

Occupational choice, satisfaction and success of PhD graduates in East Asia and the West: A systematic review

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Abstract

The globally expanding doctoral education and the diminishing availability of academic job opportunities have prompted an increasing proportion of PhD graduates to seek employment beyond academia, drawing a growing scholarly interest. However, the existing literature on doctoral career pathways tends to be fragmented and dispersed, given the idiosyncratic individual and educational characteristics of doctorates grappling with the complex structural factors. To depict a comprehensive picture of the diversifying employment trajectories of doctorates across various geographical, disciplinary and sectoral contexts, this study conducts a systematic review, scouring 831 pertinent journal articles from the Web of Science. Following a set of inclusion criteria, 31 papers were ultimately selected to identify the key factors shaping employment trajectories of PhD graduates at structural (national supply and demand), institutional (employers' perceptions) and individual (doctorates' characteristics) levels. Drawing on the boundaryless and value-based career theories, the authors develop a four-dimension analytical framework, within which the findings of the 31 papers in East Asian and Western contexts are analysed. Overall, stakeholders in Western systems generally recognise the trend of PhD graduates securing non-academic employment, whereas

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East Asian nations appear less receptive to this agenda. Meanwhile, due to their strong emphasis on research skills utilisation and employment stability, PhD graduates in certain economies find it challenging to pursue satisfying and successful careers, warranting increased attention. Building on the findings, we propose a four-quadrat model in an effort to provide a tool for evaluating the capacity to absorb doctoral workforces of specific systems by categorising the doctoral professions. Highlighting shared patterns observed across various higher education systems and distinct trends prevalent in specific economies, this paper addresses key topics in doctoral education and doctorate employment literature such as labour market conditions, employment outcomes, job satisfaction, skills (mis) matches and sustainable careers.

1 | INTRODUCTION

The conflict between the expansion of doctoral education across the world (Pedersen, 2014) and the global decrease of academic job openings (Kim et al., 2018) has resulted in an increasingly higher proportion of doctorates pursuing careers beyond academia (Neumann & Tan, 2011)—the traditionally presumable career destination for doctorates,¹ and put employment trajectories of PhD graduates in the spotlight (Auriol, 2010; Buenstorf et al., 2023; Jung, 2018). Doctorates are generally characterised by national and international policymakers as core drivers of the 'Knowledge-Based Economy' (KBE) (Bryan & Guccione, 2018; Hancock et al., 2017) and various governments invest substantial public funds in doctoral education (Molla & Cuthbert, 2015). Against this backdrop, employment trajectories of doctorates are 'vital to economic growth' (Hancock et al., 2017, p. 1124) and of prominence to a vast community of stakeholders, including policymakers formulating the budget for doctoral education, employers considering hiring doctoral graduates, academics and administrators designing and implementing doctoral training programmes and PhD students and graduates assessing prospective career options.

The changing employment landscape of this highly skilled workforce has been explored by a plethora of research (Auriol, 2007; Auriol et al., 2013; Cruz-Castro & Sanz-Menéndez, 2005; Hancock, 2023; McAlpine, 2020; Recotillet, 2007; Spronken-Smith et al., 2022). However, most of existing studies revolved around the diversifying labour market outcomes of PhD graduates, with limited attention spared to their employment process. Meanwhile, given the idiosyncrasy of career developments of doctorates in different contexts, these studies tend to be dispersed and fragmented at (supra)national, institutional and individual levels, focusing on specific or singular countries, disciplines, institutions and programmes (Hancock et al., 2017; Herrera & Nieto, 2015; Jung, 2018; Neumann & Tan, 2011; Saffie-Robertson & Fiset, 2021). This means that analysis between countries is rarely conducted. Possibly due to language barriers and cultural differences in national contexts, such analysis is also seldom observed between East Asia and the West.

Compared with their Western counterparts, East Asian countries and regions generally are rather latecomers to a strategic vision of PhD employment embedded within KBE discourses (Shin et al., 2018). However, a closer investigation reveals that the doctoral education system of each East Asian country/region appears to be at distinct stages of development. On the one hand, some countries are producing more doctorates. For example, China

has produced 66,176 doctorates in 2020 (MoE, 2020), surpassing the second-largest producer, the US, by 10,893 (NSF, 2020). On the other hand, more advanced players have experienced a decline in the number of domestic doctorates, such as Japan, whose local doctorates decreased from 17,291 in 2006 to 15,564 in 2020 (MEXT, 2020). Moreover, expanding systems prioritise academia as the primary employment destination for their doctorates, while diminishing systems pay growing attention to non-academic employers (Jung, 2018; Kobayashi, 2011; Shin & Kehm, 2013). Against this backdrop, the nuanced varieties within East Asia warrant further examination.

To address the aforementioned research gap regarding employment process of PhD graduates within East Asian countries and regions as well as between East Asia and the West, this study conducts a systematic review, with particular focus on East Asia and West included. In endeavours to transcend the contextual limitations of prior research, which were primarily based on single countries, disciplines or institutions, this systematic review (1) proposes a conceptual framework to analyse employment process of PhD graduates and (2) provides a comprehensive picture of doctorate employment trajectories on an international scale. The remainder of the paper begins with the outline of the analytical framework, which combines insights from the boundaryless career theory (Arthur & Rousseau, 1996) and values-based career theory (Brown, 2002) to address doctorate employment trajectories in the contexts of West and East Asia. This is followed by the method used for this systematic literature review, including scooping procedure, selection criteria and descriptive information of the selected articles. The findings of the review are then analysed within the analytical framework. A four-quadrat model to evaluate the capacity of a system to absorb doctoral workforces is subsequently proposed. Finally, the article concludes with a discussion of the implications of the findings and future research priorities.

2 | ANALYTICAL FRAMEWORK

To guide our analysis of articles on the employment trajectories of doctorates across Western and East Asian contexts, we propose a four-dimension analytical framework that integrates boundaryless career theory (Arthur & Rousseau, 1996) and values-based career theory (Brown, 2002). Primarily drawing upon the boundaryless career theory to emphasise doctorates' agency and the values-based career theory to highlight sociocultural nuances of employment structures, this framework allows for a comprehensive investigation into the intricate interplay between agency and structure in four dimensions of doctorates' employment trajectories: choice-making and outcomes, satisfaction and success. The conceptualisation and operationalisation of the framework are presented in the following sections.

2.1 | Conceptualisation of the framework

Boundaryless career theory emerged when conventional bounded career theory became outdated in the global economy (Sullivan & Baruch, 2009), where 'opportunity, insecurity, flexibility, and uncertainty' coexisted, rendering the old-fashioned linear career trajectory and traditional orderly employment arrangements within one single institution out of place (Arthur & Rousseau, 1996, p. 3). Against this backdrop, boundaryless career theorists delved into how individuals sought extra-organisational support through interaction and negotiation with structural factors to 'leverage highly marketable skills' for career progressions transcending any single employer (Arthur et al., 2005, p. 26). This closely connects to the employment trajectories of doctorates, who agentively (McAlpine et al., 2014; McAlpine & Amundsen, 2009; Nguyen & Blalock, 2023) pursue cross-sectoral careers (Hancock, 2019; Neumann & Tan, 2011; Pedersen, 2014; Recotillet, 2007). Although the theoretical foundations of boundaryless career theory are well established with respect to academic contexts (Chen, 2021; Dowd & Kaplan, 2005; Ortlieb & Weiss, 2018), the same theory was criticised for its overemphasised individualism (Pringle & Mallon, 2003) and simplicity (Sullivan & Baruch, 2009). Moreover, like many other prevalent career theories,

boundaryless career theory originated from the Western context, with European Americans as its prototypes (Arthur & McMahon, 2005; Brown & Crace, 1996). This resulted in its limited exploration of non-Western contexts (Sullivan & Baruch, 2009), as it failed to adequately include sociocultural nuances into important structural elements in career development (Heslin, 2005; Stead, 2004). Recognising these limitations and considering the diverse sociocultural landscapes contextualising the study, we incorporate the values-based career theory to complete our analytical framework.

To address the overlooked 'cultural values', Brown (2002, p. 48) proposed the values-based career theory. Delineating a stark contrast between East Asians characterised by collectivism and Europeans and Americans by individualism, values-based career theory examined how career development differed among people from various cultural backgrounds. While the impact of cultural elements (e.g. Confucianism (Pekerti, 2008), filial piety (Jin et al., 2009) and moral emphasis on harmony (Zhang & Chen, 2015)) on the career development of East Asians has been consistently confirmed, it would be erroneous to assume uncritically a universally shared value system across individuals within one cultural or ethnic group (Brown, 2002). For example, although early proponents (Granrose & Chua, 1996) of the values-based career theory cautioned against the integration of values-based and boundaryless career theories, emphasising the inclination among East Asians towards hierarchical career structures, recent research effectively dispelled these concerns and substantiated the combination of the two theories by demonstrating that East Asians could be boundaryless career pursuers (Chen, 2021; Pang, 2003) as well. Therefore, to enable analysis across different cultures, our analytical framework incorporates both the boundaryless career theory and the values-based career theory.

2.2 | Operationalisation of the framework

In the following sections, we articulate the distinctive albeit complementary contributions of values-based career theory and boundaryless career theory in formulating the analytical framework for the study, beginning with the overall structure of this framework and proceeding through the operationalisation of each dimension to the rationale underpinning the theoretical integration.

2.2.1 | Contributions of values-based career theory

A four-dimension framework

In his original work, Brown (2002) divided career development into three dimensions, that is occupational choice, satisfaction and success. Although umbrellaed under 'occupational choice', nuanced analysis was made to differentiate between the career choice-making process and its outcomes (Brown, 2002, p. 50), with the latter referring to specific jobs selected by the individual. Noticing this subtle yet evident differentiation, we subdivide occupational choice into two facets: the choice-making process and outcomes (see Figure 1). Deconstructing the previously unified dimension, this subdivision zooms in on greater details and allows for a more granular account of how doctorates make their career choices before landing on specific occupational outcomes.

The interplay between agency and structure

Described as 'a series of "estimates"' regarding their abilities, skills and values against the 'occupational alternatives being considered' (Brown, 2002, p. 51), the occupational choice-making process was extensively elaborated on in the values-based career theory. Such analysis underscored the dynamic interplay between individual agency and structural factors. In line with this, we relate individual agency to micro-level considerations such as demographic (i.e. age and gender) and educational (i.e. discipline and institution) variables, whereas structural factors

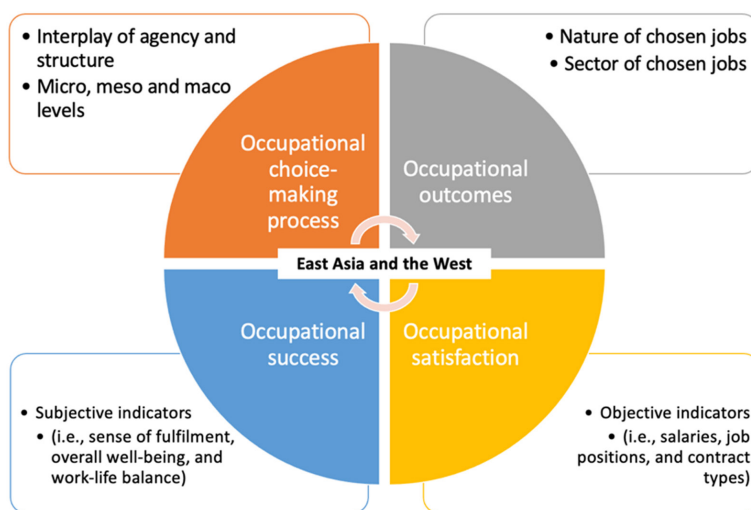


FIGURE 1 Analytical framework of career trajectories of doctorates with a focus on comparison between East Asia and the West (by the Authors).

are manifested through the influence at meso (i.e. employers and labour market conditions) and macro (i.e. national economy, governmental policies and (supra)national organisations) levels in the study.

Comparison between East Asia and West

Furthermore, Brown's (2002) observations highlighted the heterogeneities in the employment trajectories experienced by East Asians and Europeans/Americans, with the former profoundly influenced by significant others, whereas the latter mainly guided by their own principles. Consistent with these insights and the research purpose of the study, our framework classifies the employment trajectories of doctorates into East Asian and Western scenarios for examination.

2.2.2 | Contributions of boundaryless career theory

Despite its contributions in operationalising occupational choice-related dimensions, values-based career theory fell short in providing detailed insights into occupational satisfaction and success. In light of this limitation, boundaryless career theory completed the framework, enabling the operationalising of occupational satisfaction and success in the study.

Boundaryless career theory focused on career success and succinctly defined it as 'the achievement of desirable work-related outcomes at any stage of an individual's career over time' (Guan et al., 2019, p. 390). This definition, underscoring individuals' subjective perception of their career achievements, seemed to reflect the aforementioned concerns regarding the excessive individualism within boundaryless career theory. However, a closer examination revealed that, contrary to the criticism, boundaryless career theory adopted a broad spectrum of indicators encompassing structural factors and individual considerations when assessing career success. The indicators included objective measures such as salaries, job positions and contract types, alongside subjective criteria like sense of fulfilment, overall well-being and work-life balance (Arthur et al., 2005; Arthur & Rousseau, 2001; Guan et al., 2019), featuring a comprehensive approach to operationalising occupational satisfaction and success for the study.

In integrating values-based career theory and boundaryless career theory, a notable disparity between these two theories emerged: dimensions of satisfaction and success were separated in the former while synthesised in

the latter. Attempting to untangle the indistinguishability between these two, Heslin (2005) delineated occupational satisfaction as an immediate measure of occupational success primarily derived from objective aspects, whereas occupational success as a more intricate and long-term achievement predominantly assessed through subjective criteria. This approach, on the one hand, aligned with the indicators employed by boundaryless career theorists and, on the other hand, resonated with the separation between satisfaction and success in values-based career theory. Adopting Heslin's analysis, our framework assesses occupational satisfaction of doctorate employment against objective indicators and evaluates occupational success for doctorates through subjective ones (see Figure 1).

As illustrated above, the formulation of our framework benefited from combining values-based career theory and boundaryless career theory. Specifically, the four dimensions in our framework were derived from the career stages (occupational choice, satisfaction and success) presented in values-based career theory, with the occupational choice stage broken down into process and outcomes (manifested by nature and sector of actual job choices). To maintain the prominent agency-structure interaction in values-based career theory, the occupational choice-making process is scrutinised at the micro, meso and macro levels. Meanwhile, our framework primarily draws upon boundaryless career theory to assess occupational satisfaction via objective indicators (e.g. salary, job position, contract type), while occupational success via subjective ones (e.g. sense of fulfilment, well-being, work-life balance). Overall, sociocultural nuances initially exemplified by career trajectories of East Asians and Westerners in the values-based theory (Brown, 2002) are retained as the core of our framework in alignment with our research purpose.

3 | SYSTEMATIC REVIEW METHOD

Once the theoretical framework is in place, a systematic review is undertaken to evaluate the efficacy of the framework and address the research gap in terms of employment trajectories of PhD graduates across East Asia and the West. To ensure the comprehensiveness and quality of the study, the authors followed a set of steps for systematic reviews (Bearman et al., 2012; Gough, 2007), from retrieval and refinement of the database through identification and selection of relevant abstracts to the determination of final texts, with iterative cross-checks throughout the process (see Figure 2). Eligible articles were electronically retrieved from the Web of Science (WoS), a scholarly database representative of high-quality literature (Xu et al., 2019). To scope an extensive yet manageable literature, [employ*] was chosen as the main search word, with [doctoral graduate employ*] (453 results) and [PhD graduate employ*] (378 results) input into the advanced search query builder on WoS. No filters were applied, to ensure the breadth of our database at this initial stage. These 831 entries, along with their publication descriptors including authors, titles, abstracts, publication years and source journals, were retrieved and exported from WoS in an Excel spreadsheet on August 26, 2022. Considering the manageability of the review and the considerable amount of data collected, the authors intentionally abstained from expanding the database through additional retrieval procedures.

Based on the bibliographic information provided by WoS, the database was refined to include only peer-reviewed research articles relevant to our research aim. After first removing 123 repetitive entries, 129 conference papers identified by conference-related indicators, including [publication type], [conference title], [conference date], [conference sponsor], [conference location] and [meeting abstract], were also excluded. Meanwhile, since English is the only language shared by the authors, 40 non-English-written (e.g. Korean, Chinese, Spanish, Russian) articles were discarded. Then, two entries with no accessible full texts or DOIs were dropped after manually checking the availability of full texts. Next, 49 entries, categorised as commentaries, editorials, correspondences and interviews, were deleted from the list. Finally, 488 entries were clustered as peer-reviewed research articles for further selection.

After another round of removal of irrelevant articles,² the final set of research articles was selected through cross-reading between the authors. At this stage, 91 papers were synthesised in a reading grid (see Appendix S1),

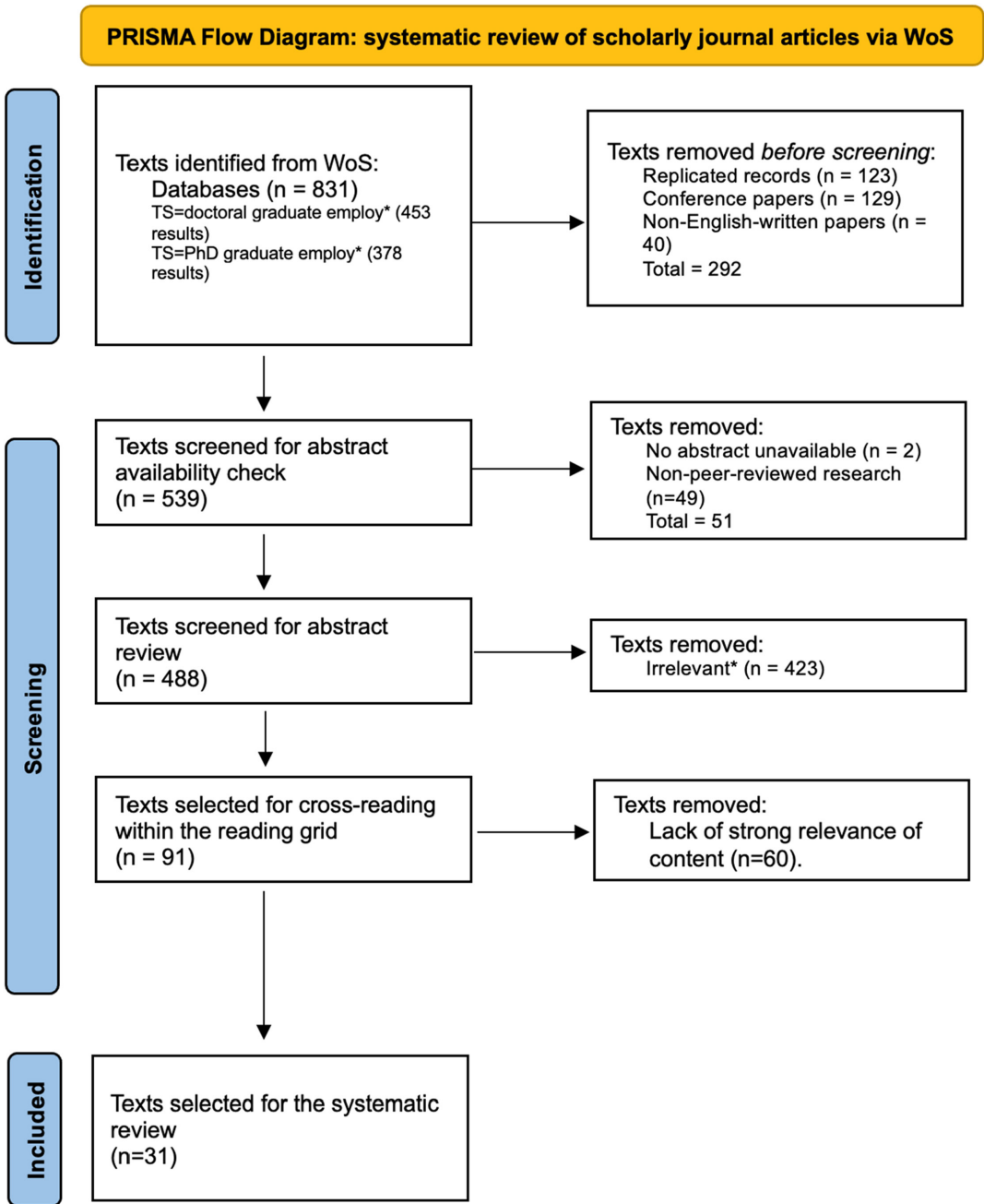


FIGURE 2 Adaption of PRISMA flow diagram (2020).

including publication descriptors (year of publication, journal, type of research, methods, level of analysis and location focus) and selected themes reflecting the four dimensions of our analytical framework (choice-making, outcomes, satisfaction and success). Finally, the authors decided on the final texts according to the research purpose separately and then compared their lists in three rounds of discussion to ensure cross-reliability before finalising on 31 papers.

4 | DESCRIPTIVE INFORMATION

4.1 | Bibliographic information

The earliest three papers selected in this study were published in 1993, 2001 and 2009. From 2011 onwards, except for 2014, at least one paper has been published each year in the dataset. Notably, 26 out of the 31 papers were published in last decade. These selected papers appeared in twenty different journals: slightly more than half were published in Higher Education journals, with Higher Education (7) and Studies in Higher Education (4) covering the majority. The remaining papers were published in other Educational journals (4), in the field of Management and Economics (5), Science and Technology (2) and other Social Sciences outlets (4).

4.2 | Methodological approach and data collection

Almost 80% of the papers mainly involved quantitative analyses (24), of which 15 drew on secondary data and nine on original data. Questionnaires were most frequently used in data collection (23), while policy documents (2), online data (2), case studies (2), interviews (1) and narratives (1) were utilised for data collection in the remaining texts. The data sampling spanned across multi-institutional (8), regional (1), national (17) and multinational (5) levels. Data collection varied in timeframe, with doctorate cohorts from the late 2000s to early 2010s being mostly investigated, whereas labour market conditions in the early and mid-2010s received considerable attention. Notably, the papers did not examine private employers until the 2000s (see Appendix S2).

4.3 | Discipline and location focus

Half of the 25 articles engaging with doctorate graduates' perceptions probed multiple disciplines (13). Eleven focused on the Sciences, with five examining the Sciences in general and six divided between Life Sciences, STEM and Social Sciences. Only one paper was dedicated to Social Sciences and Humanities. Besides the comprehensive coverage in disciplines, ten countries from four continents were surveyed on an individual-nation basis, comprising Australia (6), East Asia (4 on China and one on Japan), Europe (4 on Spain and one on Germany, Italy, Netherlands and the United Kingdom, respectively) and North America (4 on the US and two on Canada). In addition, two papers involved Chinese doctorates educated in the US. Occasionally, papers were situated within a continental scenario (e.g. Europe, East Asia) (3). Some comparative analyses of countries (e.g. France, Spain and the UK; Sweden and Spain) (2) were observed.

5 | KEY FINDINGS

This section presents the findings derived from our systematic review in both East Asian and Western contexts. In accordance with the four dimensions of our analytic framework, findings about the occupational choice-making process centre on the interplay between structure and agency, with the former mainly represented by labour market conditions within and beyond academia, whereas the latter by job-seeking activities of doctorates. Then, findings on occupational outcomes from the selected papers are categorised into the conventional binary (Hancock, 2023) of academic and non-academic sectors, outlining distinctive patterns from East Asia and the West. Finally, findings in relation to occupational satisfaction are reported against objective indicators of salary and contract types, while insights on occupational success are presented by subjectively perceived concepts of overskilling and skill (mis)matches, with due consideration given to sociocultural

differences whenever pertinent. Notably, our analysis is based on the findings reported by the 31 papers and reflects their specific foci in terms of geographical location, discipline, timeframe, key stakeholders, level of analysis, etc. (see more in Appendix S3). This has important implications for the underrepresentation of certain contexts in certain dimensions, such as the absence of East Asia in the analysis of occupational satisfaction and success.

5.1 | Occupational choice-making process

As clearly illustrated in the conceptual framework, the occupational choice-making process involves interplays between individual agency and structural elements at national, sectoral and institutional levels. To provide a clearer analysis, findings related to the choice-making process of doctorates from the 31 articles in our review are presented according to labour market condition and to individual agency across East Asian and western contexts.

5.1.1 | Labour market conditions: Within academia

As observed globally, the academic labour market appeared to be closely related to public funding for Higher Education (HE) sectors. In the 2000s, major countries in both West (Passaretta et al., 2019; Zeithammer & Kellogg, 2013) and East Asia (Shin et al., 2018; Yoshioka-Kobayashi & Shibayama, 2021) experienced dramatic decreases in academic professions (hereafter APs and NAPs for non-academic professions) availability. This decline was accompanied by an increase in fixed-term contracts as a result of the radical HE reforms catalysed by the 2008 economic recession and the concurrent expansion of doctoral education. Equally noteworthy to the decline of APs provision commonly observed in various contexts were the country-specific nuances, particularly at the meso level, where academic employers played a key role, as presented in subsequent sections.

The West

Academic employers in Western countries appeared to become more stringent over time. Only 25 percent of UK higher education institutions (HEIs) required prospective lecturers in the social sciences to hold a doctorate in the 1990s (Pearson et al., 1993). However, two decades later, as evidenced by an Australian study (Pitt & Mewburn, 2016), doctorate degrees became a standard prerequisite with HEIs listing, for example, up to 21 essential and ten desirable skills in their job advertisements. Specifically, Level A academics were expected to take responsibility for themselves and their students, be responsive to changes, teach, engage in professional development, perform administrative tasks and publish. Level B positions required additional competencies in the grant application, networking, external engagement, supervision and research, whereas Level C academics were further tasked with securing external funding and mentoring others. This image of 'academic superheroes' reflects the intensifying competition for career entrance and advancement within academia (Pitt & Mewburn, 2016).

Among all the prerequisites, publication was widely recognised as a key indicator when assessing applicants on the academic job market in the West. Examining the CVs of academics in sociology, social work/family studies, political science and psychology who secured their tenure-track assistant professorship in US research-intensive universities from 2010 to 2014, Hatch and Skipper (2016) reported that these doctorates published an average of 2, 3.9, 4.7 and 8.4 internationally indexed articles, respectively, before obtaining their positions. The figures varied across subjects, ranging from 0 to 10 for political scientists, 0 to 14 for sociologists, 1-27 for psychologists and 0 to 44 for those in social work or family studies (Hatch & Skipper, 2016), suggesting that publication was not the sole criterion adopted by US academic employers when evaluating prospective candidates.

East Asia

Two prominent features concerning the academic labour market in East Asia surfaced from the selected papers. One concerned the coexistence of two contrasting recruitment paradigms adopted by certain elite universities in China: one was universalism, underscoring individual research productivity, primarily through the number of international publications (three on average), and the other was particularism, associated with academic inbreeding (Jiang et al., 2020; Shen et al., 2018). Examining Chinese PhD returnees, Jiang and her colleagues (2020) demonstrated how the notion of meritocracy within universalism was counterbalanced by the undesirable effects of particularism (with the coefficient decreasing significantly from 3.6 to 2.7) in China's academic labour market. Though discouraged by institutional policies, such particularism was not uncommonly observed and was sometimes alternatively interpreted as 'loyalty and commitment' (Jiang et al., 2020, p. 33).

The other feature referred to the inclusion of research institutes into the realm of academia in research contextualised in China (Shen et al., 2018), where research institutes were positioned as parallel entities to orthodox academic employers like HEIs in terms of doctorate employment. This contrasted with the situation in major Western countries, where research institutes were often separated from academic employers, as in relevant discussions about the US (Shen et al., 2018), Europe (Di Paolo, 2016; Di Paolo & Mañé, 2016) and Australia (Molla & Cuthbert, 2015). Some studies conducted in Western contexts even placed research institutes in the private sector domain (Passaretta et al., 2019; Pearson et al., 1993). Incorporating an additional entity into consideration, this distinctive inclusiveness appeared to broaden the pool of employment opportunities for doctorates who favoured academic careers or similar professions. Nevertheless, whether this integration involved substantive disparities or merely reflected normative distinctions requires further analysis.

5.1.2 | Labour market conditions: Beyond academia

Findings from the papers collectively indicated that doctorate employment outside of academia typically depended on the intensity of research and development (R&D) investment, from government on macro levels and from employers from meso levels. In the 1990s, European governments predicted an increase in the demand for doctoral workforces from NAPs based on their projected augmentation of national R&D spending (Beltramo et al., 2001). Since then, a positive relationship between intensity of R&D investment and the proportion of doctorates employed in NAPs has been consistently observed in Europe and the US (Beltramo et al., 2001). Globally, the US took the lead in providing NAPs for doctorates, while advanced economies in Europe, such as Germany, the Netherlands and Sweden, also performed well in absorbing doctorates beyond academia (Hnatkova et al., 2022). These geographic disparities in NAP provision could result in frequent occupational mobility among doctorates, who tended to migrate towards locales with more R&D investments and greater employment availability (Passaretta et al., 2019). Thus, it came as no surprise that regions with intensified R&D investment—like North-western European countries (Reale et al., 2019) and the US (Sinche et al., 2017; Zeithammer & Kellogg, 2013)—seemed to experience a net gain in global brain circulation. However, the presence of children and older age when obtaining doctoral degrees (Reale et al., 2019), as well as visa policy (Jackson & Michelson, 2015; Roach & Skrentny, 2019; Zeithammer & Kellogg, 2013) occasionally hindered such mobility. Despite these commonalities, non-academic labour market conditions for doctorates varied across Western nations.

The West: US

Selected papers on the labour market outside of academia in the US predominantly focused on strategies to retain international doctorates in STEM fields for US economy. For example, Zeithammer and Kellogg (2013) conducted a series of surveys on Chinese STEM doctorates educated in US institutions, confirming that given the current US-China salary differentials, 80% of the respondents preferred to work in the US. Moreover, female STEM Chinese doctorates generally exhibited a higher level of such willingness, which was primarily

driven by better career prospects in the US rather than the previously hypothesised marriage prospects (Zeithammer & Kellogg, 2013). In the subsequent counterfactual test where the wage differentials were eliminated, this figure plummeted to 30%. Another survey (Roach & Skrentny, 2019) focused on US start-ups, revealing that foreign STEM doctorates in the US exhibited greater risk tolerance than their domestic counterparts and were more interested in joining start-ups. However, due to visa restrictions, the proportion of international doctorates working in US start-ups was half that of their domestic counterparts, primarily due to visa restrictions, despite the fact that both groups performed equally well in obtaining job offers from these start-up employers (Roach & Skrentny, 2019).

The West: Europe

Selected papers presented a more nuanced picture of the situation in Europe. On the one hand, European governments and supranational organisations, such as LERU (League of European Research Universities) and Eurodoc (the European Council of Doctoral Candidates and Junior Researchers), unanimously accoladed the diversification of career pathways available for doctorate holders beyond academia (Beltramo et al., 2001; Hnatkova et al., 2022). On the other hand, however, some non-academic employers in Europe appeared to have limited interests in hiring doctorates. For example, even though over 60% of non-academic employers sampled in a survey in Spain acknowledged the unique value of doctoral workforces to their companies, a mere 10% were willing to hire one (Garcia-Quevedo et al., 2012). This unwillingness was further scrutinised. From the demand side, it was widely confirmed that non-academic organisations engaging more in R&D activities (e.g. securing public R&D funding, establishing dedicated R&D departments, obtaining scientific knowledge from academic sources and forging partnerships with universities or research institutes) were more likely to develop demands for doctoral employees (Beltramo et al., 2001; Garcia-Quevedo et al., 2012; Germain-Alamartine & Moghadam-Saman, 2020; Herrera & Nieto, 2015). Additionally, as evidenced by Herrera and Nieto (2015), a 1% increase in company size could lead to a 29% rise in the expected number of doctoral employees, notwithstanding the U-shaped pattern between company size and doctorate demands identified in other research (Garcia-Quevedo et al., 2012). This relationship was further complicated by the cumulative effect, wherein previous experience of employing doctoral candidates reinforced non-academic employers' demands for additional doctoral employees (Garcia-Quevedo et al., 2012), making demands for doctoral workforces in European non-academic sectors more difficult to predict.

Despite these demands, non-academic employers in Europe, particularly those from small and medium enterprises, appeared hesitant and risk-averse when it came to hiring doctoral employees, primarily due to financial concerns over onboarding training and higher salary requested by PhD holders (Germain-Alamartine & Moghadam-Saman, 2020). Instead of hiring full-time doctorates, these non-academic employers addressed their demands for doctoral workforces by recruiting university researchers on temporary contracts, subcontracting R&D tasks to research institutes, establishing alliances with external producers of scientific knowledge and employing individuals with lower or alternative qualifications (Beltramo et al., 2001; Garcia-Quevedo et al., 2012). These alternatives were highly cost-effective, as employees of lower qualifications were sometimes perceived to outperform their doctoral counterparts in assimilating scientific information and bridging upstream (R&D divisions) and downstream (production and marketing divisions) departments, which was one of the core value of doctorates for non-academic employers (Beltramo et al., 2001).

East Asia

In papers on East Asia, discussions about non-academic employers appeared to be relatively limited. The attitudes of non-academic employers towards engaging in the doctoral labour market were implicit and, therefore, could only be inferred indirectly from fragmentary evidence. For example, when examining factors influencing career choices of doctorates in mainland China, Shen and his colleagues (2018) mentioned the non-competitive starting salaries offered by NAPs in comparison with APs. This may suggest the current unattractiveness of NAPs to recent

doctorates in economic terms and indicate the potential for China's non-academic sectors to further recognise the value of doctoral expertise. However, substantiation of this interpretation necessitates additional empirical evidence.

The neglect of the non-academic labour market among scholarly discussions in East Asia may relate to the region's lack responsiveness to the KBE discourse prevalent in the West, where PhD graduates are expected to contribute to national economy by working in the non-academic sector. Specifically, although Korea and Hong Kong, PRC have shown excellence comparable to the US in producing next-generation academics, East Asia overall was 'slowly waking up' to the global trend of diversifying the employment landscape for doctorates (Shin et al., 2018, p. 149). This may be attributed to the lack of appropriate pedagogical approaches and policy support. To illustrate, research in Japan identified an inter-generational emulation of supervisory practices among current doctoral supervisors (Yoshioka-Kobayashi & Shibayama, 2021), who tended to train their doctoral students in the way they were trained, that is as future 'researchers' (Shin et al., 2018) or 'academic successors' (Gu et al., 2018), rather than 'versatile experts' (Gu et al., 2018). Similar phenomenon was observed in China (Gu et al., 2018), mirrored by doctoral students' recent complaints about the inadequate training they received to fulfil their broad career aspirations (Gu et al., 2018). One of the contributing factors to this lack of pedagogical approaches was the limited understanding of NAP practices among incumbent faculty members, less than half of whom having experience in commercial or societal research (Shin et al., 2018). Meanwhile, the selected papers also reported that both the Japanese and Chinese governments launched funding schemes dedicated to postdoctoral positions, which actually indirectly encouraged AP-oriented career trajectories among doctorates (Shen et al., 2018; Yoshioka-Kobayashi & Shibayama, 2021). No comparable schemes aimed at facilitating employment opportunities beyond academia were reported in selected texts on East Asia.

5.1.3 | Individual agency in job-seeking activities

Despite the discrepancies in employment landscapes between countries, doctorates worldwide shared the trait of being agentive in job-seeking activities. To illustrate, in China, it seemed customary for doctorates with better academic performance (manifested by publication records) and ambitions of obtaining faculty memberships in elite universities to take on postdoctoral positions after graduation (Shen et al., 2018). This strategy enhanced their likelihood of obtaining faculty membership by improving their academic maturity, broadening their professional networks, and importantly, circumventing undesirable academic inbreeding effects (Shen et al., 2018). Doctorates in Canada demonstrated similar individual agency (Chen et al., 2015), particularly those on postdoc positions, who tended to be rather agentive in publishing more, establishing more networks, engaging in more teaching and research activities and seeking a balance between family and career during job seeking. Meanwhile, doctorates exerted efforts to maintain good relationships with their supervisors, who provided them with discipline-specific skills and shaped their networks (Chen et al., 2015) or *Guanxi* (Shen et al., 2018) within and beyond the academic labour market. These networks were important for doctorates' career development since employers, especially those in industry, frequently relied on personal connections when recruiting doctoral employees (Germain-Alamartine & Moghadam-Saman, 2020; Hnatkova et al., 2022).

However, doctorates also encountered challenges when navigating the labour market. For example, they seemed to have limited knowledge of potential job opportunities, particularly those opportunities beyond academia (Hnatkova et al., 2022; Manathunga et al., 2009; Pearson et al., 1993). Also, their intense focus on academic affairs during doctoral studies appeared to have rendered them ill-prepared for job interviews, as evidenced by their limited understanding of customer orientation, lack of necessary professional networks and unawareness of industry's expectations regarding the relevance of their skills for non-academic positions, all of which greatly hampered them from effectively communicating their skills to prospective private employers and bargaining for better pay (Hnatkova et al., 2022).

5.2 | Occupational outcomes

Generally, high employment rates and diversifying employment sectors characterised the occupational outcomes of doctorates across various contexts. The employment rates of PhD graduates reported in studies in Europe, Australia and China typically ranged from 92% to 96% (Hnatkova et al., 2022; Neumann & Tan, 2011; Passaretta et al., 2019; Shen et al., 2018). Despite commonly observed high employment rates, it is difficult to identify a homogenous trend due to the kaleidoscope of disciplinary and sociocultural factors affecting occupational outcomes of PhD graduates. Details are outlined as follows.

5.2.1 | The West

According to the selected papers, the proportions of doctorates working in academia ranged from 48% to 62% in most European nations in the 2010s (Hnatkova et al., 2022). A closer examination unveiled significant national disparities, with the proportions being as low as 15% in Germany and Switzerland (Hnatkova et al., 2022), 25% in Australia (Neumann & Tan, 2011), 30%–35% in Italy (Passaretta et al., 2019) and as high as 50% in the Netherlands, Finland and the UK (Hnatkova et al., 2022).

Transcending the conventional AP and NAP dichotomy, researchers investigating the US context examined the occupational outcomes of doctorates based on the classification of research-intensive (RI) and non-research-intensive (NRI) jobs. An online survey administered to doctorates in the sciences field who had worked, trained or studied in the US from 2004 to 2014 revealed that 53% of the respondents held RI positions (Sinche et al., 2017). Within this group, 28% were employed in academia (17% on tenure tracks), while 25% pursued research careers in other sectors (16% in industry and 9% in government). This RI and NRI classifications were also recognised by scholars in Europe, as this classification extended research activities beyond traditional university boundaries to the wider society by directing attention to the independent and autonomous research skills within doctoral workforces in driving societal and economic transformation in the KBE (Hnatkova et al., 2022).

In addition to national variations, occupational outcomes varied by discipline. For example, papers consistently reported the significant gap between employment aspiration and attainment among doctorates in fine arts and humanities, whose higher aspirations for professorships frequently clashed with bigger difficulties in securing academic positions than their counterparts in hard disciplines (Chen, 2021; Hnatkova et al., 2022; Walters et al., 2021). In the US context, disciplinary variations in occupational outcomes among doctorates extended to interdisciplinarity. Data from a national survey conducted on doctorates who completed their doctoral degrees between 2004 and 2007 in the US revealed that compared with their counterparts with specified subjects, doctorates who conducted interdisciplinary doctoral dissertations/projects were more likely to end up in postdoctoral roles with lower chances of securing a faculty post in early career stages, despite their higher publication productivity (Millar, 2013). Disciplinary patterns were also observed in the non-academic sector. Among doctorates who opted for employment outside of academia in Europe, STEM PhDs were well represented in the private sector (Hnatkova et al., 2022), while humanities and natural sciences PhDs were more likely to work in the public sector (Di Paolo, 2016) and social scientists with doctoral degrees often in government positions (Hnatkova et al., 2022; Neumann & Tan, 2011). Regarding job tasks, generally over half of doctorates outside academia reported being engaged in RI jobs in European countries, with the percentages occasionally reaching 80% in some surveys (Hnatkova et al., 2022). The widespread presence of doctorates in non-academic sectors was believed to benefit the wider society and the professional environment, particularly through doctorates' high ethical standards at work (Hnatkova et al., 2022).

Individual factors mattered, too. For example, a study in the Spanish context uncovered that international mobility experience, non-first-in-family university status and receiving top marks (if applicable) in the Ph.D. thesis defence positively influenced the likelihood of working in academia (Di Paolo, 2016).

5.2.2 | East Asia

The majority of the articles that discussed occupational outcomes in East Asia focused on China. Overall, doctorates had a high employment rate in China, with only 7.63% of the respondents from 2016 cohort remaining unemployed months after graduation (Shen et al., 2018). The groups most at risk of finding employment were recent agriculturalists (12.8% unemployed) and historians (10% unemployed) (Shen et al., 2018). Meanwhile, doctorates from non-elite universities and those over 35 years old upon graduation seemed to be less competitive in China's labour market, suffering from 1.908 and 1.329 higher chances of unemployment, respectively, than their younger counterparts from prestigious institutions (Shen et al., 2018). Similar discrimination based on institutional prestige was also identified in the West (Jackson & Michelson, 2015), whereas age discrimination was less common in Western contexts, where longer tenure was more likely to be viewed as favourable accumulative capital (Di Paolo & Mañé, 2016).

In terms of employment sector, APs seemed to dominate the occupational outcomes among doctorates in East Asia, including faculty and postdoc positions in HEIs (and research institutes in China) (Shen et al., 2018; Yoshioka-Kobayashi & Shibayama, 2021). For instance, data extracted from a national survey with China's 2016 cohort of doctorates demonstrated that around 56% of the sampled respondents secured faculty positions months after graduation (Shen et al., 2018). However, further research revealed that due to intensifying competition in China's hierarchical higher education system, many new academics were employed in non-elite, local or newly founded universities (Shen et al., 2018). This phenomenon was worrying as the 'heavy teaching burden and limited research conditions' in these institutions 'would hinder [doctorates'] research potential', thereby jeopardising 'the long-term research innovation in China' (Shen et al., 2018, p. 294). Against this background, postdoc, a standard route to faculty jobs in research-intensive institutions (Yoshioka-Kobayashi & Shibayama, 2021), seemingly served as a viable alternative for some doctorates willing to pursue academic careers. Based on the aforementioned 2016 data on China's doctorates, 22.6% of the respondents were working on postdoc posts—the second most frequent destination—upon the survey (Shen et al., 2018). Similarly, a survey with doctorates in science disciplines in Japan also found that between 2002 and 2006, only 6.8% of the respondents obtained faculty positions upon graduation, while 44% worked as postdocs in hopes of securing faculty membership after postdoc experience (Yoshioka-Kobayashi & Shibayama, 2021).

Selected papers offer scant insights into the professional trajectories of doctorates beyond academia in East Asia. Based on the data from 2016 national survey, around one-fifth of doctorates in China were employed outside of academia (Shen et al., 2018). This group primarily comprised male doctorates specialising in fields like physics, engineering and agriculture with less competitive academic outputs but more patents during doctoral studies than their counterparts holding APs (Shen et al., 2018). However, a recent survey (Gu et al., 2018) on doctoral students in their third year or above in China unveiled that less than half (47.9%) of the younger generations stayed committed to academic pursuits upon graduation. Their career aspirations changed along their doctoral training, with 20.9% of the respondents shifting their initial pursuit for APs to NAPs while 10% illustrating the opposite. Factors such as obtaining doctoral degrees from non-elite universities and having collaborated with non-academic organisations during doctoral studies facilitated transition of career preferences from APs to NAPs, while majoring in liberal arts and studying at elite universities contributed to the otherwise. Although changes in aspirations were observed, the actual materialisation is yet to be examined.

5.3 | Occupational satisfaction (objective indicators)

Occupational satisfaction was only addressed in Western contexts in the selected papers. Generally, doctorates working outside academia reported significantly higher levels of occupational satisfaction in terms of earnings, promotion opportunities and working conditions than their counterparts in academia (Di Paolo, 2016). Among these objective indicators, salary and contract type were extensively examined.

5.3.1 | Salary

Salary levels among doctoral employees were influenced by various micro-level factors, such as gender, age and educational characteristics. Specifically, there was a pronounced gender difference favouring male doctoral employees in annual earnings, as evidenced in Spain (Di Paolo & Mañé, 2016). Meanwhile, earnings of doctoral employees were found to increase with the age at the time of job entry and with longer job tenure, seemingly underscoring the value of accumulated human capital in Spain's labour market (Di Paolo & Mañé, 2016). However, accumulation in time was not always advantageous. For example, extended durations to complete doctoral education (exceeding six years) and prolonged gaps between bachelor's graduation and the commencement of doctoral studies were found in relation to detrimental impacts on doctoral employees' earnings (Di Paolo & Mañé, 2016).

At the meso level, salaries of doctorate employees varied significantly by sector. In the European context, jobs outside academia generally offered better salaries, leading to consequently higher levels of occupational satisfaction (Hnatkova et al., 2022). This trend was empirically exemplified in Spain (Di Paolo & Mañé, 2016) and Germany, where such disparities in salary reached one-third (see in Shin et al., 2018). Company size mattered, too, with those employed by medium-large companies earning considerably higher salaries than their counterparts in small ones, ultimately contributing to elevated job satisfaction in the former (Di Paolo & Mañé, 2016). Meanwhile, individuals holding managerial positions or engaged in health-related roles, even in public sectors within Spain, also earned more (Di Paolo & Mañé, 2016).

Disciplinary disparities were notable as well. Doctorates from STEM fields were better paid in the US (see in Shin et al., 2018) and Europe (Hnatkova et al., 2022). For example, in the US, doctoral degree holders in mathematics and computer sciences earned twice the salaries of those in the humanities, while those in physical sciences earned 1.6 times higher, and those in psychology and social sciences earned 1.4 times higher salaries (Shin et al., 2018). This international recognition of STEM doctorates in labour markets raised concerns in scholarly discussions in East Asia not regarding the occupational satisfaction but rather the challenges of attracting qualified doctoral students to fields with lower economic returns (Shin et al., 2018), reflecting the persistent AP orientation in East Asian context as demonstrated by selected papers pertinent to other dimensions.

5.3.2 | Contract type

The other factor wielding substantial influence on the occupational satisfaction of doctoral professionals was the type of employment contract. A survey with doctorates working under temporary contracts in Germany reported lower levels of occupational satisfaction across all sectors (Goldan et al., 2022). Similar results were found in Netherlands, regardless of prospects for securing permanent positions (Waaiker et al., 2017). In academia, the difference in mean occupational satisfaction between temporary and permanent employees was notable (10% disparity), while in the industry, the gap was slightly smaller (6% disparity) (Goldan et al., 2022). These disparities within academia were explainable either from the social comparison perspective where a permanent contract was perceived as a desirable social reward or from the rational choice perspective where a permanent contract offered greater certainty, leading to improved work-life balance and reduced stress, ultimately contributing to higher job satisfaction (Goldan et al., 2022; Hnatkova et al., 2022; Waaiker et al., 2017). Empirical evidence from a longitudinal study in Germany further bolstered these theoretical inferences, confirming that obtaining a permanent employment contract enhanced the occupational satisfaction of doctoral professionals by 7.6% and this positive effect remained robust even after five years (Goldan et al., 2022). Additionally, the transitioning from academia to industry led to a 4% increase in occupational satisfaction for doctorates (Goldan et al., 2022). Notably, occupational satisfaction levels eventually converged among permanent employees across all sectors, underscoring the crucial role of the contract type in determining the occupational satisfaction among doctoral professionals (Goldan et al., 2022).

Across Europe, 20%–49% of doctorate holders worked on temporary contracts, significantly exceeding the average figure (11%) of the overall workforce at all educational levels in the same year of 2020 (Hnatkova et al., 2022), implying the precarious work conditions faced by this highly skilled workforce in Europe. However, this varied by sector. For example, recent data from doctorates in Germany five years after graduation showed that the academic sector had the highest share of temporary contracts (76%) for doctoral workforces, followed by the public (54%) and private (33%) sectors (Goldan et al., 2022). Meanwhile, 90% of PhD holders in the industry sector were working under permanent contracts across Europe (Hnatkova et al., 2022). Furthermore, the risks of holding temporary contracts for PhD graduates appeared to show an upward trend, with the figure growing by 9% for those in hard sciences and 12% for those in soft sciences among sampled doctorates in Italy five years after graduation (Passaretta et al., 2019). In contrast, surveys conducted in the Netherlands revealed an opposite pattern, where 40% of doctorates obtained permanent contracts 1–3 years after graduation and 55% for those who graduated 4–5 years ago (Waijjer et al., 2017). The mixed patterns illustrated national and temporal discrepancies that were less explored in current papers.

5.4 | Occupational success (subjective indicators)

In alignment with our theoretical framework, occupational success was mainly evaluated against subjective indicators, typically referring to overskilling³ reported by employees and skills (mis)matches reported by employers, according to the selected papers.

5.4.1 | Overskilling

Generally, overskilling decreased the degree of self-perceived occupational success among doctorates. Relevant to job contents and tasks, overskilling occurred when doctorate employees perceived the skills they acquired during doctoral training not necessarily required to perform their jobs (Di Paolo & Mañé, 2016). This was sometimes accompanied by overeducation, referring to the situation when a doctoral degree was not necessary to secure the current job, although studies unveiled that overeducation impacted occupational success through overskilling (Di Paolo & Mañé, 2016; Hnatkova et al., 2022).

From information provided by the papers, the degree of overskilling varied by country. For example, across both RI and NRI careers, US doctorates reported a high degree of commensuration between the self-ratings they assigned to transferrable skills developed during their doctoral training and those required in actual work tasks (Sinche et al., 2017), correspondingly contributing to a high level of perceived occupational success. However, in Europe, around 35% to 55% of doctorates were overqualified for their current occupations (Hnatkova et al., 2022), whereas another 30% were overskilled when one quarter reported both (Di Paolo & Mañé, 2016). A study in the Spanish context found that overskilling was strongly linked to longer job tenure, working as research assistants before graduation and being employed in government or private companies (Di Paolo & Mañé, 2016). Conversely, having postdoctoral mobility, being able to develop R&D activities (Di Paolo, 2016) and conduct research at work (Hnatkova et al., 2022) improved doctorates' perceived skills alignment at work (Germain-Alamartine & Moghadam-Saman, 2020), improving their sense of occupational success.

Notably, subjective elements like the degree of overskilling exerted a more significant and enduring influence on the perceived occupational success among doctoral employees, which could hardly be compensated financially or balanced by occupational satisfaction determined by objective indicators (Auriol et al., 2013; Di Paolo, 2016). To illustrate, overskilling was frequently reported by doctorates in managerial positions within the private sector, whose earnings tended to be of the highest rank (Di Paolo & Mañé, 2016). Even being highly valued in monetary terms, these doctorates still felt unhappy about their employers' misusing their skills, thereby reporting a diminished sense of occupational success (Di Paolo & Mañé, 2016).

5.4.2 | Skills (mis)matches

In parallel with the overskilling reported by doctorates, skills mismatches from the employers referred to the misalignment between skills acquired by doctorates and those required by the employers, particularly by those in the non-academic sector (Cuthbert & Molla, 2015). Overall, there was a close skills match among OECD doctorates, with the best alignment found in academia (Hnatkova et al., 2022). Meanwhile, self-employed doctorates also reported a high level of skills matches and occupational success, attributed to the greater degree of independence, intellectual challenge, creativity, social status, level of responsibility, job contents and overall job evaluation they gained from operating their enterprises, as evidenced by a study in the Netherlands (Waijier et al., 2017). The occupational success experienced by self-employed doctorates aligned with European experts' assertion regarding doctorates' capacity to create new opportunities rather than merely occupying existing positions (Hnatkova et al., 2022).

On the contrary, most non-academic employers held contrasting opinions, expressing concerns about the lack of soft/transferrable/generic skills such as communication, organisation, client-oriented awareness, teamwork, career awareness and planning in their doctoral employees (Cuthbert & Molla, 2015; Hnatkova et al., 2022; Molla & Cuthbert, 2015; Pearson et al., 1993). Discourses on skills (mis)matches implied a skills deficit model, ascribing to universities' incompetency in developing skills in and preparing doctoral students for diverse career paths. Against this backdrop, developing professional skills in doctorates was considered important for doctoral graduates themselves, for governments who invested in doctoral education and for non-academic employers who expected higher levels of skills alignment from this highly skilled workforce (Hnatkova et al., 2022; Manathunga et al., 2009; Walters et al., 2021). As a result, driven by the notion of KBE, wherein doctorates were valuable assets for the national economy, several governments, particularly in Europe, Australia and Canada, initiated financial and administrative means to forge institutions to reform current doctoral programmes, with the goal of producing 'industry-ready' (Cuthbert & Molla, 2015, p. 44) and 'job-ready' (Molla & Cuthbert, 2015, p. 240) doctorates for non-academic employers. These responses entailed the enlargement of professional training programmes, heightened involvement with industrial parks and intensified industry-university collaboration (Garcia-Quevedo et al., 2012; Germain-Alamartine & Moghadam-Saman, 2020; Herrera & Nieto, 2015; Manathunga et al., 2009).

However, the skills deficit model widely embraced in Europe, Canada and Australia was not without criticism. For example, it was argued that doctoral students embarked on the doctoral journey with a wide range of soft skills developed through prior work and educational experiences, challenging the assumption of them being blank plates, as often portrayed in governmental policies that encouraged professional courses to be added into doctoral training (Manathunga et al., 2009; Molla & Cuthbert, 2015). Moreover, the uncritical bifurcation between doctoral training and the business environment raised questions (Molla & Cuthbert, 2015) too, particularly when their boundaries were becoming increasingly porous due to longstanding university-industry collaborations, especially in STEM fields (Molla & Cuthbert, 2015). Additionally, the tensions between traditional and broader functions of doctoral education—between blue sky research and immediately applicable research—remained examined (Cuthbert & Molla, 2015), also an ongoing debate in East Asia (Shin et al., 2018). Meanwhile, it was interesting to note that decades ago, employers, not universities, naturally assumed the responsibility for training their newly recruited doctoral employees (Manathunga et al., 2009; Pearson et al., 1993). Given these evolving dynamics, some scholars suggested industry employers participate more into the skills deficit models and scrutinise whether non-academic employers developed a PhD-ready industry (Cuthbert & Molla, 2015, p. 49) to 'productively engage with PhD graduates' (Molla & Cuthbert, 2015, p. 254) and provide appropriate job opportunities (Di Paolo & Mañé, 2016) to support the occupational success of doctorates.

6 | DISCUSSION

6.1 | Summary of key findings

Within the four-dimensional analytical framework, this systematic review uncovered some internationally shared patterns in the employment trajectories of PhD graduates. Regarding occupational decision-making, it is confirmed from the selected papers and wider literature that, despite their doctorates lack of appropriate job interview skills (Saffie-Robertson & Fiset, 2021), doctorates are highly agentive when navigating the labour market (McAlpine et al., 2014; McAlpine & Amundsen, 2009). The deteriorating labour market conditions in academia seem a global phenomenon (Barringer, 2016; Beatson et al., 2022; Horta, 2009; Saffie-Robertson & Fiset, 2021), while the provision of NAPs is more country-specific for varying intensity of national R&D investment (Garcia-Quevedo et al., 2012; Herrera & Nieto, 2015; McAlpine & Inouye, 2022; Seeber, 2020). Although the importance of excellent publication records for APs (Saffie-Robertson & Fiset, 2021) and the patents for NAPs (Balsmeier & Pellens, 2014; Germain-Alamartine & Moghadam-Saman, 2020) are commonly observed across contexts, demographic characteristics differ by culture, with age exerting unfavourable effects on employment prospects for doctorates in East Asia (mainly represented by China here) (Shen et al., 2018) when it is generally considered a favourable accumulation of human capital in West (Di Paolo & Mañé, 2016). The various factors influencing the decision-making process naturally contribute to diverse occupational outcomes, although there is a global trend for doctorates to seek employment beyond academia with more advanced systems witnessing a higher proportion of PhD graduates employed in non-academic sectors (Auriol, 2010; Buenstorf et al., 2023; Hnatkova et al., 2022; Kobayashi, 2011). While current domination of APs in the occupational outcomes among doctorates in less developed systems, research indicates a shift in career preferences towards NAPs among younger generations of doctoral students in these systems like China (Gu et al., 2018). Nonetheless, the materialisation of such changes requires further examination.

Different occupational outcomes led to varying levels of satisfaction, which is primarily assessed against objective indicators such as salary and contract type. Generally, PhD graduates employed outside academia report higher level of job satisfaction with higher earnings and higher likelihood of securing permanent contracts, as also confirmed in wider literature (Barnacle & Dall'Alba, 2011), particularly for male doctorates in STEM fields (Blackaby et al., 2005; Schulze, 2015). On the contrary, doctorates working in academia are more likely to hold fixed-term positions, resulting in long-lasting negative influence on their occupational satisfaction (Fiset & Saffie-Robertson, 2020; Goldan et al., 2022). While occupational satisfaction in the immediate terms is undeniably important, doctorates seemed to place greater importance on the alignment between skills required for their job tasks and the skills they acquired during doctoral training. It is widely established that doctorates on research roles, both within and beyond academia, report higher occupational success (Hancock, 2023; Sinche et al., 2017; Waaijer et al., 2017). This challenges the policy views based on the deficit model within doctoral education and calls for more participation from employers to create a 'PhD-ready industry' that can effectively absorb these doctoral professionals (Cuthbert & Molla, 2015, p. 49). It needs to be noted that selected papers and wider research involving the aspects of post-employment experiences of doctorates mainly focus on the Western contexts, suggesting the potential paucity in similar studies in non-Western nations.

6.2 | A four-quadrant model

Under the KBE framework, PhD graduates are portrayed as pillars of socioeconomic development and their research expertise is expected to benefit the wider society beyond academia, justifying the substantial investment in doctoral education by governments (Hancock, 2023). However, not all systems adhere to this ideal paradigm. As the study demonstrates, some systems encourage non-academic professions (NAPs) among PhD holders, whereas others maintain a more traditional approach and continue to prepare their doctorates for academic professions

(APs). Therefore, along this rationale, a system characterised by NAP orientation in relation to the employment outcomes of PhD graduates indicates a greater capacity to accommodate doctoral workforces than the AP-oriented systems in the KBE discourse. Based on findings in the study, indicators signifying the desirable NAP orientation include higher levels of national R&D investment, greater demands for doctoral employees from non-academic labour market, stronger institutional awareness of labour market requirements when designing doctoral programmes, more favourable attitudes among incumbent faculty members towards preparing PhD students for careers beyond academia and stronger preferences among doctoral graduates for non-academic careers.

However, NAP orientation alone is not inherently indicative of a system's effectiveness and success in absorbing its doctoral workforces into different professions. To illustrate, several papers in the study report the varying degrees of occupational success resulting from varying levels of skills utilisation among doctorates in different systems. In addition, the significance of such skill alignment is supported by a wider body of research, indicating that doctoral employees' inability to fully utilise their research skills at work can easily result in career frustration and diminished professional motivation (Auriol et al., 2013; Bazeley, 2003). Furthermore, AP and NAP classification may not be the most appropriate instrument to identify the utilisation of research skills, as doctorates working on NAPs may also leverage their research skills for NRI job tasks (Li & Horta, 2023). Therefore, a system characterised by RI orientation in relation to the employment provision for PhD graduates indicates its greater effectiveness in enabling a high level of occupational success for PhD graduates. Based on findings in the study, specific indicators signifying the desirable RI orientation involves participation from both doctoral employees and employers, when the former report a higher degree of RI-oriented skills utilisation and the latter report a greater number of research-intensive job openings.

Drawing upon the analysis presented above, we propose a four-quadrant model in terms of the occupational choices among PhD graduates, attempting to categorise and evaluate a system's capacity and effectiveness in providing careers with high levels of occupational success for its doctoral workforces. Referring to the scenarios emerging from the study, the four quadrants represent four types of systems in absorbing doctoral forces: mature, evolving, alternative and traditional (see Figure 3).

- **Mature (NAP and RI)** Systems falling in the NAP and RI quadrant are mature in absorbing doctoral workforces, as they prepare their PhD graduates for non-academic careers and provide them with jobs where this highly skilled group can exert its research expertise thereby allowing for greater possibility of occupational success. This is precisely the objective pursued in KBE discourse, as exemplified by the employment landscape for doctorates in STEM fields in the US.
- **Evolving (NAP and NRI)** Systems characterised by NAP and NRI orientations, such as the situation observed in Spain, are more likely to undergo an evolving phase. On the one hand, the infrastructure in these systems facilitates NAP careers for doctorates; on the other hand, the career development of PhD graduates outside academia yet needs upgraded to be more research-intensive so that the research skills of doctorates can be fully utilised to boost socioeconomic development, as envisioned by KBE. Driven by the need for improvement, these systems appear to replete with dynamic reforms involving various stakeholders to upgrade their job provisions and to optimise their absorption of doctoral workforces, as exemplified by the series of such initiatives in the EU (OECD, 2023).
- **Traditional (AP and RI)** In contrast, the imaginary of doctorate employment in traditional systems remain dominated by AP and RI orientations, with academic positions in HEIs being the prioritised career route. In the study, this type is typically exemplified by the mainstream employment landscape for doctorates in East Asia.
- **Alternative (AP and NRI)** Lastly, systems where an AP orientation in terms of employment trajectories of PhD holders leads to NRI-oriented skills utilisation at work represent an alternative scenario. This refers to the situation where doctorates are employed in academic positions at NRI institutions in mainland China (Jiang et al., 2020); while in mature systems like Sweden and Switzerland, employment at lower-tier universities are less favoured by doctorates than high-status organisations outside academia (Conti & Visentin, 2015).

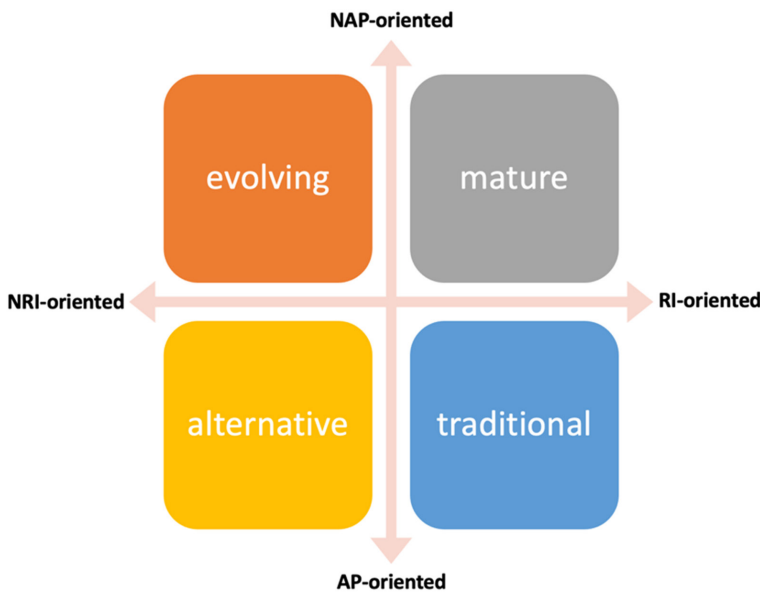


FIGURE 3 A four-quadrant model to categorise the major occupational choices among PhD graduates (by the Authors).

6.3 | Limitations

The study is subject to several limitations. Firstly, the scope of the dataset could have been considerably broadened by including non-English written literature, multiple publication types, a more extensive set of search terms and access to various databases during the data collection process. Secondly, not all nations and systems were included in the review due to our inclusion criteria, and not all findings of the selected papers received equal attention in the study possibly due to the scopes set by the four dimensions of our analytical framework. Furthermore, the analysis could have been enhanced by adopting more finely grained units of analysis than current analytical framework, especially given the diverse types of evidence encompassing qualitative, quantitative and theoretical data in the selected papers. This is consistent with calls made by other researchers for structured and internationally comparable datasets, ideally longitudinal ones (Hancock, 2023; Neumann & Tan, 2011; Walters et al., 2021). Meanwhile, the current four-quadrant mainly focuses on occupational choice and could be extended to occupational satisfaction and occupational success. Lastly, since our data extraction concluded on August 26, 2022, any relevant articles published after that could not be reviewed.

However, given the transparent and structured data collection process we adopted and the large body of literature we scoped for this systematic review, we contend that the papers examined in the study provided a reasonably solid foundation for answering our research question. Meanwhile, we acknowledge the underrepresentation of some stakeholders, contexts or systems in our data and in subsequent analysis but argue that, rather than being an intentional design flaw or an inadvertent deficit, such discrepancies represent a finding themselves—that is, the heterogeneities and varying degrees of emphasis on PhD graduate employment within scholarly discussions in different contexts or systems on a global arena. We also would like to emphasise that although the four-quadrant model mainly revolves around the dimension of occupational choices, it can serve as a starting point for further analysis in occupational satisfaction and success for PhD graduates in different professions. Finally, conducting a systematic literature review in the field of higher education is of significant challenge due to the diversity of epistemic underpinnings peculiar to this interdisciplinary and context-specific subject (Bearman et al., 2012), which is further complicated by the international nature of our research

questions in terms of indicator selection, concepts differentiations and sociocultural nuances (Cantwell, 2020) as well as the inherent heterogeneity within the research subjects. Despite these difficulties, we endeavoured to address our research questions in a scientifically rigorous manner and present an overview of the current scholarly discourses revolving around PhD graduate employment trajectories on an international scale. Therefore, it is important to note that this systematic review is far from an exhaustive investigation and warrants further examination.

7 | CONCLUSIONS

In light of the growing policy and academic interest in the employment of PhD graduates (OECD, 2023), this study contributes to the relevant body of knowledge both theoretically and practically. In theoretical terms, current investigations into employment and career progression of academics typically rely on analytical frameworks in educational contexts (Cañibano et al., 2019; Ehrenberg, 1991; McAlpine et al., 2014) and would benefit from career theories (Healy, 2023). By integrating insights from values-based career theory and boundaryless career theory, we propose a novel analytical framework with the expectation that it will diversify the spectrum of theoretical foundations and facilitate future research in related fields. Meanwhile, our analytic framework extends the existing scholarly emphasis on occupational choice and outcomes to post-employment periods, that is occupational satisfaction and success. In addition, this framework allows for the possibility of future comparative studies, as it fully accounts for sociocultural differences. Although East Asia and the West are mainly focused on in this study, it is anticipated that future research will validate and refine this framework in various research contexts encompassing populations from wider sociocultural backgrounds.

In practical terms, this systematic review presents an overall picture of the employment landscapes of doctorates on an international scale, highlighting common challenges across (supra)national contexts as well as distinctive characteristics within each system and enriching previous systematic reviews on this topic (Chen et al., 2023; Young et al., 2020) to wider contexts. Besides providing stakeholders with synthesised evidence for making better-informed decisions (Bearman et al., 2012), the study also identifies aspects warranting future research, including occupational success that aligns with the notion of sustainable careers (De Vos et al., 2020), the underrepresentation of non-academic employers in current discourse on doctorate employment (Cuthbert & Molla, 2015; Molla & Cuthbert, 2015) and the divergences between different systems (Nerad & Evans, 2014; Nerad & Heggelund, 2011; Shin et al., 2018). While it was not our primary intention to conduct a comparative study, this review can facilitate further comparative research aimed at possible reciprocal learning across multiple facets, such as national policy, institutional practices and individual development. Finally, given the growing importance of doctoral workforces in today's KBE discourses, ensuring this highly skilled workforce to fully realise their potential and effectively contribute to economic and societal development is a priority for various governments. Against this backdrop, the Four-Quadrant Model stemmed from this systematic review serves as a relevant tool for stakeholders to assess the developmental stage of a system in terms of diversifying the sustainable employment trajectories of doctorates. Such assessment and evaluation hopefully can stimulate more discussions and efforts to escalate the employment landscape of PhD graduates, which is of significant relevance to key players, including supranational organisations, governments, employers, HEIs, doctoral programme administrators, faculty and doctorates themselves.

AUTHOR CONTRIBUTIONS

Yu Yang: Conceptualization; methodology; software; data curation; investigation; writing – original draft; writing – review and editing; formal analysis; validation. **Tatiana Fumasoli:** Conceptualization; investigation; writing – original draft; writing – review and editing; validation; methodology; software; formal analysis; supervision; data curation.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest in preparing this article.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

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ENDNOTES

¹In this paper, the terms 'PhD graduates' and 'doctorates' are used interchangeably, and no distinction is made between programme types unless explicitly specified.

²Articles were categorised into five groups: A=Articles that were mistakenly pooled because 'employ' appeared in their titles or abstracts with the actual meaning of 'use', 'apply' or 'utilise'. B=Articles that indeed discussed PhD employment, but PhD employment was not their primary focus. For instance, they talked about problems within doctoral education and employment was only one of the problems. C=Articles that focused on employment, but PhD groups were mixed with bachelor's and master's graduates. D=Articles that examined PhD employment but focused on one programme. E=Articles that examined PhD employment but focused on one single subject, institution or occupation. and F=Articles that examined PhD employment and focused on more than one programme, subject, institution and/or occupation. Only entries in F group were considered relevant to the research questions.

³Overskilling and overeducation are treated separately in some research. However, differentiation between these two is not within the scope of the paper.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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