Vol.3 Special Issue No.1 (2020)

Journal of Applied Learning & Teaching

ISSN : 2591-801X

Content Available at : http://journals.sfu.ca/jalt/index.php/jalt/index

# Doctoral employability: A systematic literature review and research agenda

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## Keywords

Doctor of Philosophy;
Doctorate;
employment;
industry PhD;
PhD;
PhD education
postgraduate.

## Article Info

Received 11 March 2020
Received in revised form 6 May 2020
Accepted 6 May 2020
Available online 11 May 2020

**DOI:** https://doi.org/10.37074/jalt.2020.3.s1.5

## Abstract

Doctoral education is facing a revolution: not a new fact. Likewise, the nature of employment post-PhD has dramatically changed as market-forces drive accommodating employability outcomes from contemporary doctoral programs. This systematic literature review examines the themes emerging from 20 articles identified through the PRISMA approach to systematic reviews. The themes were grouped into three high-level concepts: policy and economics, the student, and expectations of the student. These themes are discussed in-depth within this paper, drawing on the sample literature. Following, we postulate a position for the future. Rather than reinforce the literature's approach of acknowledging the problems, and problematising the same issues of doctoral programs insufficiently preparing candidates, we propose an outlook oriented towards practically improving doctoral programs with a focus on innovative solutions that address the general themes of preparedness and the industry-academic gap.

## Introduction

Twenty-first century doctoral candidates are challenged by a constantly evolving employment landscape. The traditional postdoctoral academic pathway is no longer the norm (McGagh et al., 2016). Historically, doctoral graduates moved directly from doctoral completion into postdoctoral fellowship programs as the first stage to a tenure track academic career. In modern times, this is no longer the case (Cuthbert & Molla, 2015). The current employment prospects are different when compared to that experienced in previous generations, and this shift has left doctoral candidates uncertain as to how to prepare for their futures (Hancock, 2019). A recent report states that 57 percent of doctoral graduates are employed in non-academic roles (McGagh et al., 2016). Studies confirm the general saturation of doctoral graduates compared to academic positions available (e.g. Universities Australia, 2019).

There are reasons for concern, considering the evidence of doctorate program enrolments against academic jobs, coupled with a mismatch between the expectations of many new doctoral graduates regarding their perceived likelihood of gaining employment in the academic sector (e.g. Crawford & Probert, 2017). While some research indicates that many graduates are uncertain about their career path upon graduating (Pearson et al., 2011), a 2015 European study involving nearly 7,000 doctoral candidates indicated that the candidates believed completion of a PhD would increase their chances of employment in academia by a great extent (Parada & Peacock, 2015). Most of these respondents planned to pursue a career in academia, which led researchers to conclude there may be overly high expectations about the value of a doctoral degree for academic employment (Parada & Peacock, 2015). Accordingly, information needs to be imparted to doctoral candidates that a career in academia is not guaranteed, nor even necessarily likely.

The issue of employability post-PhD is gaining attention around the globe, for example in Canada (Rancourt & Archer-Kuhn, 2019) and the United Kingdom (*The Guardian,* 2018). As noted by a UK-based academic in a recent Guardian newspaper article, academic careers are elusive at best, and perhaps a more successful recipe for job-related emotional turmoil than for a tenured academic position (*The Guardian*, 2018). A suggestion that capabilities, such as critical thinking, are even more important than instrumental skills in terms of employability may be illustrative of the new climate affecting the postdoctoral employment landscape (Molla & Cutherbert, 2019; Rancourt & Archer-Kuhn, 2019).

As a result of this shift in the employment landscape, scholars, practitioners, and governments are seeking more industry-ready candidates (Group of Eight, 2013; Poole-Warren, 2017). Both funding bodies and industry are suggesting universities need to more effectively facilitate both academic and industry preparedness for employment (e.g. Noonan et al., 2018; TEQSA, 2017). Given the significance and potential long-term ramifications of this situation for doctoral candidates, it is important to develop a clear understanding of the current status of the employability landscape for doctoral candidates. Accordingly, the aim of this article is to provide a systematic review of the existing literature on the concept of their employability, and to produce an illustration of the employability landscape which candidates enter both during and after the completion of their doctorate.

There is significant value in pursuing research into doctoral employability within an applied learning and teaching context, given the necessity of the PhD qualification in the context of higher education. Irrespective of the domain or specialisation of the Doctor of Philosophy, this degree serves as a foundation for effective higher education more broadly: the training it provides has direct impact on the capabilities of newly graduated and appointed teaching staff and their effectiveness for students' learning. Likewise, this study focuses on the nature of doctoral training.

## Background

Historically, career success was marked by permanence (Donohue, 2006; Sullivan & Baruch, 2009). However, changing societal values have resulted in a shift in how success is defined (Fazey, 2017; Sullivan & Baruch, 2009). Across all employment sectors, the predictable progression that was the hallmark of career success in decades past is less common (Baruch, 2004; De Vos & Soens, 2008; Fazey, 2017), and careers which account for the importance of an individual's objectives and needs (i.e. the 'protean' career model) are now more prevalent (De Vos & Soens, 2008; Hall, 2004; Sullivan & Baruch, 2009). Contemporary success has different parameters: a sense of intrinsic reward and allowance for work-life balance is now more desirable than linear promotions and standardised 'ladder climbing' (Mainiero & Sullivan, 2005). Protean careers are based on dynamic individual reassessment and flexibility rather than the continuous stability that was the marker of career success in previous generations (Ballout, 2007; Fazey, 2017). Protean approaches are more common for highly trained and skilled workers, making this concept even more relevant for doctoral graduates (Fazey, 2017; Holland et al., 2007).

Despite common expectations of an academic career, there is an emergent trend, and a level of necessity, for doctoral candidates to choose a greater diversity of career paths. The ACOLA report (McGagh et al., 2016) confirms that post-graduation, even on a short-term scale (three to nine months), many Higher Degree Research (HDR) graduates are turning to areas outside academia to fulfil career objectives. The historical perspective that PhD graduates will progress directly to an academic position after doctoral completion is being challenged, and universities need to shift their perspectives to ensure that HDR candidates are prepared for a career outside academia (McGagh et al., 2016; Manathunga et al., 2009; Molla & Cuthbert, 2015). As a result, universities need to adapt their practices to ensure graduates are readily employable upon doctoral completion. The next step is to determine what defines employability.

Doctoral employability within the context of higher education has multiple definitions, depending on who is supplying the definition. From an industry perspective, the Australian Chamber of Commerce and Industry (ACCI) and Business Council of Australia (BCA) developed an employability skills

framework, and defined employability as "skills required not only to gain employment, but also to progress within an enterprise to achieve one's potential and contribute successfully to enterprise strategic directions" (ACCI & BCA 2002, p. 3). The ACCI (2007) later implored universities to apply their framework to higher education, however, whether it is the responsibility of universities to train and prepare doctoral graduates with the skills specified in the framework is an unresolved issue still under debate. For example, Taylor (2005) argues employability and the associated skills should be part of the doctoral curriculum, while Sheldon and Thornthwaite (2005) argue that it is the responsibility of the employer to provide vocational skills. Some researchers on the employability of doctoral candidates take this argument one step further, stating that a PhD is simply not adequate training for employment (Jones & Warnock, 2015).

Within the field of higher education, the most common definition of employability is: "a set of achievements – skills, understandings and personal attributes – that makes graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community and the economy" (Yorke 2004, p. 8). There are some notable differences between the industry-provided (ACCI & BCA, 2002) and academic-orientated definitions (Yorke, 2004). Chiefly, the point of view from which the definition stems differ; industry employers view employability as a higher-level ability to enterprise and strategise, whereas the academic definition is positioned from the point of view of the potential employee. Given the purpose of this research, which is to illuminate a picture of the employability landscape faced by doctoral graduates, both definitions will be considered. However, further additions and modifications to these definitions may be called for given recent developments in the field of postdoctoral employment preparedness, which suggest that the sector needs to move beyond the current focus on achieving a set of employability skills and realign the focus to achievement of a more sophisticated suite of capabilities (Molla & Cuthbert, 2019).

## Method

### Search strategy

This paper adopts a systematic literature review method to enable a response to the study objectives, using a PRISMA approach (see Moher et al., 2009) within an online software platform, Covidence®. To search, we only included peer-reviewed journal articles published between January 2000 and December 2019, that had full-texts available within the search database. The following databases that were used to undertake a query were: ProQuest, A+ Education (Informit), and Education Research Complete (EBSCO). The keyword string for this search was kept considerably strict: [("doctoral" OR "PhD") AND ("employability")] to offer a form of scoping understanding of the literature that specifically talks to, and draws on, the notion of employability. While there are likely many other studies that refer to broader notions of post-graduation work for doctoral candidates, our focus was to explore the literature that was primarily related to employability, not literature which considered employability among a wide range of other variables (e.g. Beasy et al., 2019; Crawford & Probert, 2017). Within this frame, we excluded conference papers, book chapters, and books, along with those papers not available in English.

### Selection procedure

All abstracts and metadata were imported into Covidence® to facilitate the implementation of the PRISMA approach (see Figure 1). From the three databases, there were 1,664 results, 102 of which were duplicates. Using a single author screening process, the authors assessed the validity of the papers against the criteria: i) was it relating specifically to PhD students/doctoral candidates, and ii) was it relating specifically to employability or a facet of employability? If the answer to both was yes, these would remain. If it was unclear from the abstract or title, they would also remain. While some researchers use a double screening process, we opted to use an approach to ensure that it was a second author that conducted the full-text review. We did this as the questions were considerably binary, and if in doubt, the paper was progressed to the full-text review for consideration by a second author.

### Quality review

The papers that progressed through full-text review then underwent a quality review. For the quality review, an adapted form of the Mixed Method Appraisal Tool (MMAT: Hong et al., 2018) was used with scores ranging from high (75% to 100%), medium (50% to 75%), and low (below 50%). Where papers were marked as low, they were excluded from the final sample. The results of the quality assessment (QA) are recorded in Table 1.

### Analysis

To identify themes, an inductive thematic analysis (see Braun & Clarke, 2006) was conducted, resulting in eight key themes across three broad thematic areas: policy and economics, the student, and expectations of the student. This process involved six steps: familiarisation with the data, coding, searching for themes, reviewing themes, defining and naming themes, and writing findings. The authors began with immersion in the final papers during the full-text and quality assessment stages. By the end of two careful examinations of the manuscripts, deep contextual awareness was possible. Next was the process of coding for themes. In this, authors individually and independently coded themes for a selection of the collected manuscripts, without an aim for synthesis. The authors discussed the preliminary themes to review and eventually defined higher-order themes that emerged (Tracy, 2010). The authors then sought to define and write the themes independently. Following this process, the authors co-examined, reflected, and continued to review the themes both as creators of some themes and as independent reviewers of others. This process was employed with the intention and belief that the authors would continue to view the data behind the themes

with new vision, depending on the perspective adopted, to create a form of sincerity and reflexivity in the process (Creswell & Miller, 2000).

## Results

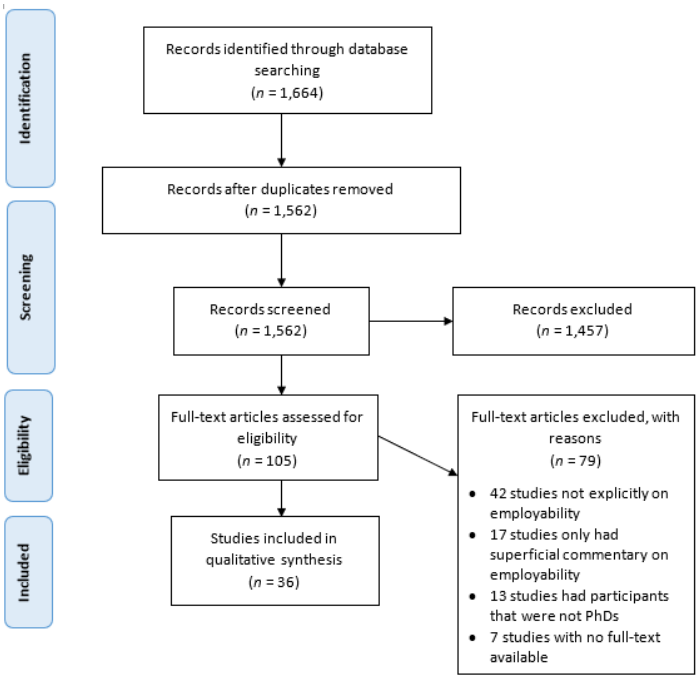


Figure 1. PRISMA Results

### Characteristics of selected articles

The articles represent a wide range of viewpoints involving current and prospective PhD Candidates, recent and longer-term Doctorate Holders, doctoral program supervisors, institutional policy analyses, industry employers, and academic employers (see Table 1). These perspectives range across numerous countries, with Australia representing the majority of examined literature. For simplicity, we have only included the name of the first author in Table 1, noting that the full reference is used in-text and within our reference list.

### Thematic analysis

When examining the literature sample for the quality assessment, preliminary themes were extracted from the papers. To do so, an inductive thematic analysis was conducted. If the quality assessment demonstrated a medium or high rating, these were recorded, with low-rated papers being removed. With this, we sought to synthesise the discrete themes (e.g. policy and student expectations) into a series of broader themes.

### Policy and economics

#### *Policy*

Globalisation and the increasing economic value placed on knowledge has led to growing importance of higher education in national policy and funding, but also pressures to conform to new conceptions of the purpose and outcomes of doctoral study (Allen, 2002; Pederson, 2014). Doctoral education is increasingly subject to institutional management, as well as national and supranational policymaking; with national and international educational politics moderating effectiveness (Manathunga, 2012; Molla & Cuthbert, 2019). In Australia, the policy shifted from an efficiency framing (late 1990s) to an employability framing (mid-2000s) and linked to employer demand for generic or transferable skills (Cuthbert & Molla, 2015).

National strategies to increase the number of PhD graduates included a whole of education system approach focused on quality, contributions to financing PhD studies and increasing PhDs in targeted areas. A focus on the sciences based on labour undersupply (Pederson, 2014) has been disputed as skewing the workforce away from the contribution to national wealth through humanities, arts, and social sciences knowledge production (Craswell, 2007).

| First author | Article | QAS | Country | Method | Sample | Theme(s) |
|---|---|---|---|---|---|---|
| Allen (2002) | Responding to the field and to the academy: Ontario's evolving PhD | Medium | Canada | Student evaluations | 26 EdD and 30 PhD graduates | Policy, student expectations |
| Bessudnov (2015) | A Statistical Evaluation of the Effects of a Structured Postdoctoral Programme | High | USA, UK, France, Italy, Other | Quantitative survey | 79 Research Fellows and 76 PhD Applicants | Knowledge or skill development, job availability |
| Bos (2017) | Reflections on the ESRC Internship Scheme for Postgraduates | Medium | UK | Reflections | Four PhD Candidates | Knowledge or skill development |
| Boud (2006) | Putting doctoral education to work: Challenges to academic practice | Medium | Australia | Discursive, invitational approach based on literature, PhD scenarios | PhD programs | Student expectations, professionalisation |
| Craswell (2007) | Deconstructing the Skills Training Debate in Doctoral Education | Medium | Australia | Literature review, open-ended questionnaire | 973 students (76% PhD students) in 2004; 471 students in 2005 | Policy, student expectations |
| Cumming (2010) | Contextualised Performance: Reframing the Skills Debate in Research Education | Medium | Australia, UK | Environmental scan, single-institution extended case study | | Knowledge or skill development |
| Cuthbert (2015) | PhD Crisis Discourse: A Critical Approach to the Framing of the Problem and Some Australian "Solutions" | Medium | Australia | Critical analysis | Four higher education programs | Policy, academic expectations |
| Edwards (2009) | Issues facing scientific research employment in Australia | Medium | Australia | Interviews and discussions | 120 science trainers, employers, and researchers | Industry expectations, job availability, student expectations |
| Haapakorpi (2017) | Doctorate Holders outside the Academy in Finland: Academic Engagement and Industry-Specific Competence | High | Finland | Survey and interviews | 1,183 doctorate holders and 26 employers | Job availability, industry expectations |
| Harman (2004) | Producing 'industry-ready' doctorates : Australian Cooperative Research Centre approaches to doctoral education | High | Australia | Survey | 651 PhD students | Industry expectations, professionalisation, knowledge or skill development, student expectations |
| Hill (2010) | Graduate research capabilities : a new agenda for research supervisors | Low | Australia | Focus group style discussions | PhD Supervisors | Academic expectations, job availability, policy |
| Jones (2018) | Contemporary Trends in Professional Doctorates | High | - | Desktop analysis | - | Changing education policy, job availability, academic expectations, industry expectations |
| Leonard (2004) | Continuing professional and career development : the doctoral experience of education alumni at a UK university | Medium | UK | Student data files; open-ended postal questionnaire (35% response) | 162 Doctorate Holders | Knowledge or skill development, policy, professionalisation |
| Manathunga (2012) | Evaluating Industry-Based Doctoral Research Programs: Perspectives and Outcomes of Australian Cooperative Research Centre Graduates | High | Australia | Survey | 1,068 Doctorate Holders | Industry expectations, knowledge or skill development, job availability |
| Molla (2019) | Calibrating the PhD for Industry 4.0 : global concerns, national agendas and Australian institutional responses | Medium | Australia | Multi-scalar policy lens and desktop program survey | Australian PhD program description, policy discourses, institutional responses | Industry expectations, knowledge or skill development, job availability |
| Mowbray (2010) | The Purpose of the PhD: Theorising the Skills Acquired by Students | Medium | Australia | Interview and grounded theory procedures | 20 PhD Candidates | Knowledge or skill development, academia expectations |
| Neumann (2011) | From PhD to Initial Employment: The Doctorate in a Knowledge Economy | Medium | Australia, UK, Canada, USA, and France | Secondary data survey | Undefined number of PhD graduates | Job availability |
| Passaretta (2019) | Between Academia and Labour Market--The Occupational Outcomes of PhD Graduates in a Period of Academic Reforms and Economic Crisis | High | Italy | Survey | 13,325 Doctorate Holders | Industry expectations, policy, equity |
| Pedersen (2014) | New Doctoral Graduates in the Knowledge Economy: Trends and Key Issues | Medium | Europe, US, Australia (OECD countries) | Secondary data survey | N/A | Job availability, policy, equity |
| Pitt (2016) | Academic superheroes? A critical analysis of academic job descriptions | High | Australia | Textual analysis | 178 job advertisements | Academic expectations |

Disruptive elements are inherent in the idea of the knowledge economy and "Industry 4.0" and have impacted higher education policy and prompted critical appraisal of the PhD in relation to its relevance, efficiency, and quality (Molla & Cuthbert, 2019, p. 167). "Industry 4.0" is considered the Fourth Industrial Revolution, characterised by technological advances in combination with significant knowledge gains (Schwab, 2016) and the emergence of digital jobs. Missing in debates about industry engagement for relevance and employability is discussion on public responsibility to "cultivate social-minded knowledge workers" (Molla & Cuthbert 2019, p. 181) and student responsibility to be aware of the need to develop professional skills (Craswell, 2007).

Policy, with consequent regulatory and funding arrangements, has a high impact on value, design and uptake of doctoral programs (Allen, 2002). Canada houses both the traditional PhD and professional doctorates (Allen, 2002), a policy now adopted by many nations. In Canada, increased development costs and quality assurance create a disincentive for new professional doctorate program development. Concurrently more flexible arrangements for traditional PhD programs and funding only traditional PhD candidates further erode uptake of professional doctorates (Allen, 2002). This contrasts with Jones' (2018) claim that the growing and global (US, UK, Australia) popularity of professional doctorates is a response to a shift in focus to PhDs designed to broadly benefit all stakeholders, not just university priorities, and that research focus should transform from mostly "ivory tower traditionalists" to include "pragmatic researchers" (Pederson, 2014, p. 640).

An important distinction made by several scholars is the impact on policy of discourses critically appraising the "capacity of the PhD to meet the expressed and perceived expectations of internal and external stakeholders" (Molla & Cuthbert 2019, p. 168), perceptions that are problematised and challenged (Leonard et al., 2004; Craswell, 2007; Cuthbert & Molla, 2015). There is an argued need to recognise diversity in the PhD student cohort and the importance of context in education policy (Craswell, 2007; Leonard, 2004). Similarly, quality is a focus for policy that is lacking, according to some scholars. The quality of research training and the quality of research produced by PhD graduates requires investment in supervisors, resources, and design to provide learning experiences (Cuthbert & Molla, 2015).

### *Job availability*

Competition for jobs has intensified due to growth in doctoral graduates (Haapakorpi, 2017), characterised as a supply and demand mismatch (Pederson 2014; Bessudnov et al., 2015). Issues associated with increased supply do not appear to affect employment, and the PhD may act as a "signal of quality" (Pederson 2014, p. 638). The risk is over-skilling the workforce and lack of clarity on the value PhD employees provide (Pederson, 2014). However, with 'knowledge economy' and 'Industry 4.0' (Molla & Cuthbert 2019) framing discussions on doctoral programs and graduate employment outcomes, there is conflicting evidence that traditional PhDs are being superseded by more industry-ready programs. Context is key (Cuthbert & Molla, 2015; Leonard, 2004), and considerations of all stakeholders need to include the complexity of the cohort (their aspirations and motivations).

While most PhD graduates find permanent employment as academics, there was a significant time lag (4+ years) (Bessudnov et al., 2015). Doctoral graduates seeking academic employment face contraction of permanent positions. Transition from PhD to academic career is characterised by uncertainty and stress of temporary, sequential employment over a period of years before obtaining permanent positions (Bessudnov et al., 2015). In this context, scholars note post-doctoral positions are viewed as a necessary step for an academic career in the sciences (Bessudnov et al., 2015), who recommend structured career development programs as an antidote to reported issues of isolation, concerns about the future, and publication pressure.

However, educational achievement is internationally linked to favourable employment and salary prospects both within academia and outside (Edwards, 2009; Molla & Cuthbert, 2019; Neumann & Tan, 2011) and "it is well documented that unemployment is not a serious problem among doctoral graduates" (Molla & Cuthbert, 2019, p. 179). For jobs outside academia, research in Finland identified evidence of stratification, with university reputation and non-educational attributes (social origin, personal attributes) impacting job availability, even where genuine demand existed (Haapakorpi, 2017). Responsibility of industry towards PhD graduate employment is raised as a policy gap: "The issue of the PhD-ready industry is rarely, if ever, addressed" (Cuthbert & Molla, 2015, p. 49). Discourse and policy that focus on deficits in doctoral graduate capabilities means that employers do not make the changes that would allow them to fully utilise doctoral graduates' skills and knowledge (Cuthbert & Molla, 2015). Percentages of employment outside the education sector are around half of doctoral graduates to be employed in the education sector, primarily higher education, although Australian figures do not distinguish what kind of position; those employed outside education are widely dispersed across all sectors (Neuman, 2011).

### *Professionalisation*

Craswell (2007) argues against the efficiency framing of policy based on an employability discourse that uses a deficiency (of skills) model to justify expectations of professional skills training in addition to research skills training to facilitate diverse career paths. The graduate employability agenda means that both institutions and students need to be aware of the range of capabilities to be acquired through a research degree, preparing them for diverse career paths (Hill & Walsh, 2010). Professional skills courses on leadership and communication, project management, research commercialisation, and entrepreneurship are formally provided to doctoral candidates at the Australian Collaborative Research Centre, or by centralised services within a university context (Craswell, 2007), or embedded

within a PhD program (for example the Monash PhD and UQ Advantage PhD) (Cuthbert & Molla, 2015), replacing less structured, more informal and ad hoc provision.

The diversification of doctoral degrees reflects the range of research and professional outcomes expected of, and desired by, graduates (Boud & Tennant, 2006). This diversity aligns with the increasing diversity of the PhD cohort, which is increasingly older and desiring to integrate existing professional experience into their studies as they join an academic community (Boud & Tennant, 2006; Leonard, 2004). The evolution of PhD programs, for example, professional doctorates, involves alignment of PhD research to goals of industry and economic return, as well as explicitly providing a mix of research and professional skills training (Jones, 2018). Industry-focused partnerships such as Cooperative Research Centres (CRCs), which increase the likelihood of employment in the private sector and public sector research, are a context in which professional skills attainment (e.g. negotiation, management, leading interdisciplinary teams) is integrated with research skills development (Harman, 2004).

## Student

### *Knowledge or skill development*

Many scholars argue in favour of skills development during the doctoral training process, including Harman (2004). Manathunga et al. (2012, p. 856) suggest that doctoral candidates who are given access to industry experience during their candidature are more likely to work outside academia after completion, and that participation in such programs may provide more effective training in strategic research that crosses boundaries between academia, industry, and the public sector than traditional PhD programs. It has also been shown that participation in a government-led internship program outside academia during candidature led to skills improvement in communication and collaboration, and an increased understanding of how academic work is applied in non-academic settings (Bos et al., 2017).

The value of skills development as part of doctoral training is not seen by all academics, however, for a variety of reasons. Leonard et al. (2004) state that doctoral candidates are equally as concerned with satisfying intellectual curiosity and making an original knowledge contribution as they are with future employment, and therefore question a move toward increased skills training for PhD candidates. Mowbray and Halse (2010, p. 653) argue that the employability skills push in doctoral education diminishes the importance of the PhD as a process of acquiring 'intellectual virtues', and that doctoral education should be more than the collection of marketable skills. Cumming (2010) similarly purports that the focus on and push for employability skills comes largely from outside academia, and may be misplaced given the wide array of attributes possessed by doctoral graduates that are less easily defined. Molla and Cuthbert (2019, p. 168) also argue against the employability skills push, but with a different, and perhaps more current, rationale. They argue that the "PhD crisis" has deepened in recent years, and there is increased disruption in the mandate of the higher education sector (Molla & Cuthbert 2019, p. 168). They go on to argue that the skills-based employability discourse for doctoral candidates is inadequate, and a deeper, more complex "capabilities" approach is required to bring the PhD in line with emerging requirements for global progress (Molla & Cuthbert, 2019, p. 183).

### *Equity*

Passaretta et al. (2019, p. 547) found that employability and "occupational outcomes" for doctorate holders varied "considerably" depending on the academic discipline. Like effects noted at lower levels of academic qualification, hard disciplines such as engineering and medicine tended to have higher rates of employment post-PhD than softer sciences such as humanities and social sciences (Passaretta et al., 2019). It is suggested that at five years post-graduation from a PhD program, doctorates from soft science disciplines will have "worse occupational outcomes" (lower rates of employment, higher rates of short-term contracts, higher rates of employment outside academia) than those from hard disciplines (Passaretta et al., 2019, p. 547). Pedersen (2014) also noted a push for science, technology, engineering, and math (STEM)-based PhDs. These hard science fields were being promoted as areas of study as they were seen to highly impact innovation, and areas that would have favourable employment prospects due to the relative undersupply of qualified candidates in these areas of academia (Pedersen, 2014).

### *Student expectations*

Allen et al. (2002) suggest that the climate shift in recent decades toward a knowledge-based economy has resulted in a need for universities to adapt to the changing demands of the labour market as well as globalisation and new technology. Expectations of students, the government, and the public are that a doctoral degree will result in employment opportunities and marketable skills, and it is suggested that traditional PhD programs need to be modified to accommodate these needs (Allen et al., 2002). Conversely, other research suggests that placing the responsibility of skills training to increase employability is not under the purview of doctoral programs (Craswell, 2007). The authors go on to suggest that the notion that doctoral programs should embed skills training within them is "reductive", and that it is "simplistic" to suggest such a broad solution when PhD training is, by its very nature, highly complex and discipline-specific (Craswell 2007, p. 388). Craswell (2007) suggests that HDR students themselves need to be involved in designing skills-based programs to embed their knowledge and experience in the process, thereby making the programs more effective.

Research graduates saw two realistic options for a career: the university sector, or a key government scientific research agency. Research jobs suitable to PhD graduates were "almost non-existent" in the private sector, according to

recent graduates (Edwards, 2009, p. 5). Despite this, recent and emerging doctoral graduates were also pessimistic about their ability to be employed post-PhD in academia (Edwards, 2009). For students seeking future careers, 74 percent of those who were based in industry-partnered PhD programs sought industry careers, comparted to 62.5 percent of traditional graduates seeking industry careers. Students want more support to prepare for a non-academic career, be supported to develop more soft skills, tend to be dissatisfied with their course, and want more opportunities to do research outside of universities (Harman, 2004). Fewer contemporary prospective students are seeking cross-disciplinary projects, relationships between decades of professional experience and their project, and opportunities to consolidate practice-based expertise (Boud & Tennant, 2006).

## Expectations of the student

### *Industry expectations*

In what has been termed "Industry 4.0", the Fourth Industrial Revolution, (Molla & Cuthbert, 2019, p. 167), the demands of industry for their future research employees have evolved. The value of the PhD is questioned by industry when comparing their needs to what is available in the labour market. In a federally commissioned study, 120 participants involved in Australian science training and employment were interviewed (Edwards, 2009). Among these participants, science industries and science recruitment firms articulated that the science PhD was not a highly desirable qualification among potential employers outside of the university sector, and key government research organisations. Among the private enterprise, there was minimal research at the scale and scope of a PhD being conducted, with most short-term projects outsourced to universities and government research organisations (Edwards, 2009).

Indeed, PhD candidates were seen by industry as too specialised and lacking adaptability to a fast-paced private sector. Distinct from trends in Australia, Finland is experiencing growth in industry-based research careers (Haapakorpi, 2017). There are, however, parallels; from a survey of 1,183 doctorate holders, 31 percent were employed outside of higher education. Interestingly, among the business sector respondents was a diverse range of careers from researcher to consultant, physician, and legal professional (Haapakorpi, 2017). Despite growth, most of those PhD graduates situated within industry were not researchers: a characteristic outcome typical of a traditional doctoral program. Employment options within academia are less secure, and employers are seeking more specific skillsets absent in traditional programs (Jones, 2018). Employers recognise that the completion of a PhD develops narrow expertise that is not generally applicable to their organisational needs. These employers are seeking broader skillsets from their prospective research employees as a mechanism to respond to competitive market forces.

Outside of the traditional model, other alternatives have been assessed with deeper industry embedding into the program to match more closely the future labour and research needs of industry with forthcoming graduates. Students who participated in a CRC arrangement between university and key industry partners, had a better experience than traditional students (Harman, 2004). Added in parallel, CRC graduates were preferable to 36 percent of industry employers over traditional graduates. In a subsequent comparison of CRC and non-CRC graduates (n = 1,068), students tended to engage in more professional development programs (CRC: 72%; non-CRC: 55%), attend more industry meetings (CRC: 57%; non-CRC: 31%), attend more research skills programs (CRC: 77%; non-CRC: 64%) and interact with more non-academic professionals than non-CRC students (CRC: 75%; non-CRC: 63%) (Manathunga, 2012).

In Italy, there was a general increase in graduates from PhD programs from 2006 to 2014, despite that during this period there were four years where expected hiring was lower than the number of graduates (Passaretta, 2019). In a comparison between 2004 graduates (n = 5,595) and 2008 graduates (n = 7,730) in Italy, there was a growth in the probability of full-time employment by 10 percent, despite a decrease in the probability of academic employment by 6 percent (Passaretta, 2019). While opportunities for doctoral candidates have increased in some parts of the world, the rate of employment into academic roles is decreasing.

### *Academic expectations*

University executives express concern over a lack of understanding from private enterprise as to the value of a science PhD. Some universities are feeling the need to respond by developing high proficiency in soft skills such as communication and leadership or commercialisation skills, while balancing the desire for innovative research (Edwards, 2009). These pressures add intensity to the PhD program, without any clear guarantee of better career outcomes.

Universities are seeking better alignment between candidate projects and industry needs to support new revenue generation strategies (Jones, 2018). Their responses include committing to redeveloping their programs to ensure better alignment with both industry and academic needs (Molla & Cuthbert, 2019). Cuthbert and Molla (2015) argue a need for strong industry-university collaboration to create specialist knowledge that exists in both commercial and university settings.

In a review of positions advertised for by universities, there was a skew towards full-time roles, with a greater number of lower-level research-intensive roles (e.g. Postdoctoral Fellowships) and broader level balanced research/teaching roles available (e.g. Lecturer with balanced workload) (Pitt & Mewburn, 2016). Among the sample of position descriptions were expectations of discipline-specific expertise, administrative duties, demonstration of research performance, teaching experience, demonstration of continued networking and professional development, interpersonal skills (e.g. communication, creativity, self-management, and personal qualities), and corporate citizenship. Responses from universities are to create pro-skill PhD programs (Cuthbert & Molla, 2015).

Scholars are arguing for greater research student reflection on their own capabilities as well as academic institutions supporting development of research capability (Hill, 2010). Mowbray and Halse (2010) articulate skills development through the lens of intellectual virtues: theoretical knowledge, scientific knowledge, productive knowledge, and intuitive knowledge.

## Discussion

### We love to problematise

In the literature we identified a growing problematisation of the doctoral landscape concerning employability. Surveys, critical analyses, and interviews point to similar challenges. These challenges include that there is a recognisable gap between what industry and academic employers need of their future research employees and what is currently available. There is a form of misalignment between candidates and their future employers on what is needed, and this includes a focus on specialised knowledge and insights that go beyond what could be commercialised or applied to industry contexts. There are also a set of soft skills that candidates and prospective employers identify they need, but do not have.

The challenges recognised by the literature are not typically new and novel findings, rather studies applied in different contexts that identify similar evidence with caveats. Each of these are important aspects within the literature: for example, understanding the forces that doctoral candidates in Australia are facing versus those in Finland. We argue the need to move beyond the problematising of elements where we have some consistency, with a progression towards testing interventions that may provide solutions. The areas we identify that are repeated within the literature:

- Traditional doctoral programs are not fit-for-purpose with a twenty-first century employment and research landscape;
- There is a need for soft skill development among and during the doctoral program;
- A balance is needed between the specialised knowledge created during a PhD and knowledge that is usable in industry, classrooms, and similar; and
- Opportunities for candidates to embed their research in industry have benefit in enabling those students to make informed decisions about their future career prospects.

There is some skepticism, however, in relation to the efficiency and employability discourse, and the associated push for doctoral training that includes transferable skills and professional skills. Dissenting scholars identified that a focus on quality is missing (both research training process and research produced by candidates). Also, that the current discourses fail to locate achievable changes by employers and the value of a 'PhD-ready' industry context.

There are some positives, however, with some scholars indicating proactive and engaged PhD graduates have high employability, both within academia and in diverse career opportunities. It is a diverse cohort, and scholars who focused on the 'student voice' identified a range of opportunities to support and facilitate their aspirations and goals, as well as create opportunities for connection and creativity (Cuthbert & Molla, 2015; Leonard, 2004).

Scholars identify the need for national-level data (Pederson, 2014) and international data (Passaretta, 2019) - pointing to the difficulty of quantifying the career paths and mobility of doctoral graduates. Critics of current policy argue for more careful terminology and policy framing, against graduate employability as 'crisis discourse' (Cuthbert & Molla, 2015) and for incorporating student voice (Leonard, 2004).

### We need to focus on solutions

With evolution comes opportunity. The landscape of twenty-first century doctoral candidates has offered new and innovative solutions to contemporary challenges, provided program, candidate, and industry are aligned in their expectations and needs. We posit the introduction of a carefully mapped stakeholder network at national and international discipline levels could facilitate a clearer understanding of the true needs of flourishing for candidates during their experience, while meeting institutional requirements, and future industry needs.

This is not an impetus from industry or higher education institutions alone, with candidates called upon to take control of their experience (Beasy et al., 2019). Establishment of shared expectations is needed early in the candidature to clarify what is the desired outcome of the program for the candidate, and for the institution. This series of conversations should be complemented with realistic industry advice and contextualisation, whether through industry mentoring, supervision, or networking. The candidate should also be exposed to both industry and academic settings to enable an informed decision of their future, given their exposure is related to their choice (e.g. Manathunga, 2012).

By establishing at the candidate-level the desired outcomes, a clear employment pathway can be developed. To provide a simple illustration, a candidate seeking employment in academia may require a series of Top Quartile journal publications demonstrating their research capability combined with teaching and grant experience. A candidate seeking employment in their chosen industry should focus on impact and engagement between their theoretical work and the challenges relevant to their future employment settings. In both contexts, a broad range of knowledge and soft skills to complement their newly formed specialisation and expertise is also recommended. Whatever the future for doctoral education, the focus must be candidate-centric, contextualised to their institution and future personal and professional prospects. The value in doing so is the generation of knowledge that enables societal development and sustains the perpetual development of scholarship over the next century.

## Limitations

One of the challenges with all systematic literature reviews is the confinement placed on the literature by adding parameters. While our parameters were broad, we also eliminated a lot of potential sources of rich data. For example, working papers and conference proceedings in the past year may have provided unique data that is not currently published in the available journal publications. We believe that we collected a breadth of data with sufficient depth to systematically understand the current state of doctoral employability, but there will be many more works we may have missed as they may have used different descriptors in their abstract than those within our search phrases.

## Conclusion

The aim of this paper relates to systematically understanding the literature on doctoral employability. We deployed a PRISMA approach to the raw texts that were identified through our search phrases. From this, we identified a series of themes that we grouped by policy and economics, the student, and expectations of the student. We discussed these in-depth, and continued to problematise the doctoral employability landscape, encouraging scholars to progress to workable solutions that support better integration between industry, student, and institutional needs. We believe an outlook oriented on how we can practically improve doctoral programs will serve to enable a more supportive and optimistic orientation of those involved in doctoral education, employment, or management.

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