

RoRI Working Paper No.2

# **21st Century PhDs:**

**Why we need better methods of tracking doctoral access, experiences and outcomes**

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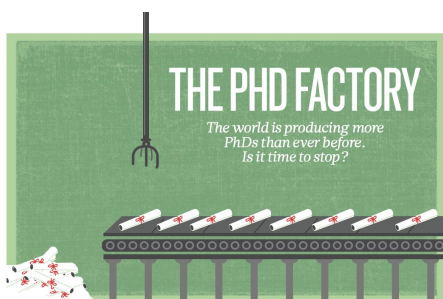
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## Summary: the PhD in an era of expansion

Across the world, universities are awarding more PhDs than ever before. Over the last two decades, governments have introduced policies to increase the number of PhD holders and to support their transition into diverse forms of employment. These efforts have emerged from a shared commitment to the knowledge economy, and that knowledge-intensive skills are central to future economic growth.

The rise of the knowledge economy has challenged the traditional notion of the PhD as an academic apprenticeship. The contemporary PhD is a dual-purpose qualification: the knowledge and skills of its holders are valued as much outside of the academic system as they are within it. PhD holders are considered “best qualified for the creation, implementation and diffusion of knowledge and innovation” – and thereby vital to successful industrial strategy (Auriol, 2010, p.6).



Scientists who attain a PhD are rightly proud – they have gained entry to an academic elite. But it is not as elite as it once was. The number of science doctorates earned each year grew by nearly 60% between 1980 and 2008, to some 34,000, in countries that are members of the Organisation for Economic Co-operation and Development (OECD). The growth shows no sign of slowing: most countries are building up their higher-education systems because they see educated workers as a key to economic growth (see “The rise of doctorates”). But in much of the world, science PhD graduates may never get a chance to take full advantage of their qualifications. In some countries, including the United States and Japan, people who have trained at

training for high-level positions in careers outside academia. Here, Nature examines graduate-education systems in various states of health.

**JAPAN: A SYSTEM IN CRISIS**  
Of all the countries in which to graduate with a science PhD, Japan is arguably one of the worst. In the 1990s, the government set a policy to triple the number of postdocs to 10,000, and stepped up PhD recruitment to meet that goal. The policy was meant to bring Japan’s science

unemployed postdoctoral students (one of several initiatives that have been introduced to improve the situation). “It’s just hard to find a match” between postdoc and company, says Koichi Kitayama, the head of the Japan Science and Technology Agency.

This means there are few jobs for the current crop of PhDs. Of the 1,350 people awarded doctorates in natural sciences in 2010, just over half (746) had full-time positions lined up by the time they graduated. But only 162 were in the academic sciences or technical services, of the rest, 250 took industry positions, 256 went into education and 39 got government jobs.

With such dismal prospects, the number entering PhD programmes has dropped off (see “Patterns of PhD production”). “Everyone tends to look at the future of the PhD labour

**“EVERYONE TENDS TO LOOK AT THE FUTURE OF THE PH.D LABOUR MARKET VERY PESSIMISTICALLY.”**

### Why doing a PhD is often a waste of time

The disposable academic

The Economist | Follow  
Dec 27, 2016 • 10 min read



This article originally appeared in the 2010 Christmas double issue of The Economist.

On the evening before All Saints’ Day in 1517, Martin Luther nailed 95 theses to the door of a church in Wittenberg. In those days a thesis was simply a position one wanted to

argue. Luther, an Augustinian friar, asserted that Christians could not buy their way to heaven. Today a doctoral thesis is both an idea and an account

**Image:** Articles like these in Nature (2011) and The Economist (2016) reflect a growing scepticism about the quality and value to individuals and society of many doctoral programmes.

In the UK, Chris Skidmore, Minister of State for Universities, Science, Research and Innovation, delivered an impassioned speech in May 2019 about the pivotal role of PhD talent in achieving the government’s ambition to invest 2.4% of GDP in research and development (R&D) by 2027.

*If we need to increase R&D spending...then we are also going to have to substantially increase the numbers of people we have working in R&D [...]. [We] we need to find at least another 260,000 researchers to work in R&D across universities, across business and across industry. [...W]e need to stop talking about jobs outside academia as being ‘second choice careers’ or ‘Plan B options’. For our 2.4% target to work, we need people*

*to be actively considering research careers across the entire science and innovation system..<sup>1</sup>*

But the drive for doctoral expansion has meant that, in most national contexts, only a minority of PhD holders now secure academic employment (Fox and Stephan, 2001; Sauermann and Roach, 2012; Hayter and Parker, 2019). Understanding the career paths and contributions of PhDs who leave the academy is therefore a matter of critical political, economic and societal importance. Several nations have responded by developing new surveys of PhD study and employment, designed to capture the more complex possibilities of the knowledge economy. Other nations – such as the USA – have in place long established methods for recording doctoral destinations.

Three dominant narratives overlay policy and academic debate about the contemporary PhD. These partly overlap, and partly contradict one another. They drive action, challenge and change, but must also be subject to detailed empirical scrutiny and test.

**Onwards and upwards** ('more is better'). The first theme, seen across national governments' drives to expand R&D, emphasises a growing need for doctoral researchers to catalyse innovation and growth. The policy challenge is then to attract the right calibre (and implicitly, discipline) of graduate into doctoral research, including by providing funding. Often this is tied to ideas of an educational 'arms race' or a global 'war for talent' (Brown and Hesketh, 2004).

**Enough is enough** ('more means worse'). As a counterpoint, others argue that there are already too many doctoral graduates, at risk of underemployment, and call for a restraint to growth (Stephan, 2013). Such arguments often come from within the university sector, from established scholars or from doctoral students and graduates themselves. At best, doctoral expansion is seen as largely supply-side driven; at worst as an academic 'pyramid' scheme, where research is subsidised by an army of doctoral hopefuls, with little prospect of 'making it' to full professor.

**Apply and diversify** ('more must be different'). A third narrative combines elements of the first two. It is not that there are too many doctoral graduates, but rather the issue is how to shift the doctorate, students and supervisors away from the academic apprenticeship model towards a more entrepreneurial stance which better connects to the wider economy outside of the university sector. In this account, it is not enough to expand the PhD; the PhD must change. A recent variant of this narrative focuses on changing the characteristics (including race/ethnicity and gender) of PhD students, as a goal in its own right, and as a means of gaining the benefits of cognitive diversity in meeting societal challenges (different people ask different questions).

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<sup>1</sup> Skidmore, C. (2019) Speech on "Reaching 2.4%: Securing the research talent of tomorrow", 7 May 2019 <https://www.gov.uk/government/speeches/reaching-24-securing-the-research-talent-of-tomorrow>



## **The case for research on (PhD) research**

The PhD occupies a totemic position in R&D policy - and economic policy as well. Equally clearly, there are competing narratives about whether and how it contributes to national goals. The PhD's prominence is not consistently matched by the quality of evidence and data about PhD students and graduates. This risks policymaking in the dark - particularly ironic in the context of an activity designed to increase knowledge and understanding through rigorous and systematic inquiry.

To again use the UK as an example. Here, the doctoral data landscape is a mess. Existing data are increasingly inadequate as a resource for understanding the PhD and its holders; and entirely unbecoming of the political attention and funding directed at doctoral education. UK policy makers have promised much about the economic and societal contributions of PhDs – but without any empirical foundation to do so. This is embarrassing when measured against the rigorous and well-funded doctoral surveys of other leading scientific nations, including Australia, Germany and the United States. But even where good survey data exists, analyses have tended to be nationally-based and inward-looking, missing the opportunity for learning through comparison about what is, after all, an international credential.

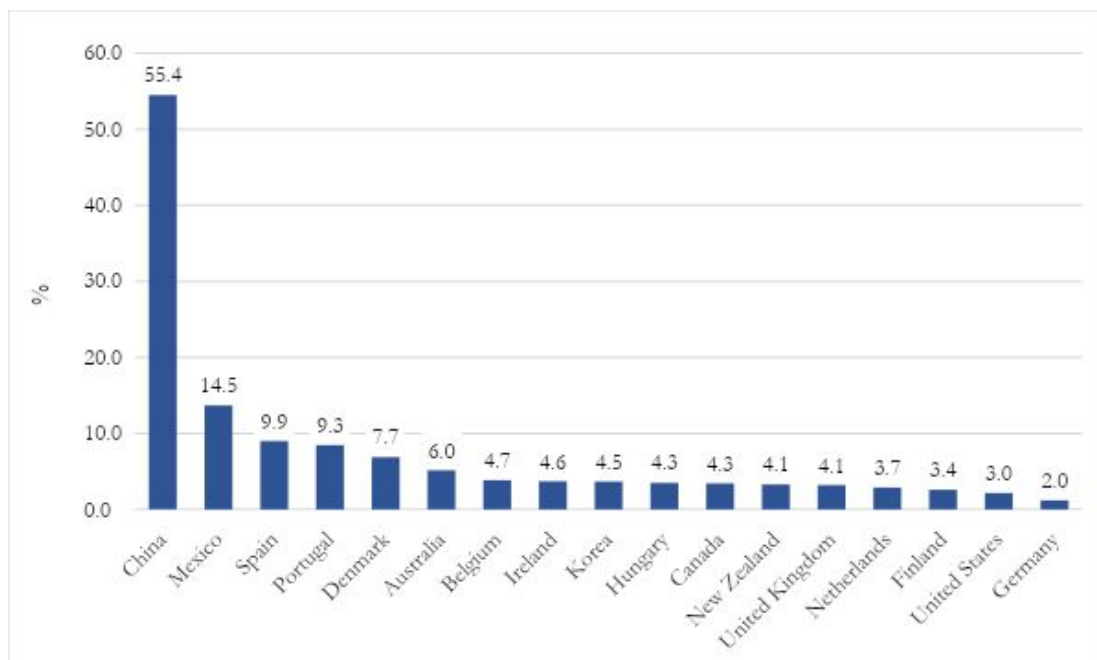
In this working paper, we make a case for closing this knowledge gap. Drawing on best practice internationally, we demonstrate the value of longitudinal surveys of doctoral access, experiences and outcomes, and argue for their introduction in the UK and other countries without access to such data. Such efforts should extend significantly beyond the timescale and scope of current data sources, and must prioritise the acquisition of detailed academic, demographic and decision-making information. We also argue for a nascent international research network on PhD career pathways in an age of expansion, to better connect colleagues who are leading work in this field globally, and to support the sharing of methods, data and other approaches. Supporting such a network could potentially be a role for the new Research on Research Institute (RoRI).

## **Structure of this paper**

We begin with an overview of the political and economic basis for doctoral expansion, and its perceived implications for PhD candidates, holders and research systems in the UK and beyond. We then map the current state of knowledge on the issues of doctoral access, experiences and employment. From this, we explore emergent and established approaches to researching doctoral candidates and holders in other countries. Next, we layout our recommendations for a new method of tracking doctoral access, experiences and outcomes in the UK and elsewhere, comprising: first, the launch of an international research network focused on PhD career pathways; and second, a longitudinal panel study of doctoral candidates and holders in the UK. Finally, we outline some of the anticipated beneficiaries and impacts of this work.

## 1. Context: the rise of the doctorate

A period of unprecedented doctoral expansion has heightened the need for better data and systematic analysis of PhDs and the career pathways of PhD holders. As shown in Figure 1 below, the growth of PhDs awarded globally has been steady for several years. The fastest rates of growth are found among countries seeking to rapidly develop their research and innovation systems. The United States remains the largest single producer of PhD graduates, awarding some 69,525 doctorates in 2016, and maintaining an annual growth rate of 3% (OECD, 2019). This global trend to growth is underpinned by the theories of human capital and the knowledge economy, which together assert the centrality of knowledge-intensive labour to future economic prosperity (Bell, 1973; Becker, 1993; Gibbons et al., 1994; Hanushek and Woessmann, 2015).

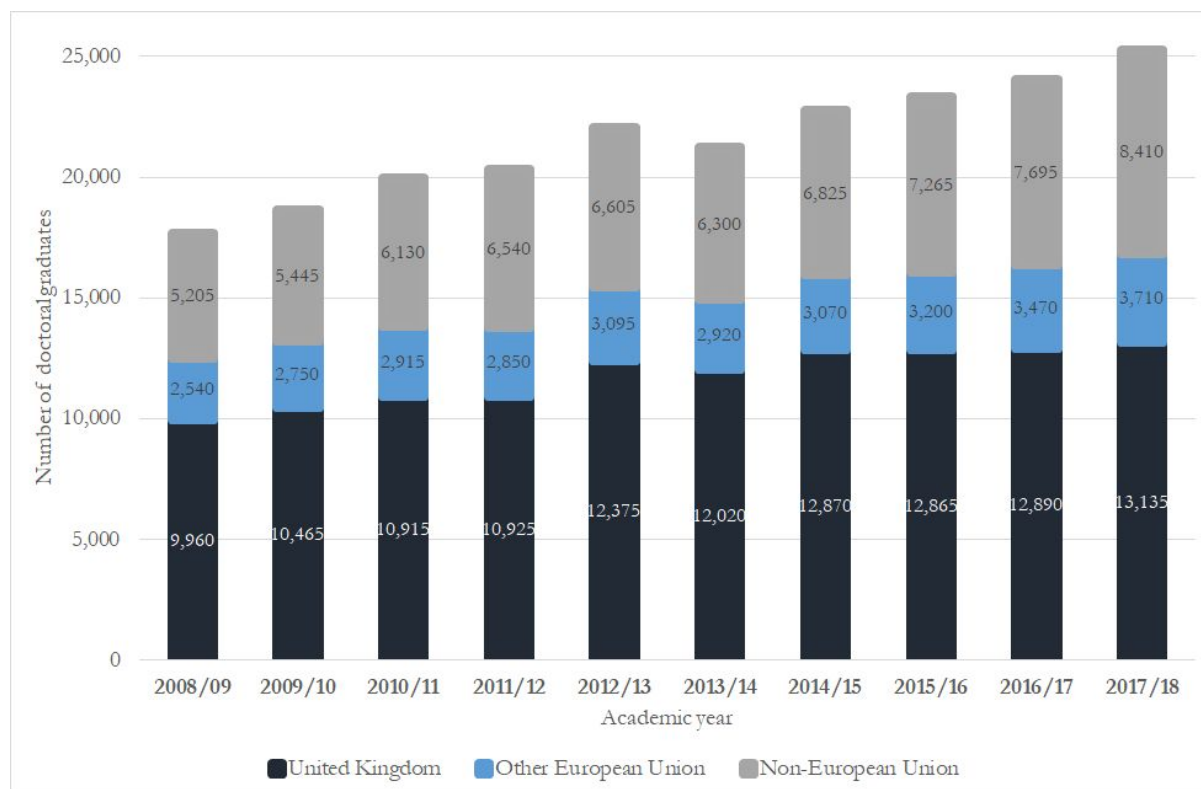


**Figure 1:** Average annual growth rate of PhD awards (2010-16) (Source: authors' own calculations from OECD (2019))

In the UK, successive governments have similarly pledged to increase the supply of national PhD holders. Most recently, the necessity of achieving this has been tied to a commitment to invest 2.4% of GDP in research and development by 2027. The Research Excellence Framework (REF), as a periodic performance-based assessment, also correlates institutional PhD numbers with research culture. However, while UK universities conferred almost 25,000 PhD degrees in the 2017/18 academic year, *UK domiciled* award holders make up only about half of these. Indeed,



as is shown in Figure 2, below, the annual number of UK domiciled PhD awards has stood at around 12,000 since 2012.



**Figure 2:** Annual PhD awards by domicile (2008-18) (Source: HESA Student Record)

The relative stagnation of domestic PhD awards has triggered a number of policy interventions to stimulate demand. There are now government loans for Master’s and doctoral study (Department for Business, Innovation and Skills, 2015; Department for Education, 2017). This follows two decades of investment in transferable skills training programmes, which aimed to broaden PhDs’ employability (Roberts, 2002; Hodge, 2010). Common to these reforms is a longstanding narrative of economic necessity (Leitch, 2006). PhD holders, we are told, are ‘in high demand from employers and industry... [and] make a vital contribution to British industrial performance and to improved economic productivity...’ (Department for Education, 2017, p.3).

Yet the return to doctoral investment is exceptionally unclear. Beyond the buoyant political narrative, sustained doctoral expansion is viewed with scepticism by those who regard UK research and innovation as a system fraught with deficiencies and inefficiencies. These concerns are varied and complex; and extend beyond the economic – questions of epistemic and social justice quickly emerge. We now consider three prominent areas of debate related to doctoral expansion – taking in turn the economic, the experiential, and the systemic.

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## 1.1 Doctoral expansion: the economic evidence

Relative to all other educational groups, the enhanced employment rate and earnings of PhD holders has been firmly established through OECD data across Europe (Auriol et al., 2013). Also uncontested is that the rates of return to doctoral study are highly variable by national context: the patterns of one country cannot be inferred to another. Such heterogeneity is particularly problematic for UK policymakers wishing to argue the case for further substantial expansion, because – as we will see – the UK evidence base on doctoral employment is severely lacking.

The discourse of expansion is further undermined by the finding that the return to doctoral study differs considerably by field of study. In disciplinary areas including the arts and humanities, the additional earnings benefit of a PhD vis-à-vis a Master's degree is small (Casey, 2009; Zolas, 2015). Moreover, a sustained increase in PhD awards could prompt a process of *credential inflation*, in which the earnings power of the qualification erodes with its ubiquity (Collins, 1979). Such an outcome must be taken seriously in the UK and other contexts, as the doctoral loans policy has partially shifted the cost and risk of further expansion from the state to individual students. It is therefore unsurprising, in light of such economic uncertainty, that fears of PhD 'over-supply' persist. Accurate empirical insight into how PhD holders' competencies are utilised and valued beyond traditional academic roles is critically lacking.

## 1.2 The contemporary doctoral experience

The lived experiences of PhD candidates and postdocs is another area of growing concern. While the diminishing prospects of securing academic employment are well documented (Cyranoski et al., 2011; Fox and Stephan 2001; Roach and Sauermann 2010, 2012); current PhD candidates are frequently portrayed as reluctant to acknowledge this shifting landscape. Qualitative studies with UK PhD candidates and postdocs consistently indicate that academic employment remains the preferred option for the majority (Hancock et al., 2017; Hancock, 2019a; McAlpine and Amundsen, 2016). Pursuing an academic career is however viewed as 'risky', with insecure rewards and a lack of support (Ipsos Mori, 2013).

The mismatch between PhDs' career aspirations and the precarity of labour market realities has incited something of a panic in public discourse. That there are too many PhDs for too few academic jobs is frequently labelled as a 'crisis' (Cuthbert and Molla, 2015); while non-academic routes are enduringly termed 'alternative' careers. Rarely does a week pass without a report of the 'harsh reality' facing junior researchers, often characterised as 'young, talented and fed up', or 'bright...disillusioned and directionless' (Nature 2014; Powell, 2016). The absence of reliable

employment data arguably fuels the wealth of anecdotal testimonials discouraging individuals from the trauma and disappointment of doctoral study (The Guardian, 2017; Maren Wood, 2019).


Viewed from this perspective, scepticism and disquiet towards yet more doctoral expansion is an understandable response. It is equally plausible to see why deteriorating mental health among PhD candidates and postdocs has been attributed to concurrence of an oversaturated academic job market, rising employment precarity, and pressures to publish and secure funding (Guthrie et al., 2017, p. 16; Nature, 2018, 2019).

### 1.3 A PhD system in crisis?

Equality, diversity and inclusion are rightly emphasised by most funders of doctoral education (UKRI, 2018). We contend that there are three reasons why access to PhD study should be a fundamental concern to all doctoral stakeholders. First, in order to secure the highest quality research workforce, there must be no entry barriers to a research career other than motivation and talent. Second, since doctoral candidates will lead the research agendas of the future, it is essential that they bring diverse perspectives to their work – to set wide-ranging research questions and pursue a plurality of approaches to addressing them. Third, and no less critical, since doctoral education can be the pathway to a rewarding career, a fair and just society demands that it is representative of that society; not only a narrow slice of it.

Mass systems of higher education, however, remain highly stratified. The growth of university participation globally has done little to reduce broader socio-economic inequalities, as higher education is differentially accessed by distinct demographic groups (Shavit, Arum, and Blossfeld, 2007; Schofer and Meyer, 2015; Marginson, 2016). In the UK, graduates who are female, of Black African, Black Caribbean, Indian, Pakistani, or Bangladeshi ethnicity, or from lower socio-economic backgrounds, have low or exceptionally low rates of progression to doctoral level study (Wakeling and Hampden-Thompson, 2013; Wakeling, 2016). Without a radical disruption to current trajectories, doctoral expansion *per se* is unlikely to ensure a more representative research workforce.

Ensuring diversity and inclusion means more than simply access to opportunity. The career prospects of even tenured academic staff continue to be shaped by gender, ethnicity and socio-economic background – despite initiatives to enhance equity in the research system (Nature, 2016). These trends are of course not new; the infrastructure of reward in science has long served to consolidate the status and influence of those in senior positions (Merton, 1968). They are, nonetheless, morally and politically troubling – and likely curtail the quality and usefulness of the research produced (Jones and Wilsdon, 2018; Nature, 2018). Narrowly representative research systems will produce narrow knowledge, with restricted economic, social



and political reach. To achieve equity in research we must first develop our knowledge of inequalities across the cycle of doctoral access, experiences and outcomes. Only then might we start to meet our ethical duty for a more diverse and inclusive research system.

## 2. Challenge: the limits to current knowledge

It is clear that ongoing doctoral expansion poses substantial implications for PhD candidates and holders, and – at a more macro level – for economic growth, social justice, and the longer-term sustainability of research and innovation systems.

We turn now to consider contributions from the current literature on doctoral access, experiences and outcomes; scrutinising the approaches and methods common to this scholarship, and its relevance to the UK context. We note a striking dearth of research on the UK system, resulting in a peculiarly diminished understanding of the national context (Wakeling and Kyriacou, 2010). Across the field, we further find that relevant studies are typically:

- based on small numbers of participants (and often, doctoral candidates and holders are not clearly delineated, despite their differing career stages);
- focused on Science, Engineering, Maths and Sciences (STEM) - with Arts and Humanities PhDs who leave academia constituting a particular blind spot; and
- where they are of a larger scale – offering an isolated snapshot of a specific point in the doctoral lifecycle (for example, of candidates *or* of recently graduated PhD holders).

### 2.1 Access to the doctorate

There are considerable gaps in our knowledge about doctoral access and success. What we do know raises significant concerns. The under-representation of women at doctoral level is a well-known and comparably well-researched phenomenon, linked to continuing inequalities throughout subsequent research careers, especially in academia (Monroe and Chiu, 2010). Existing research has however tended to focus on STEM subjects, despite there being evidence of problems in other subject areas, including the arts, humanities and social sciences (Posselt, 2016; Wakeling and Hampden-Thompson, 2013).


There is clear evidence of inequalities in access to doctoral study by socio-economic background (Wakeling, 2016; Wakeling and Hampden-Thompson, 2013). After taking into account subject discipline, sex, and classification of first degree, UK graduates from socio-economically disadvantaged backgrounds are less likely to progress immediately to a higher degree by research than their more advantaged peers (Wakeling, 2005, 2017). Evidence suggests that the socio-economic gap widens among those who do not enter a PhD immediately following their first degree. However there is a dearth of data about this set of students, since socio-economic characteristics are not currently collected for doctoral applicants, students and graduates.

Regarding ethnicity, there has been widespread concern about disadvantages suffered by minority ethnic undergraduates and staff in higher education. Doctoral study is something of a 'missing link' in this debate, given concerns about higher education curricula and research agendas (#whyismycurriculumwhite) and the representation of academics of colour in senior posts (#whyisntmyprofessorblack). To achieve a more equitable representation in senior posts, there needs to be more doctoral students of colour feeding through into the academic labour market. In the UK, current evidence suggests that, with the exception of British-born Chinese, all minority ethnic groups have a worse rate of progression into postgraduate research than white British graduates, and for some groups, levels of representation are little short of shocking (Wakeling, 2009; Wakeling and Hampden-Thompson, 2013). This is acknowledged by government and funders. UKRI's Delivery Plan (2019) commits it to improving equity and diversity and universities minister Chris Skidmore (2019) noted recently a need to "address the gender imbalances and race disparities that continue to haunt the research profession."

Recent research in the US and Germany draws attention to the post-doctoral stage as a site of inequalities. Drawing on the US Survey of Doctorate Recipients, Torche (2018, p. 266) finds a low association between parental education and adult earnings for advanced degree holders, concluding that 'a doctoral degree largely detaches individuals from their social origins in the United States'. This is particularly the case for women, but their average earnings as doctoral graduates are lower than men's, creating what she refers to as 'perverse openness'. While in Finland there seem to be similar patterns (Helin et al., 2019), in Germany inequalities continue into the postdoctoral academic career (Blome et al, 2019).

To address questions of equality, diversity and inclusion at doctoral level, it is first necessary to develop a comprehensive understanding of the representation and distribution of different groups. Two connected factors are particularly pertinent: patterns of doctoral progression across institutions; and the distribution of funded doctoral opportunities. Doctoral students are concentrated in a relatively small number of research-intensive universities, and it is known that graduates from the same set of institutions have a much higher likelihood of progressing to doctoral research. Underrepresented students, however, tend to be concentrated in teaching-focussed institutions (Wakeling, 2017). Understanding the institutional pathways into, through and out of doctoral study is therefore critical for addressing underrepresentation: who enters doctoral study and how? How do those from underrepresented backgrounds experience doctoral study and the post-doctoral labour market? Is institutional mobility a boost for career progression and why? Are there institutional dead-ends for doctoral students?

Related to this question, very little is known about the characteristics of students who are sponsored for their doctoral studies as against those who self-fund. In England, it is



well-established that those with studentships are more likely to successfully complete their studies than self-funded students (HEFCE, 2007). Since studentships are not means-tested, there is a risk that students from certain backgrounds are priced out of doctoral education; especially since a significant proportion of universities do not have access to Doctoral Training Centre funding (Budd et al. 2018). How meritocratically are studentships allocated? How much are apparent inequalities in doctoral access and success attributable to differences in funding?


Representative longitudinal data on doctoral students and graduates would allow these questions to be answered, plugging a substantial knowledge gap. Many of these key equality, diversity and inclusion issues need to be addressed through rigorous, systematic analysis; the risk otherwise is debate and policy driven by anecdote.

For some categories, such as socio-economic background and institutional trajectory, we need to ensure data is being captured from doctoral students. In other areas, we need to investigate pipelines and pathways longitudinally. With many existing data sources or analytic approaches, there is a reliance on snapshots which fail to disentangle age and cohort effects, or different disciplinary patterns of doctoral entry and progression. Critically, methodological nationalism can also mean mistakenly attributing broader international trends to local issues – and vice versa.

## 2.2 Doctoral experiences

Research on the experiences of PhD candidates and holders often pivots on the question of aspirations. Here studies tend to adopt a binary of academic versus non-academic career aspirations, seldom exploring the plethora of professional pathways associated with the latter category in any detail. A steady stream of studies suggest that the framing of the PhD as an ‘academic apprenticeship’ continues to prevail; motivating the majority of aspiring doctoral candidates, and – once enrolled – influencing their experience of the degree.

Across multiple national contexts, PhD candidates are reported to prioritise academic employment, and navigate their doctorate in relation to this ambition (Åkerlind, 2005; Roach and Sauermann, 2010; McAlpine and Amundsen, 2016; Hancock et al., 2017). Research points to the ‘glorification’ of academic careers, supervisor and disciplinary influence, and limited careers guidance as factors inhibiting the exploration of, and regard for, non-academic careers (Gaughan and Robin, 2004; Barnacle and Mewburn, 2010; Sauermann and Roach, 2012; Gardner et al., 2014; Hayter and Parker, 2019). With the notable exception of McAlpine’s work, however, few studies have employed a longitudinal design – preventing the linking of doctoral aspirations with eventual career outcomes. Where longitudinal methods are used, these have not yet been realised at a generalisable scale.



The discord of doctoral aspirations and career outcomes is not the only matter of concern. As noted, PhD candidates and holders must also contend with rising employment precarity, and acute pressures to publish, compete for research funding, and develop international collaborations (Jones and Oakley, 2018). These demands have been associated with heightened mental health difficulties. A number of recent international studies estimate that PhD and postdoctoral researchers experience rates of anxiety and depression beyond those reported for the broader population (Nature, 2018). In the UK, we possess very little evidence at scale about the motivations, aspirations, frustrations, and health and wellbeing of the PhD population. Where such evidence is collected – as with AdvanceHE’s ‘Postgraduate Research Experience Survey’ – it is disconnected from PhD candidates’ prior or future circumstances.


We have noted that PhD candidates are differentially distributed by demographic characteristics across subjects and institutions (Wakeling, 2016). These differences largely reflect the patterns observed for first degrees: high-status subjects and institutions recruit higher proportions of socially and economically advantaged students. Though these demographic differences are likely to shape the doctoral experience – and very obviously relate to equality, diversity and inclusion – we lack satisfactory data to examine this rigorously across the sector. Recent small-scale qualitative research with doctoral candidates detected considerable distinctions of opportunity and experience by doctoral institution, relating to variances in organisational culture, levels of funding, and institutional stratification (Pásztor and Wakeling, 2018).

## 2.3 Doctoral outcomes

Earlier we highlighted the highly variable evidence base on PhD employment. There are stark differences by nation in the balance of PhD holders who enter or leave academia, opportunities to conduct research in the public and private sectors, and the doctoral premium (Auriol et al., 2013). For this reason, understanding PhD career pathways within the national context is imperative. In the UK, rich data on PhD career and employment pathways are curiously absent.

Representative and detailed longitudinal data on doctoral career outcomes in the UK are not routinely collected. The most comprehensive and far-reaching record of PhD employment currently available is through the Destination of Leavers of Higher Education Survey (DLHE). The DLHE has two variants. An initial survey records employment circumstances six months after graduation, while the Longitudinal DLHE (Long DLHE) surveys graduates some 3.5 years later. These datasets form the basis of Vitae’s *What do researchers do?* reports which have, over the last decade, provided the most extensive picture of PhD employment outcomes in the UK (Vitae, 2010a, 2011, 2013).





The DLHE survey might well offer the most comprehensive record of PhD employment – but the view it permits is also desperately incomplete. The survey covers variables such as job title, sector, salary and career satisfaction, but was designed principally for first-degree holders - who comprise the large majority of its respondents. Having conducted a secondary analysis of Long DLHE data with the intention of better understanding doctoral outcomes, we contend that it is not fit for this purpose (Hancock, 2019b).

The DLHE affords a simplified and short-term view of PhD careers. The focus on employment ‘destination’ signals a neglect of process; including on how aspirations, decision-making, and access to capital influences career outcomes. Furthermore, the DLHE does not extend beyond 3.5 years – but the validity of recording employment no later than this for PhD holders is highly questionable. Permanent academic positions frequently take longer to secure – particularly in STEM disciplines; while entrepreneurial activities have an even lengthier fruition time (Vitae, 2010b). Survey items measuring the skill level of PhD holders’ work – including whether subject or research knowledge are necessary for the role – rely upon participant self-report, bringing considerable arbitrariness to responses. Indeed, there is currently no classification system for identifying doctoral level jobs to calibrate these responses against, such as there is for ‘graduate’ occupations (Elias and Purcell, 2013).

At a more technical level, important variables are absent, abridged or suffer a high rate of data missingness in the DLHE dataset. It is well established that the returns to higher education for first degree holders vary widely by academic and demographic variables (Britton et al., 2016). Given the hypercompetitive environment of academic science, and the inequalities evident in academic careers, it is reasonable to assume that doctoral career outcomes will also differ by academic and demographic characteristics. However, examining patterns of inequality with any systematic rigour is not possible through current data. By way of example, social class background is available for fewer than ten percent for the most recent doctoral cohorts in the Long DLHE sample (Hancock, 2019b); while doctoral institution is provided only by university mission group. The latter observation is a serious shortcoming when research income, culture, and performance diverge as much within the research-intensive Russell Group as they do beyond it (Boliver, 2015).

The cumulative effect of these limitations is evident in regression models of PhD employment applied to the Long DLHE data. These models suggest that *most* of the variance in doctoral employment in the UK is unexplained by the available data (Hancock, 2019b). As a result, there is a severe deficit in our understanding of doctoral employment in the UK – which stands in sharp contrast to the progressive efforts of others to track PhD career outcomes over the longer term.

### 3. Opportunity: international surveys of PhD holders

Beyond the UK, the evolving doctoral landscape has prompted a number of national attempts to map the career pathways of PhD holders. These initiatives were spurred by many of the issues outlined earlier in this paper; and were doubtlessly galvanised by pressure from the scientific community to track a ‘lost generation’ of early-career researchers (Nature, 2018, p. 302). In what follows, we assess this expanding research landscape by reporting impressions from a scoping study of five surveys of PhD candidates and holders in other nations. We then reflect on the present opportunity to follow international best practice by developing a UK survey that is both context-sensitive and allows for meaningful international comparison.

The five surveys of PhD candidates and holders included in our scoping study are detailed below.

	<b>Survey</b>	<b>Organisation</b>	<b>1st year of data collected</b>	<b>Design</b>
<b>Australia</b>	Understanding PhD Career Pathways	Group of Eight (Go8)	2018	Survey of PhD holders
<b>Canada</b>	The Labour Market Transition of PhD Graduates	Council of Canadian Academies	2019	Meta-analysis of surveys of PhD holders
<b>Germany</b>	The National Academics Panel Study (Nacaps)	German Centre for Higher Education Research and Science Studies (DZHW)	2019	Panel survey of PhD candidates and holders
<b>Netherlands</b>	The Labour Market Position of PhD Graduates	Centre for Science and Technology Studies (CWTS)	2014	Survey of PhD holders
<b>United States</b>	Survey of Earned Doctorates (SED)	National Centre for Science and Engineering Statistics (NCSES) within the National Science Foundation (NSF)	1957	Census survey of PhD candidates

**Table 1:** Overview of international PhD surveys



Our scoping study comprised semi-structured interviews with leads from each of these project teams between June and July 2019, and covered a range of topics, including: study rationale; funding; sampling; scope; and research design. Given the diverse research systems of these nations, it is not surprising that an array of approaches to researching the contemporary PhD is observed. There are, nevertheless, broad commonalities across the projects, which we will first address before turning to points of difference.

### 3.1 Commonalities across international PhD surveys

As is noted in Table 1, most PhD surveys – with the exception of the Survey of Earned Doctorates in the United States (SED) – are recent ventures. Project teams reported that concerns around continued doctoral expansion, the absence of employment data, and political pressure to link research investment to economic impact propelled their respective studies. Three projects (Canada, Germany and the USA) secured government sponsorship, although the precise channels of revenue varied. ‘Understanding PhD Career Pathways’ (Australia) is the initiative of a mission group (Group of Eight), while ‘The Labour Market Position of PhD Graduates’ (Netherlands) was supported through institutional funding (Leiden University).

Several project teams acknowledged the long-established SED survey as an initial reference point, but each team embarked upon a substantial period of development and testing, followed by data processing and analysis. This work is sustained by dedicated teams, which typically involve a minimum of two full-time researchers, with fractional support of others as needed. In the early stages, significant resource was committed to nurturing partnerships with higher education institutions and funders, which later proved vital to successful recruitment. The distribution of surveys through participants’ universities – whether by researcher development teams or alumni officers – inspired their interest and trust.

Where empirical surveys are used (in four of the five studies), these are mostly hosted online, and are largely quantitative, with closed questions. As each study employs a distinct sampling frame, the questions asked of participants vary. Across the five nations, however, the principal focus is on the prior and current employment circumstances of PhD holders – including role, sector and salary. Research instruments are subject to ongoing monitoring; and all projects have in place governance arrangements, which incorporate academics, doctoral funders, and policy makers.

### 3.2 Points of difference across international PhD surveys

While all of the projects featured in the scoping study made use of survey-based research, national approaches differ. In Canada, the project team are conducting a meta-analysis of

existing data, drawn from four institutional surveys of PhD holders.<sup>2</sup> Teams in other countries have undertaken primary data collection; although again the exact design and scale of this varies. In Germany, the Nacaps study recruits doctoral candidates who are tracked annually until eight years post-graduation.

In the USA, data collection occurs as candidates prepare to submit their doctoral thesis. Separate surveys, such as the Survey of Doctorate Recipients (SDR), then offer a later view of labour market outcomes – beginning data collection one year after graduation. The Australian and Dutch studies target PhD holders exclusively. In Australia, data are collected from PhD holders who are 3, 8, and 15 years post-graduation; in the Netherlands, eligible participants are between 2 to 6 years post-award. The Australian and US studies further exclude professional doctorates from their sampling frames.

Given the distinct approaches to sampling and data collection, questions asked of participants differ accordingly. The SED, for example, asks doctoral candidates about their educational history, demographic characteristics, and post-graduation plans. The first wave of the Nacaps survey is the lengthiest element of data collection, covering: personal background; motivations and attitudes; conditions of study (including supervisor relationship and research culture); academic work; and, career strategies and decisions. Actual career paths and other outcomes are the focus of later waves of data collection. Open questions to elicit qualitative data are included in some of the survey instruments, particularly when aspirations and future plans are addressed.


The studies achieve markedly different sample sizes; from a few thousand to around 50,000 in the SED. To an extent this once more reflects the particular sampling strategies adopted – with the exception of the SED which is a census survey, other national studies follow a cluster sampling approach, to utilise existing networks and bolster response rates (which range from fewer than fifteen to over ninety per cent).

Where a longitudinal panel design is used, such as is the case with Nacaps, participant attrition is expected – though to a certain extent this can be mitigated with condensed follow-up waves. Incentives are in use by some projects but not all; the research literature is equivocal as to the efficacy of these (Singer and Ye, 2012).

Further differences were noted between the studies, but these are perhaps less integral to the fundamental questions of research design of relevance to the UK research community. The studies enjoy varying scale and security of funding, which in turn influences the size of the project

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<sup>2</sup> These are the universities of: Alberta; British Columbia; McGill; and Toronto.



teams. Nationally specific challenges were also observed. In Germany, institutional records of registered PhD candidates have been historically patchy. The management of ethical considerations and data sharing protocols tend to be shaped by national practices and consequently take different forms.

### 3.3 Reflections for the UK

The rise of international surveys on PhD candidates and holders presents a significant opportunity for the UK research community to learn from international best practice and develop a national survey that is both context-sensitive and allows for meaningful international comparison. From this scoping work, we are convinced of the need for any UK study to be situated in – and strengthened by – a wider international network. The importance of attuning UK data collection to the efforts of international research on PhD experiences and career pathways is especially crucial in the contemporary age. Higher education and research operate as a global field, and researchers are expected to cross national borders throughout their careers (Marginson 2008, 2018; Netz and Jaksztat 2017). Anchoring a UK study in a comparative context will facilitate more profound insights into the local and the global; the specific and the shared.

## 4. New methods of tracking doctoral access, experiences and outcomes

Despite substantial investments in the PhD worldwide, our understanding of continued expansion – its causes, contributions, and consequences – is weak. As we have shown, in the case of the UK, our knowledge is greatly restricted by a dearth of available data. Beyond the UK, we see an exciting opportunity to join up the research efforts of other leading research nations to develop a richer, international view of the contemporary PhD experience and career pathways.

The UK government and research funders, in particular, must do more. To fully understand the 21<sup>st</sup> century PhD, we need far better methodological approaches to researching PhD access, experiences and outcomes, which allow more causal inferences to be drawn. Governments have long recognised that snapshot surveys have limited value, and have turned to cohort studies to address questions of economic and social change and policy effectiveness. Research teams in Australia, Germany, the Netherlands and USA are applying longitudinal methods in order to better understand their PhD populations. In the UK, we have no such equivalent study – and, as a result, can say precious little about our PhD holders beyond the immediate post-doctoral period.

Adopting a similar cohort approach in the UK would allow us to see doctoral candidates' origins, destinations and, crucially, the pathways they followed to get there. Progress through the doctoral pipeline into, out of and through a research career is a central concern. This is reflected in the attention paid to the Royal Society's famous 'pipeline' diagram (Royal Society, 2010) which powerfully captured attention with its depiction of high rates of wastage in the research career, but where there are concerns about the accuracy of the data on which it was based.

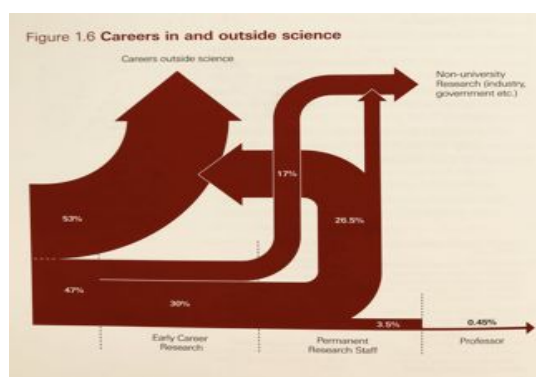


Figure 3: The 'Careers in and outside science' diagram (Royal Society 2010) gave rise to the widely cited figure that only 3.5% of PhD graduates go into permanent research roles and 0.45% become professors. This data is now known to be inaccurate (and is, in any case, 10 years out of date) but the diagram is still widely used today.

A new dedicated longitudinal survey should be established to capture far richer data than is currently the case; tracking individuals over a longer timeframe and collecting the detailed demographic, decision-making, and contextual information that is presently missing. Variations in

doctoral provision, experience and outcomes should be explored across a range of universities, selected to reflect the diversity of the UK research system.

But a new UK study must not develop in isolation. The international research teams featured in this paper have indicated their willingness to partner in new international networks and collaborations on the PhD and career pathways. This presents a significant opportunity for the UK, which has historically neglected research in this area, to learn from international best practice and develop a survey with internationally comparative elements.

Any such network could further consolidate the research already being undertaken in other nations; and take us towards a more integrated understanding of the place of PhD and its holders across the global research system. It is possible that the new Research on Research Institute (RoRI) could play a role here, ensuring strategic coherence and responsiveness to related issues in the field of research on research, including the changing dynamics of disciplines, equality and diversity, research impact, and international collaboration.

The systematic collection of data enabled by such a network, combined with new UK-based empirical work, could facilitate internationally comparative insights in the following areas:

#### **Access and selection into the PhD and academic careers**

- What are the determinants of selection into doctoral programmes and academic research careers?
- What are the determinants of retention and attrition across doctoral programmes?
- How are demographic, disciplinary, institutional and structural factors related to selection processes into the PhD and academic research careers?
- How effective are recruitment and selection processes for the academic system?

#### **Motivations, decision-making and career pathways**

- What are the motivations, values and aspirations of PhD candidates and holders?
- To what extent do these change across the doctoral journey?
- What are the decision-making and career planning strategies in which doctoral candidates and holders engage?
- How do demographic, disciplinary, institutional and structural factors relate to doctoral career pathways?
- How can the contributions of PhD holders beyond the academic system be better captured and valued?

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### **PhD experiences, cultures and support**

- What support is available to PhD candidates and holders?
- How has the supervisory model evolved in age of expansion?
- How does support vary by discipline, programme structure, institution and region?
- What is the impact of recent reforms to PhD training worldwide?
- How do the different contexts and conditions of support conditions relate to doctoral employability and career pathways?

### **Economic, social and cultural returns to doctoral expansion**

- What are the individual and public economic returns to doctoral investment?
- How do PhD holders contribute to knowledge creation, dissemination and application?
- What are the cultural and social returns to doctoral investment?



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## 5. Outcomes, impacts and beneficiaries

The creation of an international research network, and new UK initiatives to track PhD access, experiences and outcomes, will enable a diverse range of stakeholders to improve the decisions, policies and practices they undertake. These efforts must develop in close consultation and collaboration with a range of partners already invested in the PhD, early career researchers (ECRs) and the research and innovative system more broadly. The expected beneficiaries are wide-ranging. The following, which is by no means exhaustive, sets out some potential impacts of this research.

- **Governments and policymakers:** better policies can be developed on the basis of more detailed, long-term evidence on the employment and economic contributions of PhDs. This will enable greater understanding of who benefits from doctoral study, and which variables correlate to certain employment outcomes (e.g. the role of institutions, geography, demographic characteristics). These matters will need to be considered by policymakers responsible for developing the science workforce and in the UK, in particular, in light of the doctoral loan policy and plans to spend 2.4% of GDP on R&D.
- **PhD and ECR sponsoring bodies:** knowledge generated will generate fresh insights for the provision of PhD support, training and professional development courses, and highlight real or perceived gaps in support, training and development opportunities.
- **Higher Education Institutions (HEIs):** HEIs can learn from international best practice to develop and enhance supervisor and mentor training; training and development for their doctoral candidates and postdoctoral researchers. They can also better manage doctoral career expectations (including, being able to explain the benefits and likely outcomes of doctoral study to prospective candidates, domestically and internationally).
- **PhD employers:** better evidence will alert employers to particular challenges that PhD holders commonly encounter when transitioning to professional roles outside of the university, and will inform employers of the contributions PhDs bring to roles and organisations in sectors beyond academia. The potential for international comparison and learning here is considerable.
- **Prospective PhD candidates:** will be able to use any developing evidence base to make better informed decisions about whether to undertake a PhD, and to be more aware of possible outcomes at an earlier stage in their decision-making.

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- **Current PhDs and postdocs:** the developing evidence base will heighten awareness of the varied jobs that doctoral holders go on to do. A nuanced and comprehensive understanding of why career pathways develop as they do will allow PhD candidates and postdocs to make more informed decisions about their own futures. PhD candidates will also benefit from supervisors, mentors and careers services who are better informed and can enhance the advice and guidance they offer as a result.
  - **Doctoral supervisors and postdoctoral mentors:** will be better informed to assist doctoral candidates and postdocs with more informed and realistic career planning.
  - **Careers and training services:** will be able to use a more detailed understanding of PhD career pathways to adapt or develop training and support for PhDs in the most suitable and effective ways.
  - **Wider society:** improved evidence will potentially support greater appreciation of the economic, social and cultural contributions of PhD holders within and beyond the research system.

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