between publications

and productive authors in the organization, such as Wenqin Shen, Hongjie Chen, and other high-producing authors from Peking University. While Leiden University is the most prolific international publisher, the high-producing author Waaier comes from this university.

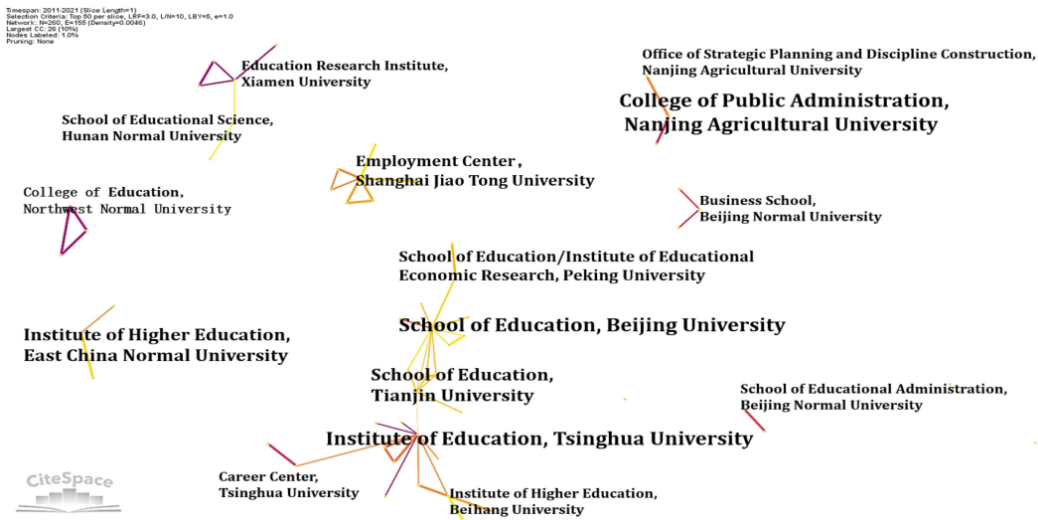


Figure 3: Chinese institutions co-occurrence of knowledge map

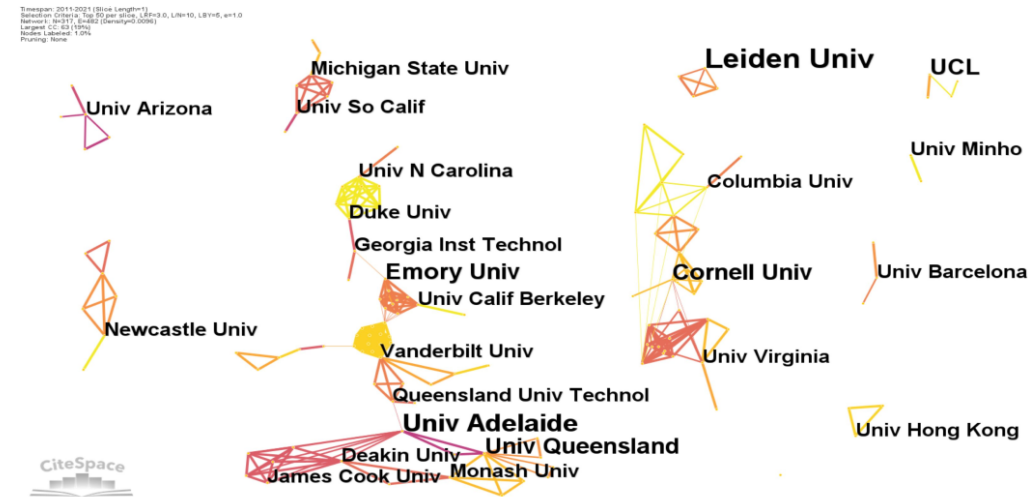


Figure 4: International institutions co-occurrence of knowledge map

From the co-occurrence of institutional cooperation, the density of Chinese links is 0.0046, while that of international relationships is 0.0091. This demonstrates the institutions' dispersed distribution and the lack of a systematic network relationship. Inter-institutional cooperation is mainly between institutions within the same university or institutions of scholars with academic ties. The awareness of collaboration between scholars and institutions is not strong, and only a few groups form. For instance, in China, the School of Education of Peking University and the Institute of Education of Tsinghua University are the core research positions. In foreign, Emory University, the University of Adelaide, and The University of Queensland are the core cooperation institutions, but no core researchers yet.

### 3.2. Analysis of research hotspots

Keywords are the condensation of the core ideas of an article, which can quickly grasp the research hotspots in a specific field[23]. In this study, keywords were imported into VOSviewer for cluster analysis. Keywords with a frequency of at least twice were chosen, and too broad a meaning was eliminated, such as postgraduate and employment. The size of each node in the diagram represents the frequency of keywords. And the larger the node, the higher the frequency.

#### 3.2.1. Chinese research hotspots

The keyword with the largest node in Figure 5 is doctoral students, followed by master's students,

employability, doctoral education, employment quality, academic careers, influencing factors, and professional degrees. Meanwhile, combined with keyword co-occurrence network clustering and secondary literature review, the literature is grouped into three research hotspots.

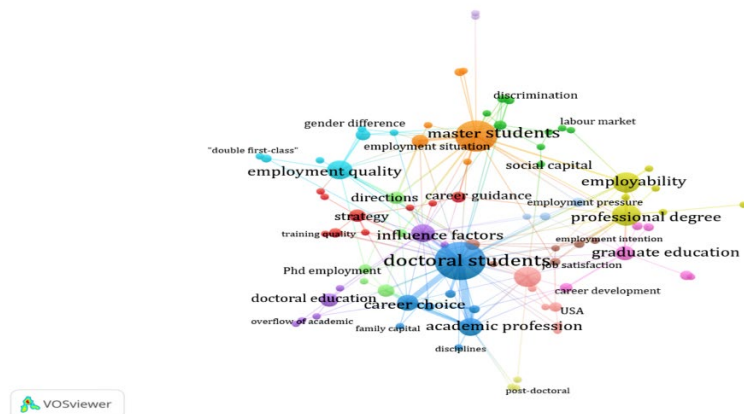


Figure 5: Chinese keyword co-occurrence knowledge map

### 3.2.1.1. Doctoral Student Career Choice and Development.

Doctorate education, academic professions, non-academic employment, and doctoral students are the critical topics of this section. Doctoral students are an essential reserve for national innovation-driven strategy and high-level top-notch innovative talents, directly driving the large-scale expansion of doctoral education in China[24]. The growing contradiction between supply and demand in the academic labour market is a result of this expansion. Chinese doctoral students' jobs are moving 'downward' and diversifying[25], with a sharp increase in the flow into non-academic careers[26], [27], especially for students in the natural sciences[28]. The phenomenon of 'pipeline leakage' is serious. The change in job trends directly drives the reform of doctoral education. However, China's doctoral education is not yet able to match the doctoral students' socialization process needs for the development of teaching ability, career planning ability, and transferable ability[25]. In this context, doctoral education should evolve from a single academic orientation to a pluralistic one to support students' preparation for careers in academia and beyond. [29], [30].

### 3.2.1.2. Professional Master's Degree in Employability Development.

Professional degree, professional competency, employability, and cultivation method are all covered in this section. The fundamental purpose of professional degree training is to offer high-level application-oriented professionals for many fields of economy and society, emphasizing professional skill and professionalism. In China, professional degrees are currently more popular than academic master's degrees[31]. However, due to the late start, professional degrees' cultivation and employment guidance are still under investigation[32], resulting in issues with low social recognition[33], consistent with the cultivation program of academic masters, short internships, and practice opportunities[34]. Given the issues at hand, they suggest that we focus on collaborative research between universities and businesses. They argue that we should pay attention to the distinct development of academic and professional masters and increase the focused employment assistance[35-36].

### 3.2.1.3. Postgraduate students' employment status and influencing factors.

This section focuses mainly on discrimination, employment quality, destination, and employment status. China's economic development brings vast job opportunities into a new normal[37]. However, there are employment barriers due to the mismatch between postgraduate student enrolment size and training and labour market demand. Employment status is an essential basis for enrolment and training reforms in higher education in China[38]. Presently, postgraduates' employment implementation rate and quality are generally high[37], with a prominent 'territorial effect' [39]and agglomeration effect in developed regions, discrimination in education[40] and gender[41], and diversified distribution in employment industries. What causes this state of employment situation? They contend that a combination of age, salary, distance from home, company size, and other factors affect people's preferences for employment areas and Organizations. They found that both antecedent and consequent human capital are essential factors influencing employment outcomes and job-starting salaries of master's students[42-43].

### 3.2.2. International research hotspots

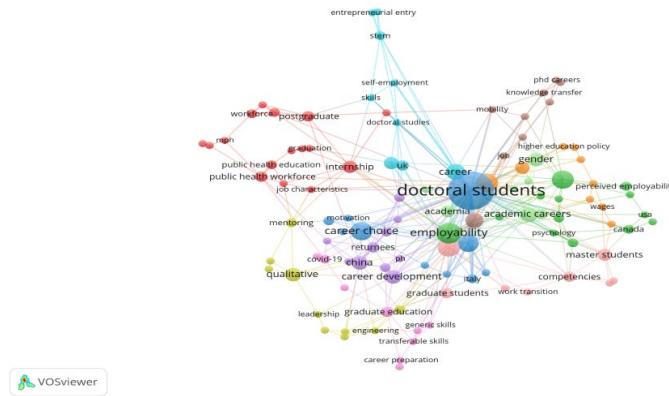


Figure 6: International keyword co-occurrence knowledge map

In Figure 6, doctorate students, employability, higher education, work satisfaction, career choice, and doctoral education are the keywords that appear from the largest to most minor nodes to highlight the core themes and hot topics of postgraduate employment research. The whole literature can also be divided into three research hotspots when paired with keyword co-occurrence network clustering and secondary literature review.

#### 3.2.2.1. Postgraduate employability and education match.

Convertible ability, general abilities, perception, and employment transfer are the primary topics covered in this part. Due to the change in business and production patterns, there is a growing need for highly qualified and competent personnel, and employability is now regarded as a crucial personal trait.[44]. However, there is a gap between postgraduate students' employability growth and the expectations of employers[45]. Colleges should take on the crucial task of preparing students for the workforce[46]. Researchers like [47]discovered that participating in continuous learning increases students' competitiveness in the labour market based on the rootedness idea. They discovered that postgraduates' transition into the workforce might be aided by a rich learning experience in building methods and practical skills as well as more shared career-related experiences and skills[48].

#### 3.2.2.2. Postgraduate employment outcomes and influencing factors.

This section discusses the labour market, job satisfaction, career mobility, career development, the labour market, and gender differences. Increased global mobility and broader participation in higher education have led to increased student mobility and a significant increase in enrolment[49], as well as an unprecedented diversification of postgraduate student groups and different employment outcomes. Disadvantaged groups, such as women[50] and minorities[51], are more likely to experience disruption and discrimination in the workplace. What causes these employment outcomes, and what factors contribute to them? Influencing variables primarily include macro and micro factors. At the macro level, postgraduate employment will be impacted by labour markets, regulations, the novel coronavirus epidemic, and more. For instance, they discovered that the type of contract, the required degree of education, and the possibility of a permanent position are all detrimental to job satisfaction. Personal aptitude, demographics, mentors, and other factors will impact employment at the micro level. They pointed out that mentorship is favourably correlated with professional development and placement satisfaction while highlighting that task priority, job feedback, and skill diversity affect career placement outcomes[52-53].

#### 3.2.2.3. Employment of doctoral students.

The doctorate job market, doctoral mobility, and doctoral education are all topics covered in this section. Doctoral students are crucial participants in regional innovation and knowledge competition processes. Nations are boosting public expenditure in doctoral education to drive innovation, prompting rapid growth in the number of doctoral graduates. Traditional academic positions are no longer sufficient to meet the demand for doctoral students. More doctoral students are moving into non-academic employment opportunities, particularly in the research area, where they must choose between the intellectual difficulties of the research and higher job stability outside of research[54]. But doctoral students pursuing non-academic employment report a considerable gap between doctoral education and market need[55], [56]. Given the employment issue facing PhD students, European and American nations

take the lead in implementing several reform objectives, such as school-enterprise cooperation training and the establishment of professional doctoral degrees Researchers are still trying to match doctoral education with the needs of the labour market today. For instance, they discovered that enrolment experience, part-time status, social networks, and demographic characteristics influence doctoral students' initial jobs. CGS promotes the Humanities Coalition to help doctoral students prepare for a variety of humanities vocations[57-58].

As mentioned above, both studies, in China and overseas, are geared toward boosting postgraduate employment and addressing societal demands. But both have a slightly different emphasis. Chinese study typically focuses on the features of postgraduate employment groups cross-sectionally, investigate the causes of the employment situation, and suggests appropriate solutions. Additionally, there is less research on the application of theory in practice. On the other hand, the international community is more concerned with improving the employability of students in postgraduate education and implementing transition programs to meet the needs of socioeconomic development. And future researchers should perform more in-depth studies because the structure of keyword co-occurrence networks in China and elsewhere is still loose and not particularly dense.

**3.3. Analysis of research trends**

The evolutionary trend of emergent keywords scientifically represents the leading research dynamics in the research field. This paper analyses the evolving trends in postgraduate employment in China and internationally, taking into account emerging keywords (Tables 2 and 3) and relevant literature.

*Table 2: Chinese keyword emergent knowledge graph*

Keywords	Year	Strength	Begin	End	2011 - 2021
Employment	2011	4.25	2011	2012	
Employability	2011	2.06	2015	2016	
employment directions	2011	1.7	2016	2017	
academic profession	2011	3.05	2017	2021	
employment preference	2011	1.62	2017	2018	
career choice	2011	2.65	2019	2021	
employment quality	2011	1.8	2019	2021	
doctoral student	2011	1.65	2019	2021	

*Table 3: International keyword emergent knowledge graph*

Keywords	Year	Strength	Begin	End	2011 - 2021
graduate student	2011	1.56	2011	2013	
gender	2011	1.54	2011	2013	
professional	2011	2.32	2012	2016	
scientist	2011	1.87	2015	2018	
job satisfaction	2011	2.18	2016	2017	
work	2011	1.78	2016	2019	
stress	2011	2.13	2018	2019	
education	2011	2.09	2018	2019	
career develop	2011	2.25	2019	2021	
knowledge	2011	2.1	2019	2021	
mobility	2011	1.97	2019	2021	

Regarding the emerging intensity of emergent keywords, academic careers, career options, and employability are the high-intensity emergent keywords in the Chinese postgraduate employment field. And specialisation, career advancement, knowledge, education, and job satisfaction are the high-intensity keywords in this field globally.

According to the pattern of emergent term evolution, the hotspots in the field of Chinese postgraduate employment evolved from 2011 to 2021. Between 2011 and 2016, China's macro employment is facing many pressures, such as economic slowdown, continuous increase in total employment, and the effective employment demand of graduates declining. China has introduced several policies to encourage postgraduate education reform and satisfy economic development demands to ease job issues. Examples include ‘the Outline of National Medium- and Long-Term Program for Education Reform and Development (2010-2020)’ and ‘Some Opinions of the Ministry of Education on Improving the Training



of Full-time Professional Master's Degree'. Numerous scholars have also conducted surveys on the whereabouts of postgraduate students to explore the influencing factors behind them. Between 2017 and 2021, the 'Overall Plan for Promoting the Construction of World-Class Universities and Disciplines' was released, and 'Double First-Class' construction peaked during this time. By 2021, there will be 509,500 PhD students enrolled, a sharp increase in the number of recognized doctoral sites and enrolment. The expansion of doctoral programs and increased competition in the academic market have contributed to a shift toward diversification of employment options.

Postgraduate education reform in China is moving toward connotative development and suggests that postgraduate education should be enhanced alongside the standard of development. Postgraduate employment research is gradually turning to improve the quality of postgraduate employment and respond to doctorate students' diversification of job options.

Research in the field of international postgraduate employment has also continued to evolve from 2011 through 2021. We have been delving deeper into the problems of disadvantaged groups, specialization, and work satisfaction in the employment process of postgraduate students from 2011 to 2017, primarily based on the current employment scenario of postgraduate students. Between 2018 and 2021, the fourth industrial revolution significantly impacted life, work, and communication, necessitating an immediate need for educational reform. Countries focus on developing relevant courses and programmes to prepare postgraduate students for a smooth transition from school to work. Additionally, the European Bologna Process, the Student International Mobility Grant Program, and the Organization for Economic Cooperation and Development's (OECD) liberalization of immigration visa policies all support student mobility for study abroad and employment and have become the focus of research.

In conclusion, Chinese postgraduate employment research has a strong policy orientation. In China, postgraduate education very recently began. The state has issued a series of policies to promote the catch-up development of postgraduate education. However, the imbalance between the supply and demand of talent has become more pronounced due to the rapid growth of the postgraduate student population. Countries have issued employment service policies and education reform measures to solve employment difficulties and meet social development needs. This shift in policy has driven academics to study employment-related concerns. While studies on the employment of foreign postgraduate students have evolved along the lines of the external influence mechanism to internal and external education reform, promoting better integration of postgraduate education with social needs and subsequently assisting postgraduate students in finding employment. Although postgraduate employment-related courses have slightly varied evolutionary pathways in China and elsewhere, they all gradually shift to internal development to accomplish the same objective of encouraging employment.

#### 4. Conclusions

Postgraduate employment influences not only the growth of postgraduates' individual careers but also the long-term planning of the country's full utilisation of human resources and university training. By utilizing visualization technologies, this study investigates the knowledge system of postgraduate employment in China and internationally. The main conclusions include the following points.

First, postgraduate employment research in China and elsewhere focuses primarily on higher education while slowly expanding into other sectors. However, interdisciplinary studies in China are still comparatively underdeveloped while it encompasses a broader range of fields in other nations. Interdisciplinary research collaboration is an important future development trend. It is necessary to strengthen the contact between disciplines.

Second, the core author groups and institutions in China and abroad have initially created a scale. However, neither a significant cooperation network nor a reliable cooperation team has yet developed. Institutions and scholars in the field of postgraduate employment also should strengthen cooperation and exchanges, set up a core cooperation team with a specific scale, and form a systematic cooperation network to dig deeper into the problem of postgraduate employment.

Third, the hotspots of Chinese postgraduate employment research primarily concentrate on postgraduate employment status and affecting variables, professional master's employability development, and career choices and cultivation of doctoral students. While three areas receive most of the attention in international nations: postgraduate employability and education matching, postgraduate employment outcomes and affecting factors, and issues with doctorate students finding jobs. Postgraduate employment studies in China and elsewhere are converging. Both advocate for postgraduate

education to align with the labour market to increase employment and satisfy societal requirements.

Fourth, postgraduate employment research has steadily tended to evolve in the direction of connotations like training and disciplines, fusing employment challenges with postgraduate education reform. This development is actual both domestically and internationally. The main forces for postgraduate employment research varied slightly between China and other countries. China exhibits a more strongly policy-oriented approach, with national directives and policies having a more significant influence on research. To satisfy the needs of the new period for development and to foster the development of the abilities required by society, it will still be essential to push research education reform consistently.

The research findings may not be completely accurate, and there may be some deviations due to the completeness of the chosen database. The future can still be postgraduate employment visualization and other directions to expand. How to encourage postgraduate education to adapt to commercial needs is one of the priorities of future research. To help postgraduates transfer into the workforce smoothly, we should create new models for employment services and improve their employability and creative thinking.

### Acknowledgements

Conflicts of Interest: The authors declare no conflict of interest.

### References

- [1] A. Kuzhabekova, 'Charting the terrain of global research on graduate education: a bibliometric approach', *Journal of Further and Higher Education*, vol. 46, no. 1, pp. 20–32, Jan. 2022, doi: 10.1080/0309877X.2021.1876219.
- [2] T. Tang, M. A. Aldhaeabi, J. Q. Lan, and E. Bamanger, 'Comparison of the Graduate Education between Canada and China', *IJHE*, vol. 9, no. 4, p. 13, May 2020, doi: 10.5430/ijhe.v9n4p13.
- [3] L. McAlpine, M. Castello, and K. Pyh  t  , 'What influences PhD graduate trajectories during the degree: a research-based policy agenda', *High Educ*, vol. 80, no. 6, pp. 1011–1043, Dec. 2020, doi: 10.1007/s10734-019-00448-7.
- [4] A. Amida, S. Algarni, and R. Stupnisky, 'Testing the relationships of motivation, time management and career aspirations on graduate students' academic success', *JARHE*, vol. 13, no. 5, pp. 1305–1322, Dec. 2021, doi: 10.1108/JARHE-04-2020-0106.
- [5] E. Zhou and J. Gao, 'Graduate enrollment and degrees: 2010 to 2020', Council of Graduate Schools, Washington, DC, 2021. <https://cgsnet.org/data-insights/admissions-enrollment-and-completion/graduate-enrollment-and-degrees/> (accessed Nov. 02, 2022).
- [6] D. Cyranoski, N. Gilbert, H. Ledford, A. Nayar, and M. Yahia, 'The PhD factory: The world is producing more PhDs than ever before. Is it time to stop', *Nature*, vol. 472, no. 7343, pp. 276–279, 2011.
- [7] International Monetary Fund. Research Dept., *World Economic Outlook, October 2022*. Washington, USA: International Monetary Fund, 2022. [Online]. Available: <https://doi.org/10.5089/9798400218439.081>
- [8] V. Kumar, H. Alshazly, S. A. Idris, and S. Bourouis, 'Evaluating the Impact of COVID-19 on Society, Environment, Economy, and Education', *Sustainability*, vol. 13, no. 24, p. 13642, Dec. 2021, doi: 10.3390/su132413642.
- [9] S. Dewan, E. Ernst, and S. Achkar Hilal, 'World employment and social outlook: trends 2022', International Labour Organization, 2022. [Online]. Available: [https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms\\_834081.pdf](https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_834081.pdf)
- [10] National Bureau of Statistics, 'Annual data of National Bureau of Statistics of the People's Republic of China'. <https://data.stats.gov.cn/easyquery.htm?cn=C01> (accessed Sep. 21, 2022).
- [11] H. Luo, T. Xiang, and Y. Gao, 'Analysis of the Employment Characters of PhD Students after Graduation in China', *Academic Degrees & Graduate Education*, no. 01, pp. 53–62, 2022, doi: 10.16750/j.adge.2022.01.009.
- [12] X. He and X. He, 'Analysis of the Mechanism of "Three Wide Education" for Postgraduates in Post-epidemic Era', *Academic Degrees & Graduate Education*, no. 03, pp. 32–37, 2021, doi: 10.16750/j.adge.2021.03.006.
- [13] H. Li, K. Liu, Y. Yang, and J. Zhang, 'Research on the Employment Quality Evaluation, Influencing Factors and Promotion Ways of College Masters in First-tier Cities', *Northwest Population Journal*, vol. 43, no. 02, pp. 114–126, 2022, doi: 10.15884/j.cnki.issn.1007-0672.2022.02.010.
- [14] S. Dryden and S. Dovchin, 'Translingual English discrimination: loss of academic sense of belonging, the hiring order of things, and students from the Global South', *Applied Linguistics Review*, 2022, doi: [org/10.1515/applirev-2022-0065](https://doi.org/10.1515/applirev-2022-0065).

- [15] N. H. Choe and M. Borrego, 'Master's and doctoral engineering students' interest in industry, academia, and government careers', *J Eng Educ*, vol. 109, no. 2, pp. 325–346, Apr. 2020, doi: 10.1002/jee.20317.
- [16] S. J. Lee, S. Kim, and J. Jung, 'The Effects of a Master's Degree on Wage and Job Satisfaction in Massified Higher Education: The Case of South Korea', *High Educ Policy*, vol. 33, no. 4, pp. 637–665, Dec. 2020, doi: 10.1057/s41307-020-00200-2.
- [17] M. Zhu, C.-Y. Guo, A. Y.-C. Hou, and M.-S. Chiu, 'Graduate employment in higher education: applying bibliometrics to world-system theory', *Journal of Education and Work*, vol. 34, no. 3, pp. 356–372, Apr. 2021, doi: 10.1080/13639080.2021.1922621.
- [18] Y. Ma and L. Ma, 'Visualization Analysis of Research on College Graduates' Employment Structure and Industrial Structure', *Education & Economy*, no. 06, pp. 40–46, 2016.
- [19] C. Chen, 'CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature', *J. Am. Soc. Inf. Sci.*, vol. 57, no. 3, pp. 359–377, Feb. 2006, doi: 10.1002/asi.20317.
- [20] N. J. van Eck and L. Waltman, 'Software survey: VOSviewer, a computer program for bibliometric mapping', *Scientometrics*, vol. 84, no. 2, pp. 523–538, Aug. 2010, doi: 10.1007/s11192-009-0146-3.
- [21] L. Egghe and R. Rousseau, in *Introduction to Informetrics: quantitative methods in library, documentation and information science*, Amsterdam, Netherlands: Elsevier Science Publishers, 1990, pp. 341–344. [Online]. Available: <http://hdl.handle.net/10760/6011>
- [22] D. J. D. S. Price, *Little Science, Big Science*. New York Chichester, West Sussex: Columbia University Press, 1963. doi: 10.7312/pric91844.
- [23] C. Chen, F. Ibekwe-SanJuan, and J. Hou, 'The structure and dynamics of cocitation clusters: A multiple-perspective cocitation analysis', *J. Am. Soc. Inf. Sci.*, vol. 61, no. 7, pp. 1386–1409, Mar. 2010, doi: 10.1002/asi.21309.
- [24] X. Zhao and Y. Chen, 'Changes, Controversies and Approaches of the Enrollment Scale of Doctoral Students in China', *Higher Education Exploration*, no. 08, pp. 43–49, 2021.
- [25] W. Shen, X. Xie, and E. Guo, 'The Reform of the Academic Labor Market and Its Impact on Doctoral Education in China', *Educational Research*, vol. 43, no. 05, pp. 70–82, 2022.
- [26] Y. LI, 'Research on Employment Choice and Flow Trend of Chinese Doctoral Graduates: Taking Universities Directly Under the Ministry of Education as an Example', *China Higher Education Research*, no. 09, pp. 87–93, 2019, doi: 10.16298/j.cnki.1004-3667.2019.09.15.
- [27] L. Fan, 'On Non-academic Career Choice of Doctoral Students in Research Universities—Based on the Employment Data of "Double First-Class" Colleges and Universities(A)', *Research in Higher Education of Engineering*, no. 04, pp. 120–125, 2018.
- [28] Y. Gao, W. Qiao, and J. Yang, 'Where Did the Doctors from First-Class Universities Go? Analysis of Employment Trends of Doctoral Graduates', *Academic Degrees & Graduate Education*, no. 03, pp. 53–60, 2021, doi: 10.16750/j.adge.2021.03.009.
- [29] S. Qing and Y. Liang, 'Analysis of the Characteristics of the Diversity and Quality of PhD Graduates' Employment', *Academic Degrees & Graduate Education*, no. 11, pp. 56–62, 2019, doi: 10.16750/j.adge.2019.11.010.
- [30] S. Cheng and W. Liao, 'Diversified Employment and Doctoral Education: Empirical analysis based on data from C9 League', *Journal of Graduate Education*, no. 05, pp. 24–30, 2020, doi: 10.19834/j.cnki.yjsjy2011.2020.05.04.
- [31] 'Ministry of Education: Master's degree awards increased from 35% to 58%', Jun. 14, 2022. [http://www.moe.gov.cn/fbh/live/2022/54521/mtbd/202206/t20220614\\_637463.html](http://www.moe.gov.cn/fbh/live/2022/54521/mtbd/202206/t20220614_637463.html) (accessed Aug. 28, 2022).
- [32] L. Huang and M. Cao, 'Construction of Employment Guidance Models for Professional Degree Postgraduates', *Journal of National Academy of Education Administration*, no. 08, pp. 61–65, 2014.
- [33] J. Li and Y. Song, 'Research on Present Situation and Countermeasures of Postgraduate Training of Educational Economics and Management Specialty', *Academic Degrees & Graduate Education*, no. 11, pp. 46–50, 2016, doi: 10.16750/j.adge.2016.11.009.
- [34] Y. Shi and X. Wang, 'What Kind of Training Environment does Professional Degree Master's Students Need: An Empirical Study Based on the Survey of Master's Students', *China Higher Education Research*, no. 11, pp. 35–41, 2021, doi: 10.16298/j.cnki.1004-3667.2021.11.06.
- [35] F. Li, Y. Ma, and X. Fu, 'Influence of Training Mode on Employment of Master of Engineering', *Academic Degrees & Graduate Education*, no. 01, pp. 56–60, 2017, doi: 10.16750/j.adge.2017.01.012.
- [36] M. Li, N. Hao, H. Chen, and Y. Gao, 'A Comparative Study of Employment Status between Full-time Professional Master and Academic Master', *Higher Education Exploration*, no. 09, pp. 32-39+81, 2019.
- [37] F. Yu, W. Qiu, and C. Yue, 'An Empirical Study on Graduate Employment in China', *Academic Degrees & Graduate Education*, no. 06, pp. 32–38, 2019, doi: 10.16750/j.adge.2019.06.006.
- [38] C. Yue, 'Research on the Relationship between Higher Education Structure and Industrial Structure', *China Higher Education Research*, no. 07, pp. 31–36, 2017, doi: 10.16298/j.cnki.1004-3667.2017.07.07.

- [39] Y. Gao, X. Liu, and Y. Yi, 'Employment Status of Master's Degree Recipients in China—Based on a Quantitative Analysis of 75 Universities Directly under the Ministry of Education in 2014', *Journal of Graduate Education*, no. 03, pp. 12–19, 2016.
- [40] W. Wu, 'Quality of Bachelor Degree and Postgraduate's Starting Salary', *Education & Economy*, no. 03, pp. 89–96, 2017.
- [41] Y. Yue, 'Occupation Choice of Academic Postgraduates and Gender Differences', *Research in Educational Development*, vol. 37, no. 09, pp. 59-63+71, 2017, doi: 10.14121/j.cnki.1008-3855.2017.09.010.
- [42] X. Shi, Y. Chen, and K. Li, 'Empirical Test on Employment Preference of Graduate Students', *Statistics & Decision*, vol. 34, no. 24, pp. 113–116, 2018, doi: 10.13546/j.cnki.tjyj.2018.24.027.
- [43] J. Liu, C. Yue, and H. Yang, 'On the Factors Affecting Postgraduates' Employment and Starting Salary—An Empirical Analysis of 2019 National Graduate Employment Sampling Survey', *Education Research Monthly*, no. 11, pp. 64–72, 2020, doi: 10.16477/j.cnki.issn1674-2311.2020.11.009.
- [44] E. Krajňáková, V. Pilinkienė, and P. Bulko, 'Determinants Of Economic Development And Employability of Higher Education Institutions Graduates', *EE*, vol. 31, no. 2, pp. 211–220, Apr. 2020, doi: 10.5755/j01.ee.31.2.24751.
- [45] M. Solem, A. Kollasch, and J. Lee, 'Career goals, pathways and competencies of geography graduate students in the USA', *Journal of Geography in Higher Education*, vol. 37, no. 1, pp. 92–116, Feb. 2013, doi: 10.1080/03098265.2012.729563.
- [46] Z. Yue and K. Zhao, 'Understanding the Effectiveness of Higher Education System: Evidences from Market Outcomes of Early University Graduates in Seven European Countries', *Sustainability*, vol. 12, no. 18, p. 7761, Sep. 2020, doi: 10.3390/su12187761.
- [47] M. A. Fraser-Arnott, 'Librarians Outside of Libraries: The Experiences of Library and Information Science Graduates Working Outside of Libraries', *Libri*, vol. 65, no. 4, Jan. 2015, doi: 10.1515/libri-2015-0099.
- [48] A. García-Aracil, S. Monteiro, and L. S. Almeida, 'Students' perceptions of their preparedness for transition to work after graduation', *Active Learning in Higher Education*, vol. 22, no. 1, pp. 49–62, Mar. 2021, doi: 10.1177/1469787418791026.
- [49] D. Bunney, 'Facilitating the transition to postgraduate studies: What can we learn from the First Year Experience?' *J. Acad. Lang. Learn*, vol. 11, no. 1, pp. A23–A38, 2017.
- [50] S. Crabb and S. Ekberg, 'Retaining female postgraduates in academia: the role of gender and prospective parenthood', *Higher Education Research & Development*, vol. 33, no. 6, pp. 1099–1112, Nov. 2014, doi: 10.1080/07294360.2014.911251.
- [51] A. Rafferty, 'Ethnic penalties in graduate level over-education, unemployment and wages: evidence from Britain', *Work, Employment and Society*, vol. 26, no. 6, pp. 987–1006, Dec. 2012, doi: 10.1177/0950017012458021.
- [52] C. J. F. Waaijer, R. Belder, H. Sonneveld, C. A. van Bochove, and I. C. M. van der Weijden, 'Temporary contracts: effect on job satisfaction and personal lives of recent PhD graduates', *High Educ*, vol. 74, no. 2, pp. 321–339, Aug. 2017, doi: 10.1007/s10734-016-0050-8.
- [53] S. A. Carless, K. Robertson, J. Willy, M. Hart, and S. Chea, 'Successful Postgraduate Placement Experiences: What is the Influence of Job and Supervisor Characteristics?', *Australian Psychologist*, vol. 47, no. 3, pp. 156–164, Sep. 2012, doi: 10.1111/j.1742-9544.2012.00085.x.
- [54] R. Neumann and K. K. Tan, 'From PhD to initial employment: the doctorate in a knowledge economy', *Studies in Higher Education*, vol. 36, no. 5, pp. 601–614, Aug. 2011, doi: 10.1080/03075079.2011.594596.
- [55] C. N. Fuhrmann, 'Enhancing Graduate and Postdoctoral Education To Create a Sustainable Biomedical Workforce', *Human Gene Therapy*, vol. 27, no. 11, pp. 871–879, Nov. 2016, doi: 10.1089/hum.2016.154.
- [56] M. Schwabe, 'The Career Paths of Doctoral Graduates in Austria: European Journal of Education, Part II', *European Journal of Education*, vol. 46, no. 1, pp. 153–168, Mar. 2011, doi: 10.1111/j.1465-3435.2010.01465.x.
- [57] D. Jackson and G. Michelson, 'Factors influencing the employment of Australian PhD graduates', *Studies in Higher Education*, vol. 40, no. 9, pp. 1660–1678, Oct. 2015, doi: 10.1080/03075079.2014.899344.
- [58] 'The Humanities Coalition', Council of Graduate Schools. <https://cgsnet.org/data-insights/graduate-professional-development/the-humanities-coalition/> (accessed Nov. 01, 2022).