**What is known about doctoral employment? Reflections from a UK study and directions for future research.**

**Author details**

Sally Hancock, Department of Education, University of York UK.

sally.hancock@york.ac.uk

ORCiD ID: https://orcid.org/0000-0001-8488-2765

Twitter: @sallyehancock

**Funding details**This work was supported by the Society for Research into Higher Education under Grant NR201609.

**Abstract**

Over the last two decades, international governments have positioned PhD holders as vital to prosperity – and yet, understanding of PhD holders’ economic, social and cultural contributions remains considerably undeveloped. This article shares insights from a secondary analysis study of PhD employment in the UK. This study made use of the Destination of Leavers of Higher Education Longitudinal Survey, which provides the most comprehensive record of PhD employment currently available in the UK. Nevertheless, significant limitations arose when using the dataset to explore doctoral careers, suggesting that a new empirical approach is needed. In particular, there is a pressing need for richer demographic and decision-making data on PhD holders, along with a more extensive, longitudinal view of the careers they forge. The reflections and recommendations emerging from this study will be of interest to scholars and policymakers beyond the UK, given the global investment in the expansion of doctoral education.

**Keywords:** PhD education; doctoral careers; human capital; knowledge economy; research policy; secondary analysis.

**Introduction**

The number of PhDs awarded by universities has grown steadily in recent decades (Cyranoski, Gilbert, Ledford, Nayar, & Yahia, 2011). The expansion of doctoral education is in part ideologically driven; as policymakers invoke the vision of an economy reliant on knowledge and highly skilled workers. This perspective is not entirely new: for the last fifty years, the concepts of human capital and the knowledge economy have underpinned ever-expanding systems of higher education (Hanushek & Woessmann, 2015; Marginson, 2019). Doctoral expansion is, however, a more recent phenomenon and one which – this article will argue – advances from a relatively undeveloped evidence base.

It is now well documented that, across most national contexts, increasing numbers of PhD holders enter non-academic employment (Hayter & Parker, 2019; Fox & Stephan, 2001; Sauermann & Roach, 2012). This trend could be seen to justify policymakers’ assertions that PhD holders are highly valued across the economy and wider society. However, detailed longitudinal understanding of doctoral careers is lacking. Knowledge on the occupations of PhD holders beyond academia is sparse, as is understanding of the variables that shape particular employment outcomes. Given such limited understanding, it is not surprising that expansion has polarised doctoral stakeholders: while some support continued growth, others deem it unsustainable and even harmful. For the latter, doctoral expansion and changing employment destinations have transformed the PhD from academic apprenticeship to general – if highly advanced – occupational training. They question whether the PhD is fit for such a broad purpose; taking the view that society faces an ‘oversupply’ of PhDs, ill-suited to careers outside of academia (Gould, 2015; Stephan, 2013). Crisis discourse is frequently deployed in these debates: *Nature* articles of recent years make reference to the: ‘*PhD factory*’; ‘*uncertain futures*’; and the ‘*harsh reality*’ and ‘*empty promises*’ of the postdoctoral labour market (Cuthbert & Molla, 2015; Cyranoski et al., 2011; Nature, 2014; Rohn, 2011). The lived experiences of PhD holders are another concern: they are characterised as ‘*young, talented and fed up*’ and ‘*bright… disillusioned and directionless*’ (Nature 2014; Powell, 2016). More recently, the increased competition for postdoctoral funding and academic posts associated with doctoral expansion has been linked to the relatively high prevalence of mental health problems in the PhD population (Guthrie et al., 2017).

Understanding the wide-ranging implications of doctoral expansion is thus likely to assume greater international importance in years to come. This article considers recent research on doctoral employment, identifying prominent limitations in both the literature and common methodological approaches to researching the careers of PhD holders. It shares insights and reflections from a study of doctoral employment in the UK, which serves to illuminate key issues for doctoral stakeholders internationally. The articlebegins with a brief introduction to doctoral education in the UK and recent policy. This is followed by a critical overview of existing scholarship on doctoral employment. Next, the methods of and focused findings from the UK study are presented, in response to major themes from the current literature. The implications of these findings are discussed, with attention to the shortcomings of present knowledge, and recommendations for future research.

**Recent developments in doctoral education in the UK**

In common with the global tendency, successive UK governments have endorsed policies and investment to increase the supply of PhD holders and support their transition into wide range of occupations (Leitch, 2006; Skidmore, 2019). To prepare PhDs for non-academic employment, transferable skills courses have become an established part of doctoral programmes over the last two decades (Roberts, 2002; Hodge, 2010; Vitae, 2019a). In 2009, the introduction of Doctoral Training Centres signaled a shift from the student-supervisor model of doctoral training to a cohort-based one, emphasising interdisciplinary collaboration, knowledge exchange and research impact (Lunt, McAlpine, & Mills, 2014). Collectively these reforms aim to broaden the professional horizons of PhD holders and support preparation for diverse employment (Hancock & Walsh, 2016). At the time of writing, two major funders of UK PhDs are reviewing their doctoral training offer to ensure the relevancy of skills development to a broad range of employment sectors (EPSRC, 2020; ESRC, 2020).

In 2018, government confidence in the economic importance of PhDs led to the introduction of the Postgraduate Doctoral Loan, through which UK and EU nationals can apply for £25,000 to support their studies. During a consultation process in 2017, the proposal was justified in light of PhD holders’ ‘vital contribution to the UK’s world class research base and… to British industrial performance and to improved economic productivity’ (Department for Education, 2017, p. 3). The current UK government plans to increase expenditure on R&D to 2.4% of GDP by 2027 (HM Government, 2020) – an ambition which, if achieved, is estimated to bring a further 25,000 PhD students into the system. Such expansion will further intensify competition for academic jobs and increase the number of PhD holders employed beyond academia.

**What is known about doctoral employment? An overview of recent research.**

Historically, doctoral education has received less attention than other areas of higher education (Wakeling & Kyriacou, 2010). This is, however, changing: doctoral expansion has coincided with a multiplication of interested stakeholders and a number of burgeoning research areas. The latter has included studies on: inequalities in doctoral education (Gopaul, 2015; Pásztor & Wakeling, 2018); lived experiences of the doctorate (Bryan & Guccione, 2018; McAlpine and Amundsen, 2018); critical appraisals of pedagogy, training and assessment (Budd, O'Connell, Yuan, & Ververi, 2018; Elliot, Bengtsen, Guccione & Kobayashi, 2020); and, employment destinations. While research on doctoral employment is growing, tensions between traditional and reformist views on the purpose of the PhD have both repressed and propelled studies in this area (Barnett, 2020).

*Researching doctoral employment*

Broadly, research on doctoral employment has involved one of two approaches: large scale quantitative studies, which typically report survey responses or draw from secondary analyses of national employment statistics; or, smaller-scale qualitative research.Mixed-method inquiries in this area are rare. Despite the global consensus on the economic importance of PhD holders, there is notably less consistency to international evidence gathering. Several nations – including the USA, Germany, and the Netherlands – have established large-scale surveys to record the employment destinations of PhD holders in their countries (Hancock, Wakeling, & Chubb, 2019). These datasets, together with analyses conducted by the OECD, reveal that PhD employment trajectories are highly variable by nation (Auriol, 2010; Auriol, Misu, & Freeman, 2013). Stakeholders in the UK, which currently has no such survey specific to doctoral employment, should therefore exercise caution in inferring the findings from other contexts to its own.

*The knowledge economy vision*

Turning to consider the knowledge economy, existing studies provide a tepid endorsement of its promises. PhD holders have lower rates of unemployment than all other educational groups, and a doctoral earnings premium – when considered against all other educational groups – is fairly well established (Auriol et al., 2013; Skovgaard Pedersen, 2014). However, this premium differs by field of study, and the benefit of holding a PhD vis-à-vis a Master’s degree can be small (Auriol et al., 2013; Casey, 2009; Zolas et al., 2015). It is plausible to hypothesise that a sustained increase in PhD awards could prompt a process of *credential inflation* – devaluing the earnings power of the PhD and leading to declining returns (Collins, 1979). The plausibility of credential inflation amid further doctoral expansion arises because understanding of whether and why employers value PhD holders is limited. Empirical research with PhD employers is particularly scarce. Why a PhD enhances employability and earnings is unclear: the qualification may well act as a ‘signal’ of quality, rather than being of direct relevance to an occupation or the basis for increased productivity.

*Doctoral employment* *destinations*

A central preoccupation in the empirical research is the quantification of PhD holders’ transitions into or out of academic employment. This is typically achieved through the analysis of large-scale survey data or official employment statistics, with a focus on PhD employment destinations at a single point in time. In the UK, Vitae – an organisation which supports the professional development of researchers – has led research on doctoral employment destinations in the last decade, through its series of ‘What do doctoral graduates do?’ reports. These reports relate secondary analysis of data from the Higher Education Statistics Agency’s Destinations of Leavers of Higher Education (DLHE) survey, which records graduate activity at six months and three and a half years after graduation. The most recent published data from Vitae (2019b) illustrate that across all fields, over half of all PhD holders have left higher education six months after completion.

Beyond the UK, a number of comparative and single nation studies have examined doctoral employment destinations in the last decade. Auriol, Misu and Freeman’s (2013) analysis of the Careers of Doctorate Holders (CDH) dataset – an initiative between the OECD, the UNESCO Institute for Statistics and Eurostat – demonstrated the increasing tendency for PhD holders to be employed beyond academia. While higher education remains the largest single employer of PhD holders, the share employed by business and government has increased in most nations.

Most studies of PhD employment destinations are located in countries with well-developed research systems. The trend for PhD holders to increasingly forge non-academic careers is consistent across nations, although the precise ratio of those employed in/out of academia varies by context. Analysis of 2016 Australian census data indicates that some 41.9% of PhD holders are employed in the academic sector (McCarthy & Wienk, 2019, p. 8). In Norway, a similar proportion of PhD holders are employed in academia (Kyvik & Bruen Olsen, 2012, p. 205; Thune et al., 2012, p. 82). In the Netherlands and United States, around one-third of PhD holders remain in academia (van de Schoot, Yerkes, & Sonneveld, 2012; McCarthy & Wienk, 2019). In Germany, only one-quarter of PhD holders secure academic positions one year after completion (Hauss, Kaulisch, & Tesch, 2015). There is some evidence that different doctoral routes may lead to distinct occupational outcomes. In the German context, a doctorate achieved under the supervision of a professor with ‘high research performance’ is associated with securing a public research role, while a doctorate undertaken with industrial links is predictive of a career in the private sector (Hottenrott & Lawson, 2017). In Australia, Jackson and Michelson (2015) report that PhD holders from the prestigious Group of Eight universities are significantly more likely to enter full-time employment.

Given the focus on transitions into or out of academic employment, research into self-employment and entrepreneurial activities among PhD holders is notably underdeveloped. The reliance on employment statistics and large-scale quantitative surveys often means that analysis of the subjective factors influencing career pathways – including the role of values, aspirations and access to capitals – is absent. In short, the lived experiences associated with particular employment outcomes are seldom addressed. In contrast to the optimism of policymakers, analyses of European economies do, however, indicate that PhD holders often experience a protracted route into non-academic employment and face a lengthy wait for permanent contracts (Skovgaard-Pederson, 2014). Somewhat undermining the view of PhD holders as agents of knowledge exchange, Skovgaard Pedersen also found limited evidence for intersectoral mobility; reporting that once doctoral graduates leave academia, they rarely return. Moreover, PhD holders who leave research entirely report lower professional motivation and satisfaction (Auriol et al., 2013).

The focus on employment destination has hindered detailed understanding of the contributions that PhD holders make in their varied professional roles. Perhaps reflecting the positionality of university-based scholars approaching this topic, few studies extend beyond the academic/non-academic binary to richly explore the work of those who exit academia or consider systematically how employers make use of doctoral-level knowledge and skills. In contrast to the analytical consensus around the notion of a ‘graduate job’ (c.f. Elias & Purcell, 2013), there is currently no agreed definition of doctoral level work. Researchers from different nations apply vastly different measures and conceptualisations of doctoral employment. This makes comparison of PhDs’ contributions across national contexts especially challenging, and likely underplays the research and knowledge exchange activities of PhD holders in non-academic occupations (Hancock *et al*., 2019). Such inconsistency limits the potential of current scholarship as a force for political scrutiny.

*Doctoral career aspirations*

The heightened interest in doctoral employment destinations has been complemented by a growing body of research examining PhD career preferences. Smaller-scale, qualitative methods are deployed here; which, while offering an in-depth account of individual preferences and behaviours, are rarely linked to macro-level data on actual employment destinations. The qualitative tendency of this research limits claims of representativeness or broader generalisation.

Across several national contexts, a number of studies report that PhD students continue to prioritise academic employment, despite the evidence that this is a diminishing likelihood (Åkerlind, 2005; Roach & Sauermann, 2010; Hancock, Hughes, & Walsh, 2017). In a study of almost 8,000 doctoral graduates across Europe, Parada and Peacock (2015) concluded that academic careers remain the most popular option in all countries, and that the contemporary doctorate is ‘largely mis-sold’ (p. 610). Sauermann & Roach’s (2012) study of natural science PhDs in 39 ‘tier-one’ US research universities found that while the attractiveness of academic careers declined over the course of doctoral study, late-stage students seeking academic careers continued to outnumber job openings. The influence of academic culture and disciplinary norms is such that PhD students appear reluctant to consider so-called ‘alternative’ careers beyond academia (Barnacle & Mewburn, 2010; Gardner, Jansujwicz, Hutchins, Cline, & Levesque, 2014; Hancock, 2019). The ‘glorification’ of academic careers, supervisor influence, and insufficient careers guidance are cited as prominent factors compounding these narrow preferences (Gaughan & Robin, 2004; Hayter & Parker, 2019; Sauermann & Roach, 2012).

From this basis, it is unsurprising that transitions into non-academic employment are portrayed as a difficult process – and one which PhD holders can feel substantially unprepared for (Crossouard, 2013; Hayter & Parker, 2019). McAlpine’s qualitative studies of doctoral and postdoctoral researchers characterise career strategies as identity work: involving an ongoing negotiation of personal biography and responsibility, imagined future selves, and the labour market (McAlpine & Emmioglu, 2015; McAlpine & Amundsen, 2018). By portraying the transition into non-academic employment as one of compromised ambition and revised professional identity, these studies add weight to the scepticism of stakeholders who are wary of the continued doctoral expansion. While destinations data clearly demonstrate that the growing likelihood of non-academic careers, students’ aspirations are often not aligned to these outcomes. Studies of doctoral career aspirations highlight the diverse aims, expectations and values that students bring to the PhD – and indicate that career planning may not be entirely or rationally responsive to employment statistics.

**A UK study of doctoral employment**

**Methods and data**

The gaps and limitations apparent in the existing literature prompted this study of doctoral employment in the UK. The UK Higher Education Statistics Agency (HESA) collects extensive data on the students, graduates and staff of UK universities. Prior to embarking on any new data collection, it was decided to first examine the available HESA data on PhD holders. The most comprehensive data available on the employment circumstances of PhD holders in the UK is collected through the Destinations of Leavers from Higher Education (DLHE) survey. As noted, DLHE survey data formed the basis of Vitae’s reports on PhD employment.

The DLHE has two variants: an initial survey records employment circumstances at six months after graduation, and the ‘Long DLHE’ takes place at three and a half years. At the time of writing, the DLHE has been replaced by the Graduate Outcomes survey; the implications of which are discussed in the concluding section of this article. Though the DLHE offers the most comprehensive record of PhD employment in the UK, HESA do not routinely publish findings on PhD holders, nor analyses of employment changes between 6 months and three and a half years. Data on PhD holders can be obtained by researchers on request. The standard DLHE dataset is, however, limited to survey variables only, which cover the conditions and destination of employment, but not the academic and demographic characteristics of the PhD holders. It was reasoned that this analysis of doctoral employment should include such information, since variables such as subject, institution, gender, ethnicity and socio-economic background are associated with significant variance in both first-degree employment outcomes and academic career progression (Britton, Dearden, Shephard, & Vignoles, 2016; Nature, 2016; Vettese, 2019).

To achieve a richer analysis of UK doctoral employment than has previously been attempted, a bespoke dataset – incorporating the academic and demographic characteristics of UK domiciled PhD holders in the Long DLHE – was created. Given evidence in the literature that doctoral careers can be protracted, the Long DLHE was chosen as a basis for more meaningful insight than the six-month survey. At the time of data purchase, the two most recent waves were requested. Demographic and academic information were obtained through data linkage to the Student Record, a census dataset of students registered at UK universities. In theory, the data linkage would enable employment destination to be analysed by gender, ethnicity, social class, age and institution – though the challenges of realising this in practice will be addressed in the discussion.

The final dataset contained UK domiciled PhD holders who obtained their degrees in 2008/9 and 2010/11 (*n*=4,731; response rate 39.5%). The survey therefore captures labour market activity in 2011/12 and 2013/14. The sample represents around one-fifth of the population of UK domiciled PhDs graduating in those years. Data were weighted by HESA prior to analysis, in reference to key academic variables, such as doctoral subject area. Table 1 displays the distribution of academic characteristics in the dataset.

TABLE 1 HERE

The majority of PhDs are awarded in the scientific disciplines, and from Russell Group institutions, which is comparable to HESA statistics for the wider doctoral population. Table 2 sets out demographic characteristics. Notable here is the relatively young age of the sample; over half are 30 or under at the time of the survey. The vast majority of PhD holders are White British (90.4%). Two-thirds have a parent or guardian with a higher education qualification, and one third originate from the highest occupational group. These are well above UK averages, suggesting that PhD holders originate from comparatively advantaged social positions (Office for National Statistics, 2013).

TABLE 2 HERE

The principal aim of this article is to reflect on current knowledge of doctoral employment and draw out recommendations for future research. In what follows, key insights on – rather than a full analysis of – doctoral employment in the UK are presented. Since the Long DLHE survey data were supplied independently of the six-month data, the following analysis is cross-sectional and does not track individuals over time. In the absence of an internationally agreed definition of doctoral employment, the supplementary material details the approach taken to classifying occupational destinations. The findings are limited to univariate and bivariate analyses; selected to address the themes of the literature earlier discussed, and issues which most prominently occupy the attention of doctoral stakeholders. This includes the employment rate of PhD holders, and the proportions forging academic and non-academic research careers. Additional analyses, including academic and demographic differences in employment outcomes, form the basis of separate outputs forthcoming from this study.

**Selected findings: the employment of PhD holders in the UK**

Table 3 sets out PhD holders’ main activity at the time of the survey. Consistent with earlier research in the UK and beyond, PhD holders report a high rate of full or part time employment (88.4% across the whole sample). There are, however, sharp variations by subject area, particularly in relation to full and part time employment. Differential distributions of age and gender across subject areas may partly explain this. Doctoral graduates in the arts and humanities and social sciences, for example, are on average approximately ten years older than those in the scientific disciplines (x̄ age in years: arts and humanities 39; natural and physical sciences 31; social sciences 41).

TABLE 3 HERE

The issue central to many studies and commentaries on PhD employment – of the proportion employed within or beyond academia – is addressed in figure 1, below. While the vast majority of PhD holders have left academia at the time of the survey (70.1%), there are again notable differences by doctoral subject area. To an extent, these outcomes reflect the differing numbers of PhDs obtained across fields. The majority of UK PhDs are awarded in the natural and physical sciences (HESA, 2020a), and funded places on science doctorates outnumber those available for programmes in the arts and humanities and social sciences. While it is unknown how many PhD holders in the dataset *intended* to embark on an academic career, it is clear that the ratio of PhD holders to academic openings is far higher in the natural and physical sciences than for all other subject areas. If, however, the doctoral loan initiative succeeds in increasing the number of PhD holders over time, employment destinations by subject area may begin to look more uniform. The limited scholarship funding available for arts and humanities and social science students has made the loan a more attractive option for pursuing doctoral study in these areas (Bennett, 2020).

FIGURE 1 HERE

Since the majority of PhD holders have left the academic sector three and a half years after graduation, it is valuable to observe the proportion who report an ongoing involvement in research in non-academic occupations (figure 2). Considering the data in this way should not be taken to imply that a career in research is the most important or indeed only occupation a PhD prepares for. Nevertheless, since research careers are the preferred ambition for the majority of PhD students – and leaving research is associated with lower career satisfaction – these outcomes are important to note.

FIGURE 2 HERE

The classification of ‘research’ and ‘non-research’ roles applied here is compromised by the noted absence of an agreed definition of doctoral-level research work outside of academia. A variable for ‘research roles in non-academic occupations’ was created by examining individual job titles and corroborating these with questions on the use of doctoral-level knowledge and research skills in participants’ occupations. Stark disciplinary differences are again apparent. Although PhDs in natural and physical sciences leave academia at a higher rate than other subject areas, higher proportions of scientists are subsequently employed in research roles outside the academic system. This suggests clear demand for scientific research skills in the wider economy – but that employer demand for the research skills of arts and humanities and social science graduates in the UK is less certain.

**Discussion and conclusion**

*Doctoral employment in the UK and beyond*

Much has been promised about the economic benefits of doctoral expansion, but existing international scholarship – and data available in the UK in particular – prevent clear judgement on the knowledge economy narrative at this moment in time. Analysis of the UK data show that while the employment rate of PhD holders is high, there are considerable variations by subject area. As is the case for most nations with advanced research systems, the vast majority of UK PhD holders leave academia after obtaining their doctorate – but, once more, large differences are observed by subject area. PhD holders in the scientific fields leave academia at a far higher rate than those in arts, humanities and social science subjects. To an extent, these outcomes reflect differences in the number of PhDs awarded, since many more science PhDs are funded and conferred. Nevertheless, these data do not suggest that ‘too many’ science PhDs are being awarded. Contrary to the pessimism of some, science PhD holders leaving the academic system report a high entry into research employment across the private, public and third sectors. Conversely, if arts, humanities and social sciences PhD holders leave academia, their rates of securing research roles are comparatively low. Indeed, the majority of arts, humanities and social science doctoral graduates working outside of academia undertake non-research jobs.

The available UK data cannot tell us whether or not these observations should prompt concern. Employees with doctoral-level knowledge and skills may enhance the work of organisations that have no direct role in the creation or application of research. There are, of course, plentiful non-monetary benefits to undertaking a doctorate – and, for PhD holders, there are various domains of ‘doctoral value’ that extend beyond job title or salary (Bryan & Guccione, 2018).

Nevertheless, without further detail on the responsibilities of those occupying non-research roles, it is difficult to assess the value of doctoral training beyond the level of subjective, individual assessment. It is also the case that the high proportion of arts, humanities and social science graduates leaving research altogether is at odds with numerous studies which show that research roles remain the professional objective for the majority of those embarking on a PhD (Åkerlind, 2005; Roach & Sauermann, 2010; Parada & Peacock, 2015). It is also undermining of the policy discourse of the knowledge economy, which states explicitly that the research expertise and technical skills of all doctoral graduates are sought across all sectors (Hayter & Parker, 2019).

*Limitations of UK data on doctoral employment*

This study applied a secondary analysis of existing data to explore doctoral employment in the UK. Though the data analysed are the most comprehensive record of doctoral employment currently available, the insight they provide on PhD careers is significantly limited. The political and economic attention directed at PhD holders in recent decades has not been matched with an equivalent effort to improve data collection and evidence-based policy in this area.

A number of limitations of the Long DLHE dataset are worthy of discussion, so that the methods of researchers in the UK and elsewhere might avoid these in the future. To begin, it is clearly reductive to conceive of employment as a ‘destination’ only. Implicit in this approach is a neglect of career as trajectory: an ongoing negotiation of decisions, contexts, opportunities and barriers (McAlpine & Amundsen, 2018). The dearth of contextual and subjective information meant that the UK data impart little of the nuances of perception, decision-making and capital known to shape pathways in and out of the doctorate (Gopaul, 2015; Pásztor & Wakeling, 2018). Further problematic is the timing at which ‘destination’ is recorded. It is increasingly the case that early employment data are an inadequate measure of longer-term career development. This is particularly true in academia, where ‘early career’ is varyingly defined as between four to ten years post-PhD. Beyond academia, such short-termism thwarts understanding of PhD holders engaged in entrepreneurial activities, which typically have an even lengthier fruition time.

The lack of insight afforded on the precise circumstances of employment have already been noted. For employees in the academic sector, the specific responsibilities of the post-holder – including time allocated for research, teaching or administrative duties – are not recorded in the Long DLHE. Given the growing heterogeneity of the academic workforce, and the rise of precarious employment, the absence of such detail is significant (Marini, Locke, & Whitchurch, 2019). The challenges of identifying doctoral-level research roles outside of academia are even greater. While it is possible from job title and self-report data to approximate whether PhD holders continue to engage in research, there is little of the necessary detail – of research funding, collaborations, outputs and impact – to develop a robust ontology of doctoral level research work outside of academia. These shortcomings prohibit understanding of how doctoral graduates contribute to the creation, application and dissemination of knowledge across all sectors of the economy; and, therefore, render the UK data powerless as a tool to assess policy-makers’ claims about PhD holders and the knowledge economy.

Finally, the method of data linkage employed in the UK study was only a modest success. As is shown in table 4, important variables were absent, abridged or suffered a high rate of missingness.

TABLE 4 HERE

The analysis of employment data without accurate and detailed information on individuals’ academic and demographic background characteristics means that outcomes cannot be interpreted in relation to economic and social justice. Again, this limits the power of the dataset to scrutinise and inform policy. A number of characteristics known to be associated with the employment outcomes of first-degree graduates, such as degree classification or first-degree institution, were not available for UK PhD holders. Doctoral institution was provided only by university mission group: a considerable shortcoming when research culture and performance varies as much within the research-intensive Russell Group as it does beyond it (Boliver, 2015). Variables pertaining to socio-economic background, namely parental occupation and type of school attended, suffered a particularly high rate of data missingness. The case of socio-economic background is especially pertinent in the UK, as it is associated with short and long-term employment outcomes across all educational groups.

As noted, the DLHE has since been replaced by the Graduate Outcomes survey, from which the first set of data have recently been released (HESA, 2020b). Graduates are now surveyed only once; at fifteen months following their degree. This new survey includes graduates’ reflections on their activities and wellbeing. It is, however, unlikely to fully address the limitations identified in the DLHE with regard to doctoral employment. As with its predecessor, Graduate Outcomes was designed to capture the destinations of first-degree holders. There are no questions on conditions and experiences specific to the doctorate. Important contextual information about the doctoral research project, supervision and funding are not collected and cannot be factored into an analysis of employment outcomes. Information on how decision-making has shaped outcomes is also not enhanced in the new survey. As Graduate Outcomes is different to the DLHE, longitudinal comparison of trends over time is further hindered by this development. Additionally, there are concerns about data reliability: the response rate achieved for research students fell below target (HESA, 2020c).

*Directions for future research*

The limitations of the Long DLHE dataset suggest that a new approach to researching doctoral outcomes in the UK is needed. The doctoral loan programme and plans for continued expansion emphasise the urgency of this. While the international literature demonstrates the importance of national studies, the UK case generates learning for other countries undergoing doctoral expansion. Nations including the United States, Germany and the Netherlands are leading this endeavour and – given the global nature of the research system – collaboration across borders to ensure the development of comparative methods and data should be sought.

For scholars and policymakers in and beyond the UK seeking to better understand doctoral employment, a number of essential principles emerge. A *longitudinal* view of the doctoral journey – linking PhD holders’ motivations, aspirations and experiences to eventual destinations – is essential to capture why career pathways unfold as they do. Alongside macro-level quantitative data on labour market destinations, qualitative information on the *subjective and contextual* factors informing decision making is needed. Further, the analysis of employment outcomes cannot be divorced from the dynamics of social and institutional stratification; detailed *demographic* information on doctoral graduates must also be collected in a routine and consistent manner.

The global emphasis on the development of knowledge-based economies and the need for equality and diversity in research systems should provide a favourable context for future research. If doctoral expansion – and the policy promises underpinning it – continue, it is vital that the UK and other nations develop more sophisticated methods to capture the contributions of PhD holders. Having considered existing data in the UK, this article marks a starting point towards a more meaningful long-term evidence base.

**References**

Åkerlind. G (2005). Postdoctoral researchers: roles, functions and career prospects. *Higher Education Research & Development*, *24*(1), 21–40.

Auriol, L. (2010). *Careers of doctorate holders: Employment and mobility patterns.* OECD Science, Technology and Industry Working Papers 2010/4. OECD Publishing.

Auriol, L., Misu, M., & Freeman, R. A. (2013). *Careers of doctoral holders: Analysis of labour market and mobility indicators*. OECD Science, Technology and Industry Working Papers, 4, 1–61.

Barnacle, R. & Mewburn, I. (2010). Learning networks and the journey of ‘becoming doctor’, *Studies in Higher Education*, *35*(4), 433-44.

Barnett, R. (2020). Keynote address at the Philosophy and Theory of Higher Education Society seminar ‘Revitalising doctoral education – beyond global trauma’, 26th November.

Bennett, M. (2020). *Doctoral loans have not radically changed PhD recruitment.* Retrieved from <https://wonkhe.com/blogs/doctoral-loans-have-not-radically-changed-phd-recruitment/>

Boliver, V. (2015). Are there distinctive clusters of higher and lower status universities in the UK?, *Oxford Review of Education*, *41*(5), 608-27.

Britton, J., Dearden, L., Shephard, N., & Vignoles, A. (2016). *How English domiciled graduate earnings vary with gender, institution attended, subject and socio-economic background.* IFS working paper W16/06.

Budd, R., O'Connell, C., Yuan, T., & Ververi, O. (2018). *The DTC Effect: ESRC Doctoral Training Centres and the UK Social Science Doctoral Training Landscape.* Retrieved from<http://hira.hope.ac.uk/id/eprint/2675/1/The%20DTC%20Effect%20-%20Electronic%20Version.pdf>

Bryan, B., & Guccione, K. (2018). Was it worth it? A qualitative exploration into graduate perceptions of doctoral value, *Higher Education Research & Development*, *37*(6), 1124-1140

Casey, B. H. (2009). The economic contribution of PhDs. *Journal of Higher Education Policy and Management*, *31*(3), 219–227.

Collins, R. (1979). *The Credential Society: an historical sociology of education and stratification*. New York: Academic Press.

Crossouard, B. (2013). Conceptualising doctoral researcher training through Bernstein's theoretical frameworks. *International Journal of Researcher Development*, *4*(2), 72 – 85.

Cuthbert, D., & Molla, T. (2015). PhD crisis discourse: a critical approach to the framing of the problem and some Australian ‘solutions’. *Higher Education*, *69*(33), 33-53.

Cyranoski, D., Gilbert, N., Ledford, H., Nayar, A., & Yahia, M. (2011). Education: The PhD factory, *Nature*, 472, 276–9.

Department for Education. (2017). *Postgraduate Doctoral Loans: government consultation response*. London: Department for Education.

Elias, P., & Purcell, K. (2013). *Classifying graduate occupations for the knowledge society*. FutureTrack, Working Paper 5.

Elliot, D., Bengtsen, S. S., Guccione, K., & Kobayashi, S. (2020). *The hidden curriculum in doctoral education*. Cham: Palgrave Macmillan.

EPSRC. (2020). *EPSRC announces review of support for doctoral education.* Retrieved from <https://epsrc.ukri.org/newsevents/news/epsrc-announces-review-of-support-for-doctoral-education/>

ESRC. (2020). *Review of the UK Social Science PhD - a major examination of the future capabilities needed by social science graduates.* Retrieved from <https://esrc.ukri.org/skills-and-careers/review-of-the-uk-social-science-phd-a-major-examination-of-the-future-capabilities-needed-by-social-science-graduates/>

Fox, M., F., & Stephan, P., E. (2001). Careers of young scientists: preferences, prospects and realities by gender and field. *Social Studies of Science*, *31*(1) 109–122.

Gardner, S. K., Jansujwicz, J. S., Hutchins, K., Cline, B., & Levesque, V. (2014). Socialization to interdisciplinarity: Faculty and student perspectives. *Higher Education*, *67*(3), 255–271.

Gaughan, M., & Robin, S. (2004). National science training policy and early scientific careers in France and the United States. *Research Policy*, *33*(4), 569-81.

Gopaul, B. (2015). Inequality and Doctoral Education: Exploring the “rules” of doctoral study through Bourdieu’s notion of field. *Higher Education*, *70*(1),73-88

Gould, J. (2015). How to build a better PhD, *Nature*, 528, 22-25.

Guthrie, S., Lichten C., A., van Belle, J., Ball, S., Knack, A., & Hofman, J. (2017). *Understanding mental health in the research environment: A Rapid Evidence Assessment.* Retrieved from <https://www.rand.org/pubs/research_reports/RR2022.html>

Hancock, S., Hughes, G., & Walsh, E. (2017). Purist or pragmatist? UK doctoral scientists’ moral positions on the knowledge economy. *Studies in Higher Education*, *42*(7), 1244-1258.

Hancock, S., & Walsh, E. (2016). Beyond knowledge and skills: rethinking the development of professional identity during the STEM doctorate. *Studies in Higher Education*, *41*(1), 37-50.

Hancock, S. (2019). A future in the knowledge economy? Analysing the career strategies of doctoral scientists through the principles of game theory. *Higher Education*, *78*(1), 33–49.

Hancock, S., Wakeling, P, & Chubb, J. (2019). *21st Century PhDs: why we need better methods of tracking doctoral access, experiences and outcomes*. Research on Research Institute. Retrieved from <https://doi.org/10.6084/m9.figshare.9917813>

Hanushek, E., & Woessmann, L. (2015). *The Knowledge Capital of Nations: Education and the Economics of Growth.* Cambridge, MA: MIT Press.

Hauss, K., Kaulisch, M., & Tesch, J. (2015). Against all odds: determinants of doctoral candidates’ intention to enter academia in Germany. *International Journal of Researcher Development*, *6*(2): 122– 143.

Hayter, C., & Parker, M. (2019). Factors that influence the transition of university postdocs to non-academic scientific careers: An exploratory study, *Research Policy*, *48*(3), 556-570.

HESA. (2020a). What are HE students' progression rates and qualifications? Retrieved from <https://www.hesa.ac.uk/data-and-analysis/students/outcomes>

HESA. (2020b). HE Graduate Outcomes data. Retrieved from <https://www.hesa.ac.uk/data-and-analysis/graduates>

HESA. (2020c). Graduate Outcomes Cohort D Review. Retrieved from <https://www.hesa.ac.uk/files/End%20of%20cohort%20D%20report.pdf>

Hodge, A. (2010). *Review of progress in implementing the recommendations of Sir Gareth Roberts, regarding employability and career development of PhD students and research staff.* Swindon: Research Councils UK.

Hottenrott, H., & Lawson, C. (2017). Flying the nest: how the home department shapes researchers’ career paths, *Studies in Higher Education*, *42*(6), 1091-1109.

HM Government. (2020). *UK Research and Development Roadmap*. Retrieved from <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/896799/UK_Research_and_Development_Roadmap.pdf>

Jackson, D., & Michelson, G. (2015). Factors influencing the employment of Australian PhD graduates, *Studies in Higher Education*, *40*(9), 1660-1678.

Kyvik, S., & Bruen Olsen, T. (2012). The relevance of doctoral training in different labour markets, *Journal of Education and Work*, *25*(2), 205-224.

Leitch, S. (2006). Leitch Review of Skills: Prosperity for All in the Global Economy – World-class Skills. London: HM Treasury.

Lunt, I., McAlpine, L., & Mills, D. (2014). Lively bureaucracy: the ESRC’s Doctoral Training Centres and UK universities. *Oxford Review of Education*, *40*(2), 151-170.

Marginson, S. (2019). Limitations of human capital theory, *Studies in Higher Education*, *44*(2), 287-301.

Marini, G., Locke, W., Whitchurch, C. (2019). *The future higher education workforce in locally and globally engaged higher education institutions.* Centre for Global Higher Education Working Paper 43.

McAlpine, L., & Amundsen, C. (2018). *Post-PhD Career Trajectories: Intentions, Decision-Making and Life Aspirations.* London: Palgrave Macmillan.

McAlpine L., & Emmioğlu, E. (2015). Navigating careers: perceptions of sciences doctoral students, post-PhD researchers and pre-tenure academics, *Studies in Higher Education*, *40*(10), 1770-1785.

McCarthy, P., & Wienk, M. (2019). *Advancing Australia’s Knowledge Economy: Who are the top PhD employers?* Retrieved from <https://amsi.org.au/wp-content/uploads/2019/04/advancing_australias_knowledge_economy.pdf>

Nature. (2014). Editorial: Harsh reality. *Nature*, 516, 7–8.

Nature. (2016). Science and Inequality. *Nature*, 537 (7621), 465.

Office for National Statistics. (2013). 2011 Census: Key Statistics for England and Wales. Retrieved from <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/2011censuskeystatisticsforenglandandwales/2012-12-11>

Parada, F. & Peacock, J. (2015). Quality of doctoral training and employability of doctorate holders: The views of doctoral candidates and junior researchers. In *The European Higher Education Area: Between Critical Reflections and Future Policies* (pp. 593-612). Springer Open. Retrieved from <https://doi.org/10.1007/978-3-319-20877-0>

Pásztor, A., & Wakeling, P. (2018). All PhDs are equal but.... Institutional and social stratification in access to the doctorate. *British Journal of Sociology of Education*, *39*(7), 982-997.

Powell, K. (2016). Young, talented and fed-up: scientists tell their stories. *Nature*, 538, 446-9.

Roach, M., & Sauermann, H. (2010). A Taste for Science? PhD Scientists’ Academic Orientation and Self-selection into Research Career in Industry, *Research Policy, 39*(4), 22–34.

Rohn, J. (2011). Give postdocs a career, not empty promises. *Nature*, 471(7).

Sauermann, H., & Roach, M. (2012). Science PhD Career Preferences: Levels, Changes, and Advisor Encouragement. *PLoS One*, *7*(5). Retrieved from <https://doi.org/10.1371/journal.pone.0036307>

Skidmore, C. (2019). Reaching 2.4%: Securing the research talent of tomorrow. Retrieved from <https://www.gov.uk/government/speeches/reaching-24-securing-the-research-talent-of-tomorrow>

Skovgaard-Pedersen, H. (2014). New doctoral graduates in the knowledge economy: key trends and issues, *Journal of Higher Education Management and Policy*, *36*(6), 632-45.

Stephan, P. (2013). Too Many Scientists? Chemistry World. Retrieved from <https://www.chemistryworld.com/opinion/too-many-scientists/5820.article>

Thune, T., Kyvik, S., Sörlin, S., Olsen, T. B., Vabø, A., & Tømte, C. (2012). *PhD education in a knowledge society: An evaluation of PhD education in Norway*. Oslo: Nordic Institute for Studies in Innovation, Research and Education. Retrieved from <https://www.nifu.no/publications/951985/>

van de Schoot, R., Yerkes, M., & Sonneveld, H. (2012). The Employment Status of Doctoral Recipients: An Exploratory Study in the Netherlands. *International Journal of Doctoral Studies*, 7, 331–348.

Vettese, T. (2019). Sexism in the Academy. *n+1*, 34, Spring 2019.

Vitae. (2013). What do researchers do? Early career progression of doctoral graduates. Retrieved from <https://www.vitae.ac.uk/vitae-publications/reports/what-do-researchers-do-early-career-progression-2013.pdf/view>

Vitae. (2019a). The Concordat to Support the Career Development of Researchers. Retrieved from <https://www.vitae.ac.uk/policy/concordat/Download_Concordat_PDF>

Vitae. (2019b). Do researchers’ early careers have to be precarious? Retrieved from <https://www.vitae.ac.uk/impact-and-evaluation/what-do-researchers-do/vitae-wdrd-infographic-final-sept-19.pdf/view>

Wakeling, P., & Kyriacou, C. (2010). *Widening participation from undergraduate to postgraduate research degrees.* Swindon: NCCPE and ESRC.

Zolas, N., Goldschlag, N., Jarmin, R., Stephan, P., Owen-Smith, J., Rosen R., et al. (2015). Wrapping it up in a person: Examining employment and earnings outcomes for PhD recipients. *Science*, 350(6266), 1367–1371.

**Tables**

|  |  |
| --- | --- |
|   | **Valid percent** |
| **Year of doctoral award** |   |
| 2008/9 | 46.7 |
| 2010/11 | 53.3 |
| **Doctoral subject area** |   |
| Arts and Humanities | 14.8 |
| Biological sciences | 21.2 |
| Biomedical sciences (including clinical | 16.9 |
| Physical sciences and engineering | 32.0 |
| Social sciences (including education) | 15.1 |
| **Doctoral institution** |   |
| Russell Group | 61.7 |
| 1994 Group | 8.2 |
| Guild HE | 0.7 |
| University Alliance | 7.8 |
| Million Plus | 2.5 |
| Other | 19.3 |
| **Entry qualification** |   |
| Undergraduate qualification only | 54.2 |
| Postgraduate qualification | 41.2 |
| No higher education qualification | 3.9 |
| Postgraduate Certificate in Education | 0.7 |

**Table 1**. Academic characteristics of PhD holders (*n*=4,731)

|  |  |
| --- | --- |
|   | **Valid percent** |
| **Survey age** |   |
| 22-25 | 3.0 |
| 26-29 | 46.2 |
| 30-34 | 18.1 |
| 35-39 | 8.7 |
| 40-44 | 6.1 |
| 45-59 | 5.6 |
| 50-54 | 5.0 |
| 55-59 | 3.5 |
| 60-64 | 2.2 |
| 65 + | 1.5 |
| **Gender** |   |
| Male | 49.7 |
| Female | 50.4 |
| **Ethnicity** |   |
| White | 90.4 |
| Asian | 5.3 |
| Black | 1.2 |
| Other (including Mixed) | 3.1 |
| **School attended** |   |
| Privately funded school | 1.5 |
| State-funded school or college | 98.5 |
| **Parental occupation** |   |
| Higher managerial and professional occupations | 31.3 |
| Lower managerial and professional occupations | 31.0 |
| Intermediate occupations (clerical, sales, service) | 11.6 |
| Small employers and own account workers | 5.3 |
| Lower supervisory and technical occupations | 8.5 |
| Semi-routine occupations | 9.2 |
| Routine occupations | 2.5 |
| Never worked or long-term unemployed | 0.7 |
| **Parental education** |   |
| Higher education | 66.9 |
| Not higher education | 33.1 |
| **Parental home: higher education participation** |   |
| Low participation neighbourhood | 7.6 |
| Other neighbourhood | 92.4 |

**Table 2**. Demographic characteristics of PhD holders (*n*=4,731)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | **Arts & Humanities** | **Biological sciences** | **Biomedical sciences**  | **Physical sciences & engineering** | **Social sciences** |
| **Activity** |  |  |  |  |  |
| Full-time paid work | 66.0 | 80.6 | 79.6 | 87.1 | 72.8 |
| Part-time paid work | 12.9 | 9.0 | 10.5 | 5.3 | 12.7 |
| Voluntary/unpaid work | 1.3 | 0.2 | 0.4 | 0.1 | 0.4 |
| Work and further study | 2.9 | 2.5 | 1.9 | 0.4 | 2.5 |
| Further study only | 2.9 | 1.3 | 2.0 | 1.3 | 0.6 |
| Assumed to be unemployed | 2.2 | 2.0 | 1.3 | 2.8 | 2.5 |
| Not available for employment | 8.7 | 2.0 | 2.6 | 1.4 | 6.3 |
| Employed mode unknown | 1.0 | 1.7 | 1.1 | 0.6 | 1.3 |

**Table 3.** Main activity of PhD holders 3.5 years after graduation(*n*=4,731)

Note: ‘Social Sciences’ includes Education. ‘Voluntary/ unpaid work’ includes unpaid internships.

|  |  |
| --- | --- |
|   | **Valid percent** |
| Academic year | 0.0 |
| Doctoral subject | 0.0 |
| Doctoral institution | 0.0 |
| Entry qualification | 12.7 |
| Age | 0.0 |
| Gender | 0.0 |
| Ethnicity | 6.2 |
| School attended | 56.0 |
| Parental occupation | 94.0 |
| Parental education | 7.0 |
| Neighbourhood participation in higher education | 3.9 |

**Table 4.** Data missingness of academic and demographic variables (*n*=4,731)

Note: percentages denote missing values.

**List of figures**

1. **Figure 1.** Percentage of PhD holders in academic or non-academic employment 3.5 years after graduation (*n*=4,288)



1. **Figure 2.** Percentage ofPhD holders employed in research roles (non-academic employment only) (*n*=3006)

