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PROMOTING DIVERSE CAREER PATHWAYS FOR DOCTORAL AND POSTDOCTORAL RESEARCHERS

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Foreword

The OECD Global Science Forum (GSF) project on career options for doctoral and postdoctoral researchers is a natural sequel to earlier work on precarity in academic research careers. This earlier work reviewed career prospects in academic research in different countries, and the various initiatives being taken to mitigate precarity among doctorate holders. One of the report's main conclusions was that doctorate holders should be encouraged to consider careers beyond academic research: not in a simplistic sense, as a way to "ease the bottleneck", but rather as a worthwhile and valuable choice for themselves and for society. Ultimately, it is difficult to address the question of solutions to precarity in academic research careers, without seriously and thoroughly considering the career options for doctorate holders and how the preparation for, and acceptance of, those options need to be addressed at multiple levels.

This second project has been an opportunity to learn more about what is happening on the ground in different countries. The present report provides a wealth of information on: the need to reshape approaches to career paths after the doctorate; on the research being done; and, on the initiatives and practices already being implemented. It provides eight recommendations for policy action, targeted at research councils, government departments, national organisations and higher education institutions.

The project has been overseen by an international Expert Group (see annex A), nominated by GSF. That Group was chaired by Verity Elston (University of Lausanne, Switzerland) who summarised its relevance at a workshop in November, 2022 as follows: " The importance of this OECD project and of the recommendations that comes out of it, is to show how different countries are indeed exploring the ways to make a change, and to make that connection between the reforms needed in academic research paths, and the value and support given to diverse career options with a doctorate. The recommendations provide starting points for those of us who work in the development of doctoral and postdoctoral frameworks: whether we are in government departments or funding bodies, university administration or faculty management."

Abstract

This report analyses the career options of doctoral and postdoctoral researchers. It identifies policies and practices to promote diverse careers, flexible career trajectories and ultimately better-quality research and innovation across different economic and social sectors.
The report presents a conceptual framework and synthesis of available data and policy information. It offers recommendations and a set of policy options to: promote engagement and interaction with employers outside academia; provide researchers with experience and skills for diverse careers; encourage valorisation of diverse career options; support career development and guidance for researchers; promote inter-sectoral mobility; and, reconfigure and support careers in academia.

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Executive Summary

There is growing concern across OECD countries about research culture and the future of the scientific research workforce. In particular, it seems that many potentially excellent researchers are electing not to do PhDs and those that do complete PhDs are often then 'trapped' in precarious postdoctoral positions, which continue for several years. Many disillusioned young scientists eventually drop out of academia to pursue other career paths. The privileged minority, who eventually secure a permanent position, have earned their spurs in a hyper-competitive, publish or perish, environment that is simply not attractive or not liveable for many. The result is an academic workforce that is very poorly representative of society as whole in terms of gender, social class and representation of minority groups. Excluding so many people from research at the outset is bad for science and bad for society as a whole.

The main policy response in many countries has been to feed the PhD pipeline, i.e. encourage and incentivise more graduates from diverse backgrounds to take a PhD. In most OECD countries, there has been a significant increase in the past two decades in the number of people with PhDs. Many of these have postdoctoral research experience. Indeed, public research systems have become increasingly dependent on young researchers in precarious employment conditions to do the actual research. However, in the absence of measures to expand the number of permanent academic posts, the prospects for these people to continue to pursue their career of choice in academia have deteriorated. Most end up elsewhere, some continuing to do research, many having abandoned research but applying their scientific skills elsewhere and some having changed track altogether. The transition out of academia is often difficult and made in the full knowledge that the possibility of coming back at a later career stage is extremely limited.

From both an economic and personal perspective there are arguments for and against increasing the number of PhD and postdoctoral posts. Many would argue that the critical analysis and research skills that individuals acquire are assets across society as a whole – more scientists everywhere is a good thing. Others have noted that training PhD students is expensive if they do not subsequently use their research skills. Either way, it is clear that making the PhD and postdoctoral experience more attractive is likely also to make it more inclusive and productive. If there is limited room for increasing the number of permanent academic positions, then explicitly reframing the PhD and postdoctoral experience as a valuable step that can open up many different career paths, is essential. This in turn implies a number of policy actions.

The aim of this project was to explore what policy actions are most appropriate in what contexts to promote different career options for doctoral and postdoctoral researchers both within and beyond academia. The evidence base for this work includes a literature review, an analysis of existing statistical data and the *de novo* collection of information from 16 countries represented on an Expert Group (EG) that oversaw the work. This was supplemented by discussions within the EG and at an international workshop that was organised in November 2022. It has been a mutual learning exercise and, while it is recognised that the context in each country is unique, it is striking that the main challenges are very similar. The policy actions that are beginning to be implemented to address these also have much in common.

One of the major structural challenges in relation to the doctoral and postdoctoral phase of research careers is that there are multiple actors involved with varying responsibilities. At the governmental level, the policy responsibility is often divided between ministries for education and ministries for research, which

can have varying degrees of legal authority over the employment conditions for researchers. Research funding agencies are also important stakeholders and public research institutes are the major research actors and employers in some countries. Universities are responsible for awarding PhDs and are the main public research employers in most countries. However, early career researchers are often supported on stipends, may not have formal employment contracts and are frequently not represented in university governance and collective bargaining processes.

The fact that PhD and postdoctoral researchers are mobile and incentivised to move between institutions and countries, reinforces the lack of 'ownership' that their host institutions might feel for them. The Principal Investigators (PIs) who supervise their junior colleagues are mainly interested in research achievements rather than personal development and are often ill-equipped in terms of their own experience and networks, to act as mentors and advise on career options outside academia.

This report presents a conceptual framework that combines many of these factors in a systemic model for analysis of research careers. This framework was used to structure 'country notes', which were developed by EG members, and for the subsequent analysis. Eight key recommendations emerge from the overall analysis based on this framework and these are summarised in the next section of the report. Improving research careers is a systemic challenge that requires collective action at different geographic scales. Whilst many policy initiatives are being implemented in different jurisdictions, these often focus on specific aspects of the issue and a more strategic and co-ordinated approach, involving all relevant actors, is necessary.

Recommendations

This report offers eight recommendations to promote diverse career pathways and options for doctoral and postdoctoral researchers. They have emerged from the data analysis and review of policy initiatives developed by countries, or jurisdictions within them, to address the challenges they face in this area. The recommendations are complemented by a policy toolkit presented at the end of this report (see Table 6), and examples of good practice from different countries (annex C).

Given the general increase in doctorates awarded and postdoctoral positions in universities and research centres, without concomitant increase in the availability of long-term or permanent senior positions in academia, the diversification of career options for doctorate holders is a shared policy concern among OECD countries. Nevertheless, different countries have different governance arrangements, with different roles for government and institutions with different levels of autonomy, contexts, and priorities, and thus the relevance of each recommendation and associated policy options will also be different in different countries. Differences may exist even between jurisdictions within countries, depending on governance levels and responsibilities between central and local government, funders, and research performing organisations.

1. **Promote the engagement and interaction of academic institutions and their funders with employers beyond academia**

There is a need to overcome the tendency of leaving it entirely to the researchers themselves to bridge the gap between academic research and careers beyond academia. It is important to hear the voices of potential employers of doctorate holders to see how young scientists from all disciplinary backgrounds can be better prepared for career options beyond academia. There is a need to create opportunities for interaction between employers from different sectors and researchers, for instance through recruitment fairs and other events. Policy frameworks for doctoral education and postdoctoral work should include provisions for explicit engagement and interaction with employers beyond academia. In some instances, there may be a need to review the governance of universities and public research organisations to promote more systemic engagement with civil society.

2. **Provide doctoral and postdoctoral researchers with experience and skills for diverse careers within and beyond academia**

Traditional doctoral education and postdoctoral work has focused on disciplinary research skills, and less on transferable skills, such as project management, collaboration, teamwork, and communication. Given that most doctorate holders will eventually find employment beyond academia and that transferable skills are equally needed within academia, it is important to support development of a broader set of skills that can be used in all employment sectors. This includes, but should not be limited to, entrepreneurship, project management and communication skills. Wider skills development can be achieved through a variety of means, including collaborative doctorates across sectors, skills training programmes, mentoring and leadership programmes, collaborative projects between academia and other sectors, and placements.

3. Render more visible and encourage valorisation of diverse career options within and beyond academia

Careers beyond academia tend to be seen as a 'plan B' for doctoral and postdoctoral researchers in many disciplines. It is important to make visible both the skills developed during doctoral education and postdoctoral work, and the diverse career options available to doctorate holders. With regard to the latter, it is essential in to systematically track the careers of doctorate holders using both quantitative and qualitative data, and to analyse and publish that data on institutional websites and on a system-wide basis. This can support doctoral and postdoctoral researchers, their supervisors, and their institutions, to understand not just what the possibilities are within their disciplinary domains, but also to see those options in research elsewhere and in society more broadly.

4. Offer career development and guidance on career options for doctoral and postdoctoral researchers and their supervisors

To make the most of wider skill development and the understanding of different career possibilities, it is important to institute and develop personalised career plans and guidance through dedicated structures, such as institutional career offices and programmes that support both researchers and their supervisors. Career development should be recognised as one of the responsibilities of research supervisors, who can play an important part in providing access to academic and non-academic networks, as well as providing guidance and support for junior researchers.

5. Promote inter-sectoral mobility with the business enterprise sector

Many doctorate holders will eventually work in the business enterprise sector. To make the most of their advanced skills it is important to facilitate the transition in a formal and systematic manner, with appropriate funding and organisational mechanisms. These include: training in enterprises; placements and exchange of research personnel between academia and enterprises; support for establishing start-ups, spin-offs and personal entrepreneurship; and, tax incentives for employment of researchers in enterprises. In addition, an eventual return to academia should not be hindered by a failure to recognise professional experience outside academia. Nor should it be compromised by a lack of portability of pension and other social rights between sectors.

6. Promote inter-sectoral mobility with the government and the private not-for-profit sectors

Important sectors of employment for doctorate holders are the government and the private not-for-profit sectors. To facilitate the transition to these sectors, it is important to offer cross sectoral training initiatives, placements, and exchange of research personnel. The issues regarding this type of inter-sectoral mobility are broadly similar to those with the business enterprise sector, but appropriate initiatives need to be tailored differently. Dedicated policies and programmes to promote interaction need to take account of specificities in organisational traditions, cultures, and objectives. Different sectors may be more or less intuitively attractive to different academic disciplines but there are openings or requirements in most sectors for multiple scientific backgrounds.

7. Reconfigure traditional academic career models and support diverse careers in academia

Careers for doctorate holders within academia are changing to include more diverse profiles with different emphasis on research, teaching, economic, civic, and social engagement, and academic leadership. The emergence of 'third-space professionals at the interface between academia and professional services also opens new carrier paths. There is growing recognition of a need to look beyond traditional academic career models and explore new ways to attract, recognise and reward academic staff for multiple different roles. This includes: national initiatives that bring together relevant stakeholders to agree on common principles

and effect change on academic careers; implementation of institutional equity, diversity and inclusion (EDI) initiatives; and, changes to evaluation systems that value different profiles.

8. Support international mobility

The labour market for researchers is global, with significant mobility of researchers across borders, and international experience becoming a de facto requisite in many instances to be able to pursue a long-term research career. It is important to take account of mobile researchers' needs, including those that weigh heavily on women and those with children. This includes: supporting outgoing and incoming mobility across borders; addressing regulatory arrangements to facilitate the integration of foreign and returning researchers; ensuring portability of rights across jurisdictions; offering a level playing field to foreign researchers; and, developing virtual international connectivity arrangements for those who cannot easily change countries.

Introduction

In the context of an expansion of doctoral training and research in OECD countries, and in the number of postdoctoral researchers, who will not find permanent employment in academic research, countries and institutions are interested in promoting and better preparing doctorate holders for diverse career options. Efforts in this direction are often confronted with conflicting policy objectives and priorities related to the way that academic research operates and is incentivised (OECD, 2021[1]).

Doctorate holders on average experience better labour market outcomes than other graduates, in terms of employment rates and pay. However, younger cohorts have seen deteriorating working conditions and increasing precarity (OECD, 2021[1]; Janger et al., 2022[2]). Given this context, the current project focuses on those in the early stages of a research career: doctoral and postdoctoral researchers.

Doctoral researchers, as considered in this report, are those pursuing a doctoral degree. Doctoral level education corresponds to ISCED-2011 level 8 in the International Standard Classification of Education (ISCED), which leads to the award of an advanced research qualification, e.g., a PhD. In most countries, the theoretical duration of doctoral programmes is three years full time, although the actual enrolment time is typically longer. Programmes at this ISCED level are devoted to advanced studies and original research and are typically offered by research-oriented tertiary educational institutions such as universities. Doctoral programmes may exist in both academic and professional fields (OECD, 2015[3]).

In some contexts, doctoral researchers are considered students, often either self-financed or in receipt of a stipend. In others, they are employees with contracts linked to the attainment of their degree, and may perform additional duties, such as teaching and/or research assistance. This report recognises the hybrid nature of the doctoral period, by generally referring to doctoral education *and* training.

Postdoctoral researchers already hold a doctorate and can be designated by a variety of terms, such as "postdoc", "research assistant", "research associate", "research fellow"; some may be hired for teaching-only positions but pursue research on the side as "hidden researchers". For the purpose of this report, the unifying characteristic is that they have a fixed-term contract or stipend without permanent or continuous employment prospects.

The working conditions of researchers has been a concern of many OECD countries for some time. This work specifically builds on the findings of the OECD Global Science Forum (GSF) project on "Reducing the precarity of academic research careers" (OECD, 2021[1])and other GSF work on challenges and new demands on the academic research workforce (OECD, 2021[4]). This work attracted much interest and at GSF44 meeting, in April 2021, it was decided to follow up with a study to address the need to better prepare doctorate holders for diverse career options within and beyond academia.

Following a scoping exercise, an expert group (EG) composed of national nominees from countries was established. The EG met five times from January 2022 to February 2023 and has steered the project and facilitated data and information collection in countries. The project also included an international workshop in November 2022, where the EG met with a variety of stakeholders, participating as panellists or discussants and representing the views of policy officials, funders, employers of researchers, and doctoral and postdoctoral researchers.

The purpose of this report is to offer recommendations for action by different stakeholders in the research and innovation systems to promote diverse career pathways and options for doctorate holders, with a focus

on doctoral and postdoctoral researchers. It provides an overview of relevant scholarly and policy literature. Building on this, it includes a conceptual framework that guided an initial analysis of publicly available data and information. It then draws on new data and information collated specifically for the project, via country notes from participating countries. As a result of this analysis it proposes a set of 8 overarching policy recommendations (see previous section) and a policy toolkit (table 6) based on examples of good practice across different countries (annex C).

Overview of factors influencing the careers of doctorate holders

This section presents a review of the scholarly and policy literature on the diversification of the careers of doctorate holders within and beyond academia. The review underpins the conceptual framework that guided the collection and analysis of *de novo* data and information from countries and informed the policy recommendations in this report.

Many studies have been conducted on the factors determining career choices by early-career stage researchers. However, these studies tend to be localised, and the population samples relatively small (very small scale, local studies, e.g., focussing on single institutions, have been excluded from the present review). Some of the identified factors are context-specific, for example the high share of foreign postdocs in the United States. Different research methods have been reported, but questionnaire surveys are the most frequently used tool. The literature analysis provides insights about career options beyond academia in different contexts, but it is difficult to draw general conclusions or make robust international comparisons. It should also be noted that the research presented here is heavily influenced by studies in the United States, Australia, and the United Kingdom and their specificities: non-anglophone countries are less well represented in the literature as a whole. Studies also tend to be biased towards the natural sciences and laboratory-based research.

Drivers for a career beyond academia

(Hayter and Parker, 2019[5]) conducted an exploratory qualitative study of 97 postdocs and 35 related individuals in the United States, including principal investigators (PIs), university administrators and industry employers, to understand which factors affect the transition of postdocs to careers beyond academia. Table 1 provides a summary of the factors found to influence the transition related to individuals, PIs, and organisation and policy.

Table 1 Detailed factors influencing the transition of postdocs to careers beyond academia

Individual factors	• **Career expectations**: obtaining a tenure track position is very unlikely.
	• **Information asymmetries**: no accurate information about the academic job market, glorification of tenure-track positions, no information about the value of doctorate degree outside academia, in either government or industry.
	• **Skills**: do not know how to apply to non-academic environments, how to use their scientific knowledge in another context, lack of soft skills.
	• **Personal crisis**: occurs when postdocs realise an academic career will not be possible, along with uncertainty around the future, salaries, student debt, language barriers and sometimes visa issues.

Role of PIs	• **Lack of career support**: Academic-centric definition of success: not finding an academic position and looking outside academia are seen as flaws.
	• **Skills and capabilities**: Academic job market has changed: mentoring is not based on today's reality but on the PI's previous experiences. Lack of knowledge of the non-academic sector.
	• **Socially irresponsible behaviour**: abusive work hours, penalizing interests in a non-academic career, inappropriate behaviour toward postdoc-generated IP, etc.
Organisation and policy	• **Nature of postdoc position**: "little *formal* occasion to learn about non-academic opportunities or build corresponding skills and networks."
	• **Institutional policy**: some universities have career development programs (academic or non-academic, entrepreneurship, etc.), but sometimes facing opposition from faculty.

Source: Factors that influence the transition of university postdocs to non-academic scientific careers: An exploratory study (Hayter and Parker, 2019).

Although some identified factors facilitate the transition to non-academic positions, most "may be classified as barriers, likely slowing the transition of postdocs to non-academic employment" (Hayter and Parker, 2019[5]). The paper recommends further research, especially looking for the enablers and barriers to transition to a non-academic career, but from the perspective of people who succeeded in this transition.

Dorenkamp and Weiss (2017[6]) used structural equation modelling (SEM) to analyse data from 421 postdocs in Germany. They showed that effort-reward imbalance is both directly and indirectly related to the intention to leave academia: a three-path-mediated effect is found from work stress to the intention to leave academia via strain and job (dis)satisfaction. In addition, the relationship between overcommitment and strain was stronger for women, and a significant direct link between work stress and intention to leave applied only to women. This provides some evidence that, not surprisingly, dissatisfaction and personal stress, have a negative impact on research performance as well as 'drop out'.

However, Christian et al. (2021[7]), who surveyed 658 Australian early career researchers (ECRs), "representing the transition stage between PhD and senior academic positions", found that job satisfaction does not have a significant impact on intentions to change career path. There is one group of ECRs who are dissatisfied with their current position but feel trapped and unable to move on, whereas another group, who are happy with their current workplace, may feel changing jobs within or outside research would be beneficial for their career. In their survey, they also found that women experience higher rates of inequitable hiring practices and harassment from those in positions of power. Both men and women are concerned about parental and care responsibilities affecting their productivity and thus compromising academic career prospects. Job security was the main reason for ECRs leaving their current positions.

Stenard and Sauermann (2016[8]) studied longitudinal data on more than 25 000 scientists and engineers in the United States and discovered that educational mismatch between what doctorate holders learn during their PhD and the needs of non-academic employers can be an important factor prompting people to become entrepreneurs instead. A mismatch may involve "overeducation," where an employee's level of education in a certain area exceeds that demanded by employers. It can also involve differences in skills, e.g., when jobs do not use certain types of skills acquired during education or if they require skills that were not part of that education. They identified different reasons for the mismatch: (i) *market mismatch*, when a job in the graduate's highest degree field is not available, (ii) *career mismatch* due to pay or promotion opportunities, change in career or professional interests, or working conditions, (iii) *personal mismatch* for family or location reasons.

They found that people with PhDs are more likely to report a *market mismatch* than those with bachelor's and master's degrees. The finding is consistent with concerns that highly trained and specialised PhD holders are often "underemployed" because of a lack of adequate positions. Market mismatch is particularly associated with lower pay and job satisfaction. All types of mismatches have a negative relationship with R&D activities, yet only *career mismatches* are associated with more non-R&D activities. High-ability PhD holders tend to focus primarily on research and development work. PhD holders who are mismatched for career or personal reasons are more likely to move into entrepreneurship. Stenard and Sauermann conclude it is important to revise and expand curricula to provide students with a broader range of skills, including non-R&D skills that are particularly valuable in entrepreneurship, as it may mitigate labour market imbalances for PhD holders.

Table 2 synthesises some of the key factors identified from the literature in relation to the intention to leave or remain in academia.

Table 2. Push and pull factors to leave or stay in academia for doctoral and postdoctoral researchers

Push factors out of academia	Pull factors into academia
- Losing interest in less attractive academic careers. - Low job satisfaction (depending on the study and groups of researchers). - High level of work stress (especially for women). - Effort-reward imbalance. - Career development programmes in universities.	- The training over-emphasises academic careers. - Information asymmetries: doctoral researchers do not know enough about careers beyond academia. The nature of the postdoc position also favours this asymmetry, as there is no incentive for the supervisors to inform postdocs about it. - No experience or network to find non-academic jobs. - Educational mismatch between academic skills and those needed in other contexts. - Influence of PIs: tenure-track is seen as the best path, no incentive to mentor researchers, rather PIs have incentives to use their work for grants and papers, no skills, and networks to help find non-academic opportunities

Sources: Factors that influence the transition of university postdocs to non-academic scientific careers: An exploratory (Hayter and Parker, 2019[5]); What makes them leave? A path model of postdocs' intentions to leave academia, (Dorenkamp and Weiß, 2017[6]).

Time influences non-academic career choices

Time influences the willingness of postdocs to seek non-academic careers. The later they are in their trajectory, the more pessimistic they become about their career prospects within academia ((Hayter and Parker, 2019[5]).

Sauermann and Roach (2012[9]) surveyed over 4 000 PhD students in 39 top-tier research universities in the United States. They show that career preferences among United States PhD students change over time during their studies. Preference for an academic career declines over time, despite the fact that supervisors strongly encourage academic careers over non-academic careers. Part of this decline may be due to increased knowledge of the difficulties with the academic job market. Sauermann and Roach suggest providing PhD applicants with the necessary information for them to make their own cost-benefit analysis of doing doctoral studies. They also advocate providing information and training experiences for PhD researchers beyond that normally provided by supervisors.

In a later study, Roach and Sauermann (2017[10]) tried to further explain the reasons for the declining interest in academic careers among United States PhD graduates in life sciences, chemistry, physics, engineering, and computer science during their training. They used panel data from a survey of over 800 United States PhD students in science and engineering. Their results show no clear evidence that the anticipation of career difficulties changes attitudes toward career preferences. There is a group that remains highly interested and others that lose interest. The decline is not driven by the availability of positions in academia, instead it seems due to a mismatch between students' preferences for certain job attributes and the nature of academic work, as well as their own perceived research ability. They suggest that workshops and information that are offered by many universities may not be enough to convey what it means to work outside academia, and that work-based experiences, such as internships, may be a more effective way for students to experience non-academic careers. The conclude that students should consider their career early on in their studies and start exploring diverse possibilities.

The importance of mentor support

McConnell et al. (2018[11]) surveyed 7 673 postdocs in the United States. They find that the influence of mentors appears as crucial in career plans and choices for postdocs, and they seem to rely on mentorship to guide them. Although postdocs willing to stay in academia are mostly satisfied with the support they receive from their mentors, those thinking about other options perceive their mentors as less supportive. Most postdocs who feel "very well" or "well" prepared for their career are choosing academic careers. Those who gave a different answer choose academia less often. Academia is over-represented in initial career choices, while non-academic choices more often result from a change in plans.

Christian et al. (2021[7]) asked Australian early-career researchers (ECRs) about mentoring from more senior colleagues. More than half felt they lacked support from institutional leaders, 38% did not have a mentor, and 32% did not participate in performance reviews. They found that ECRs particularly value advice on career decisions, introductions to relevant networks, and the capacity of their mentor to help them find employment. Those that participated in staff performance reviews valued the focus on career aspirations and how they are met by their current work, and on identifying personal strengths and achievements.

McAlpine et al. (2020[12]) in a qualitative systematised review of international research on the doctoral experience since 2000 mention the importance of supervisors for successful doctoral education, but that supervisors' workloads and interest may be a barrier to mentoring. They suggest considering alumni with PhDs as potential mentors for those wanting a career outside academia.

Sauermann and Roach (2012[9]), in the previously-mentioned study, suggest that advisors' apparent preference for the academic path may not be intentional, but instead reflect their own experience of having chosen an academic career and having less experience of other career options. They suggest that other sources of career guidance be provided to complement that of advisors.

Problems encountered by doctorate holders outside academia

Cultural and quality perception obstacles

In a reflection on the "PhD crisis discourse" in many countries, Cuthbert and Molla (2014[13]) point out the detrimental cultural perceptions that PhDs not employed in academia are necessarily being under-employed. This is coupled with prejudice by non-academic employers who see doctorates as too academic and not useful for jobs beyond academia. They also warn that there is a danger in trying to "fix" a PhD that is not as broken as many think. For them, the biggest issue is not one of employability outside academia and building transferable skills of graduates, but that of the *quality* of those that are accepted into doctoral studies, the quality of doctoral graduates, of their research and their training. Few universities engage in

high-intensity research, but almost all now offer PhD programmes; relevance and employability are thus serving as proxies for quality, as the number of doctoral graduates increases.

This is an interesting perspective on the "PhD crisis discourse", which is quite different to the line taken in most of the literature that was reviewed for this project and may merit further investigation and debate. The issue of 'qualification inflation' was touched on in the earlier OECD-GSF work around the research precariat (reference to be inserted).

Culture shock entering non-academic organisations

Skakni et al. (2021[14])conducted semi-structured interviews with 32 PhD graduates from different fields of research in the United Kingdom and Switzerland, who were working in non-academic environments (private, public, and non-profit). Many experienced an organisational culture shock, especially those who entered non-academic environments directly after their PhD and those with little or no work experience before the PhD. Table 3 synthesises the findings. The list is not exhaustive, but it illustrates many difficulties in the transition beyond academia.

Table 3 Organisational culture shock challenges when transitioning beyond academia

Organisational culture shock challenge	Differences with the academic sector
Daily functioning of the workplace	*Time management and schedules*: strict schedule and lack of freedom *Tasks performance*: less research and evidence, more efficiency in writing *Modes of collaboration*: less solitary work, teamwork is inevitable, difficulties to establish who takes the lead in teams *Quality and productivity criteria*: deliver faster at the expense of quality
Organisation's values	*Purpose of work*: less passion for work and a more business-oriented mindset in the organisation *Work attitude*: more tact and diplomacy are needed when being critical *Commitment to work*: expectations can be greater *Work ethics*: lack of rigor for research and other tasks
Status within the organisation	*Hierarchical structure*: difficulty to find your own status, hierarchy is less "flat" *Degree of autonomy*: comply with the organisation's line, accept that your ideas will often be rejected *Recognition of expertise*: no recognition, and a feeling of starting from zero to prove oneself again

Source: Skakni, I., et al. (2021[14]). "PhD holders entering non-academic workplaces: organisational culture shock." Studies in Higher Education.

The mismatches observed tend to reduce doctorate holders' satisfaction at work, especially regarding working time flexibility, working conditions and peer recognition. There seems to be a need for PhDs to learn "how to promote their skills and expertise in a way that speaks to non-academic employers", but also for employers to know them better and thus better use their skills.

Limits of a skills-for-employability approach

Cuthbert and Molla (2014[13]) note the tension in doctoral education between intellectual excellence and the relevance of the doctorate to the needs and priorities of society. This tension is exacerbated by the oversupply of doctoral graduates and the gap between supply and demand, and the perceived lack of generic or transferable skills that would enable the doctorate to be of service to the knowledge economy. However, they consider the logic of restructuring PhD programmes predominantly based on skill proficiency as problematic, and that it is more urgent to address the quality of PhD programmes, as well as the readiness of industry to employ PhD graduates.

Cuthbert and Molla (2014[13]) following a qualitative analysis of Australian policy documents and reports tried to identify the skills that would address the perceived mismatch between doctoral training and employers' needs outside academia. The dominant perceptions are that PhD training is too theoretical in orientation, too narrow in scope, and that most doctoral graduates lack generic employability skills. The sought-for skills include communication, teamwork, problem-solving, initiative and enterprise, planning and organising, self-management, learning, technology usage, commercial acumen, project management, commercialisation, critical thinking, time management, career planning, leadership, resilience, and IT skills. It is notable that all of these skills might be considered desirable within academia as well as outside.

The authors identify institutional responses towards a pro-skills PhD in several new programmes in Australia, which incorporate training in the skills identified as missing for broader career prospects. Nonetheless, they emphasise the need to ensure the quality of doctoral education, alongside the development of skills for employability.

Meeting the immediate needs of the market can be problematic. Despite training good workers for the "knowledge economy", the skills-for-employability approach could present a risk of losing graduates' ability to become innovative scholars. There is already evidence of declining original and disruptive science (Park, Leahey and Funk, 2023[15]; Machado, 2021[16]), and many countries are developing policies to foster high-risk/ high reward research to encourage risky, out-of-the-box ideas for advancing science and solving urgent societal challenges (OECD, 2021[17]).

Doctorate holders already possess transferable skills

Skakni et al. (2021[14]) found that skills developed during the PhD are already transferable, although they need adaptation in non-academic settings. In fact, Mantai and Marrone (2022[18]) in an analysis of over 13 000 advertisements for PhD programmes published on the Euraxess platform from 2016 to 2019 found that, when recruiting students, institutions already expect individuals to have diverse and transferable skills. These include cognitive and interpersonal skills.

Mantai and Marrone (2022[18]) created a skills taxonomy based on these PhD programme advertisements, using a data-derived dictionary and machine learning. The goal was to find what skills are expected from PhD applicants across years, countries, and disciplines. They found, for example, that interpersonal skills are much more valued in medical sciences and physics than in other disciplines. There are also important differences between countries. The Netherlands puts a strong emphasis on communication abilities compared to other countries, and mentions more types of attributes in PhD advertisements, meaning that they search for more complete student profiles. It is also clear that more attributes are mentioned in more recent posts, suggesting that communication, interpersonal skills, personal attributes, digital skills, alongside traditional cognitive skills, are increasingly important for admission into PhD programs. They conclude that successful PhD applicants possess a breadth of attributes transferable to other careers already and should be expected as PhD graduates to be able to follow diverse careers. This complements the argument of Cuthbert and Molla (2014[13]) that the quality of doctoral education, including the quality of those admitted, is of the essence.

Importance of collecting data to improve doctoral education

The number of long-term follow up studies on PhD careers is largely limited to data from individual institutions. Feig et al. (2016[19]) present the results of their follow-up of career trajectories among PhD graduates from Wayne State University, using a time span of 15 years, as they consider most career follow-ups are too short to capture evolutions in trajectories. They emphasise the importance of collecting data on career trajectories using dedicated software to facilitate the collection phase and diffusion of this data to the stakeholders who need it, including students and those responsible for doctoral education. Coupling career development programmes and data about PhD graduates could be very useful, allowing

programmes to build transferable skills there is a need to recognise also the transferable skills that are already inherent in doctoral training. Longitudinal data about career trajectories informs understanding of the changes that might need to be made in PhD training to adapt to the evolving job market.

Reithmeier et al. (2019[20]) present the results of the "10,000 PhDs project" from the University of Toronto. Based on data from the internet on the employment position of PhD graduates, they identified employment trends between 2000 and 2015. As many of these initiatives to collect data are centred around a single higher education institution, the authors advocate for a better co-ordination between universities, to make comprehensive comparable data readily available. The study confirms that as the number of graduates per year has increased, the private and public sector beyond academia have become significantly more important as destinations for PhD graduates. However, at a more granular level, the employment destinations of graduates are very different between fields. Making this type of data and analysis openly available can inform students in their career choices.

Xu et al. (2018[21]) conducted a survey of the career outcomes of 891 postdoctoral scholars that are alumni of the National Institute of Environmental Health Sciences during a 15-year period. They found striking differences among subpopulations. They too advocate for the use of surveys at every institution following a common career outcome taxonomy, covering job sector, job type and job specifics. This will allow for comparable data across all members of the scientific community and make their career prospects clearer for potential doctoral candidates.

Employment in the business enterprise sector

Entrepreneurship

Stenard and Sauermann (2016[8]) have shown that people in a situation of educational mismatch have more reasons to engage in entrepreneurship. When facing a mismatch, job satisfaction and salaries may be lower, decreasing the opportunity costs of leaving the current job. However, this analysis should be tempered, as it is not necessarily applicable to most PhD holders and postdocs since entrepreneurship requires skills beyond scientific knowledge production. Those skills may not be developed enough in routine PhD and postdoctoral work (Hayter and Parker, 2019[5]).

Muscio et al. (2021[22]) study how the characteristics of university laboratories influence the propensity of PhD student to entrepreneurship, through a survey of 5 266 Italian doctoral graduates. Results show that academic laboratories have an influence over the propensity of their graduates to set up their own business. Business experience through industry collaboration has a positive influence on the choice of becoming an entrepreneur. On the contrary, the scientific capital of an academic laboratory seems to have a negative effect on entrepreneurship choices. This can be explained by a greater positive impact of access to scientific capital on career advancement in academia instead. The social capital of the laboratory can have a significant positive impact on PhD entrepreneurship, but only when students have business experience, in the form of industry collaboration and industrially applicable research projects during their studies. Muscio et al. find that three quarters of university-related start-ups are established by students who maintained academic employment. This double affiliation acts to reduce the inherent risks of entrepreneurship.

Science parks

Germain-Alamartine and Moghadam-Saman (2019[23]) studied science parks in Sweden and Spain to understand the alignment of doctoral education to the needs of local industrial employers. They find that interviewees recognise the need to make doctoral education more relevant to industry, which necessitates more involvement of non-academic employers with doctoral education. As it stands, most industrial employers prefer to hire and invest in the further training of master's graduates instead of doctorate

holders, because they perceive them as more adaptable and cheaper to train to be work ready. For the situation to change, the authors argue for more engagement through discussion forums, and the creation, dissemination, and support for inter-sectoral mobility during doctoral education, to prevent skills mismatch.

Absorptive capacity of firms

Cruz-Castro and Sanz-Menéndez (2005[24]) studied a sample of doctorate holders and their employing firms involved in a Spanish funding program to promote the employability of doctorate holders in firms. They analysed the patterns of mobility, economic returns, and innovation outputs. Qualitative and quantitative indicators were combined to tackle two sets of general questions: the incentives for doctorate holders to pursue a company career versus an academic career and the flexibility and/or reversibility of career options for young doctorate holders and the relative value of the doctorate outside academia. Their results in 2005 questioned the idea that the labour market for doctorate holders was still mainly limited to academia.

Martínez et al (2015[25]) evaluated the effectiveness of the Spanish Torres Quevedo Programme subsidising the hiring of research personnel in firms. They studied factors associated with the duration of contracts and their transformation into open-ended contracts, a basic aim of the programme. They explored the characteristics of subsidies, individuals, entities, and projects related to the eventual stabilisation of the new research employees, when the subsidies had ended. The programme was found to strengthen R&D capacity in recipient firms – above all in technology centres – yet, only about half of the subsidized short-term contracts had been converted into permanent contracts by the end of their second year. The program appears to have increased the absorptive capabilities of the recipient entities, but mostly in the short term.

Diversity and inclusivity in academia

Lambert et al. (2020[26]) studied the career choices of underrepresented and female postdocs in the biomedical sciences in the United States. From their survey of 1 284 postdocs, they find that self-worth plays an important role in the process of choosing an academic, research-intensive career. They show that the first three years of the postdoctoral phase are crucial to keep women and underrepresented minorities in academia, and that self-worth is a very important factor for minorities in predicting an academic research career. Self-worth is also more important for women than for men. Consequently, special attention needs to be paid to mechanisms such as mentoring and coaching that improve success in grants and publications, for these two categories of postdocs if we want to increase diversity in academia.

Evers and Sieverding (2014[27]) surveyed 380 doctorate holders in a German university about their intention to pursue an academic career, soon after finishing a PhD and at an eight-month follow-up for those still in academia as postdocs. They found that women were significantly less likely from the start to plan to stay in academia. Men reported more social pressure to become professors than women; they had a more positive attitude to becoming a professor and perceived their academic abilities to be more in line with the requirements of becoming a professor. However, no gender difference was found in the intention to continue in an academic career for those who were postdocs eight months after their doctorate. The authors argue that supporting women's academic career intentions at an early stage – even during the PhD – could be a way to close the academic gender gap. The authors conclude that having more women professors that act as role models, mentoring programmes, and family-friendly institutional policies are important to attract women to an academic career.

Conceptual framework

Previous OECD-GSF work called for systemic changes, requiring action from multiple actors, to support a more diverse, healthy, and effective research workforce. The prevalent model for academic careers is characterised by a bottleneck between the doctoral phase and a secure academic research post, which is ultimately accessible to only a few. Those caught in the bottleneck often serve in a series of precarious postdoctoral positions before eventually 'dropping out' and pursuing other career options. A desirable alternative vision would see early-career researchers prepared for different roles within academia and beyond - in public administration, the social sector, the business sector, or self-employment - and supported and empowered to make informed career transitions (OECD, 2021[4]).

The current project addresses a number of barriers that countries encounter that hinder the achievement of this vision. These include: a lack of diversification of research career options; lack of intra- and inter-sectoral mobility; a lack of engagement of a diversity of employers in doctoral and postdoctoral training; inadequate training of researchers for diverse career paths, and inadequate support for a transition from higher education to other sectors of the economy. These concerns have emerged in a context of significant increases in doctoral level attainment in OECD countries: just in the period 2016-2021, it grew 23% (1.01-1.25%), compared to tertiary education that grew by only 13.3% (35.25-39.95%).

Enduring cultural expectations about the career of doctorate holders by doctoral and postdoctoral researchers and their academic supervisors give preference to traditional academic careers within the professoriate, i.e., those in protected contracts as assistant, associate, and full professor (or equivalent). Despite the reduced number of positions in the professoriate that does not match the increase in the doctorates being awarded every year, governments continue increasing funding for doctoral and postdoctoral research and universities are commonly rewarded to produce doctorates and associated research publications. In many countries, the labour market for researchers is still concentrated in the higher education sector, to the detriment of possibilities in the business enterprise, government, and social sectors which do not have the capacity to absorb new doctorate holders and offer them positions compatible with their advanced training.

 Existing frameworks for doctoral and postdoctoral training often have not adapted to prepare doctorate holders for careers beyond academia. Recognition and reward systems for researchers continue to focus on traditional disciplinary research and bibliometric measures of individual performance. These systems in turn incentivise research supervisors, and discourage them from investing in professional development and promoting career choices beyond academia for those they supervise.

The following key policy questions were included in the terms of reference that guided this project:

- How can doctoral and postdoctoral researchers be best prepared for different career trajectories? How can they develop the transferable and translatable skills that are required for successful careers within and beyond academia? What **training and experiences** can support doctoral and postdoctoral researchers to develop these skills?

- What **recognition and reward systems** are required in academia to ensure that personal development, acquisition of transferable skills and different career trajectories are taken seriously and as an integral part of ensuring research quality and impact?

- How can institutional practices regarding **professional development** for different career options for doctoral and postdoctoral researchers be improved? What are the implications for funding models, individual supervision, and mentoring?

- What can be done to support quality **career transitions** within academia and between academia and other sectors? How can the cultural obstacles to such transitions be addressed? How can employers be encouraged to see the added value of a PhD?

- What actions can be taken to promote an **inclusive academic culture**, improve the diversity of the academic research workforce and offer attractive career options to men and women from a wide variety of social and economic backgrounds?

- What **evaluation criteria and processes** for individuals and teams are required to promote the development of a diverse, highly skilled and motivated research workforce that meets the multiple demands of academia and supports other sectors of the economy and society?

To answer these questions, it is important to recognise the multi-level governance of research and innovation systems, which include many stakeholders, with different roles and whose weight is different in different jurisdictions. Governments steer the system using a set of regulatory, financial, informational, and organisational levers (see Figure 1), that will affect the behaviour of research performing organisations in higher education (HE), the business enterprise sector (BE), the government sector (GOV), and the private not-for-profit sector (PNP). In addition, research agencies, universities that provide doctoral and postdoctoral positions, representative associations of researchers, including postdocs, and their employers, and supranational organisations, such as the OECD and the EC, also contribute to the governance of the overall system. Steering change in the desired direction requires co-ordination of efforts from these different stakeholders.

Figure 1: Governance of research and innovation systems
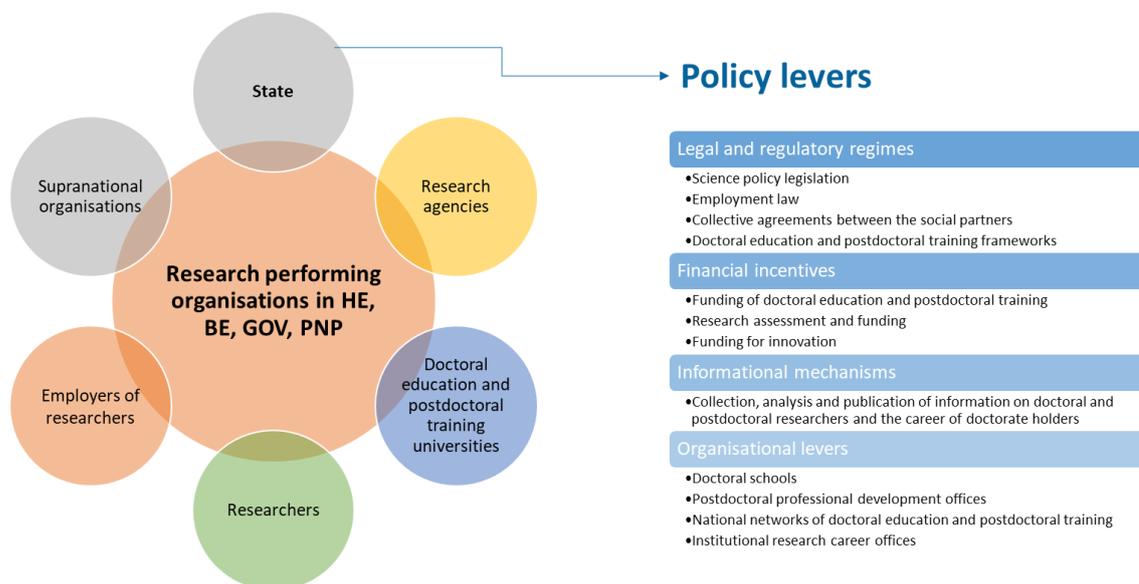
There are a number of policy issues that impact on the diversification of career options for doctorate holders. These include: the stock and flow of doctorate holders, doctoral education or training, postdoctoral work, transitions from the higher education to other sectors of employment, intra- and inter-sectoral mobility, and engagement of academic institutions with other employers of researchers. The importance of all these areas was confirmed in the country notes that were generated for this project and the discussions with research stakeholders that took place during the project.

It is important to understand the purpose and content of different policy initiatives being undertaken in different contexts in order to facilitate peer learning among countries. This includes knowing the policy levers used in the design of each policy, which stakeholders are involved in policy implementation, and the outcomes of any evaluation policy.

A conceptual framework that integrates all these various considerations is presented in Figure 2.

Figure 2. Framework of analysis for promoting diverse career options for doctoral and postdoctoral researchers

Context
- Increase in doctoral level attainment
- Cultural expectations
- Funding of doctoral and postdoctoral training
- Labour market for researchers in HE, BE, GOV and PNP sectors
- Doctoral education and postdoctoral training frameworks
- Research assessment and funding frameworks
- Recognition and reward system for researchers

Governance of research and innovation systems
- Research performing organisations in HE, BE, GOV, PNP
- State
- Research agencies
- Doctoral education and postdoctoral training universities
- Researchers
- Employers of researchers
- Supranational organisations

Policy Concerns
- Lack of diversification of research career options
- Lack of intra and inter-sectoral mobility
- Lack of engagement with diverse set of employers
- Inadequate education and training of doctorate holders for diverse career paths
- Inadequate support for doctoral and postdoctoral researchers' transition from HE to other sectors

Main Policy Question
- How to promote diverse career options for doctoral and postdoctoral scientists?

Object of Focus
- Careers of doctorate holders, especially the transition from doctoral education and postdoctoral training

Policy areas
- Stock and flow of doctorate holders
- Doctoral education
- Doctoral training
- Transition from HE to BE, GOV, PNP sectors
- Intra and inter-sectoral mobility during research career
- Engagement with employers of researchers

Policies and initiatives
- Policy design: Regulation, Funding, Information, Organisation
- Policy implementation: Funders, Universities, PROs, Other employers, Researchers
- Policy evaluation: Effects, Enablers, Barriers

Intended policy outcomes
- Diverse research career options for doctoral and postdoctoral researchers
- Flexible career trajectories of researchers
- Better quality research and innovation across economic and social sectors

Methodology

This section presents the methodological approach, which included data analysis and synthesis of available policy information, the collection of information from countries via country notes (see template at Annex B), and discussions during an international workshop and within the Expert Group that oversaw the work.

The conceptual framework presented in the previous section, which built on previous work and the dedicated literature review, guided the project. The main data sources were international administrative and survey data: OECD-Eurostat co-ordinated R&D data collection (RDS), UNESCO-OECD-Eurostat data collection on education statistics (UOE), OECD Survey on the career of doctorate holders (CDH), OECD International survey of science (ISSA), Survey on the mobility patterns and career paths of EU researchers (MORE), policy information already provided by countries and organised in the EC-OECD International database on STI policies (STIP compass), and the scholarly and policy literature.

With the help of the EG, 15 countries provided a country note with information on recent, existing, and planned policies and institutional practices to promote the diversification of the career of doctorate holders. The following countries took part: Australia, Belgium, Canada, Chile, Costa Rica, France, Germany, Japan, Korea, Netherlands, Norway, Portugal, South Africa, Spain, Switzerland, United Kingdom. A recently published country case study on the labour market relevance and outcomes of doctoral education in Hungary (OECD, 2022[28]) was also used. Regarding Spain, a recent study to foster co-operation between universities, research and business in Spain is also relevant (OECD, 2021[29]).

This set of countries has a reasonably balanced distribution in terms of size, geographical location and different governance regimes for science and innovation, with different decision-making processes and structures that steer their systems. They have a range of different emphases regarding academic self-governance, state-steering, and market or quasi-market steering mechanisms.

In their notes, countries provided information on their national context, policy concerns, available national and international evidence, information on policy initiatives and on existing practices, programmes, and initiatives (see Annex B, for the country note template). Where available similar, albeit less detailed, information from several other countries not represented on the Expert Group, most notably the United States, was extracted from the published literature and public databases.

Towards the end of the project, an international workshop was organised to present and discuss the emerging findings with a multi-stakeholder audience. The goal was not only to share the main lessons learned but also to exchange on best practices presented by invited experts. These discussions included experts that participated and/ or were consulted in the development of the country notes, other relevant stakeholders invited by countries (policy officials, research funders, representative associations of employers of researchers (e.g., universities, public research organisations, other relevant employers), representative associations of researchers, Trade Union Advisory Committee to the OECD), and relevant supra-national organisations.

Finally, the EG undertook a rapid foresight exercise to explore a future vision for the research workforce and the actions necessary to achieve this vision, with the overall aim of identifying critical issues for the future. This forward-looking exercise was not designed to be predictive but rather it recognised that research is evolving rapidly with significant implications for the future workforce, and it provided an opportunity to think beyond the immediate concerns and issues.

Findings from internationally comparable data

This section is an analysis of relevant internationally comparable data that are useful to understand the career paths of doctorate holders. Following the guidance in the Frascati Manual (OECD, 2015[30]) , the following acronyms are used for the institutional sectors performing research: business enterprise (BE), government (GOV), higher education (HE), and the private not for profit (PNP) sector.

International quantitative data

There are gaps in the data available for some countries and years, but it is clear that the new doctorates awarded have been growing steadily in the last two decades, practically doubling in size during the period 1998-2017 (see Table 4).

Table 4. New doctorates awarded in OECD countries (1998 - 2017)

Year	New doctorates awarded
1998	140 000
2000	158 000
2006	200 000
2012	247 000
2017	276 800

Sources: Auriol (2010[31]), Auriol et al. (2013[32]), OECD (2014[33]), OECD (2019[34]).
Notes: The number of OECD countries grew during the period: Chile (2010), Estonia (2010), Israel (2010), Latvia (2016), Slovak Republic (2000), Slovenia (2010).

It is difficult to measure completion rates for doctoral education, as international comparable data based on rigorous cohort methods that follow the individuals from entry to completion or leaving the system is not available. However, in many countries doctoral education graduation rates are markedly lower than entry rates (Figure 3). Although this data can be difficult to interpret and should not be used alone to draw strict comparisons between countries (see legend to fig. 3) it indicates a certain level of inefficiency and raises questions regarding how well doctoral education meets the expectations and needs of doctoral researchers, and how well those entering doctoral education are prepared for it, both in terms of ability and motivation.

Figure 3. Doctoral education entry and graduation rates (2020) for select OECD countries
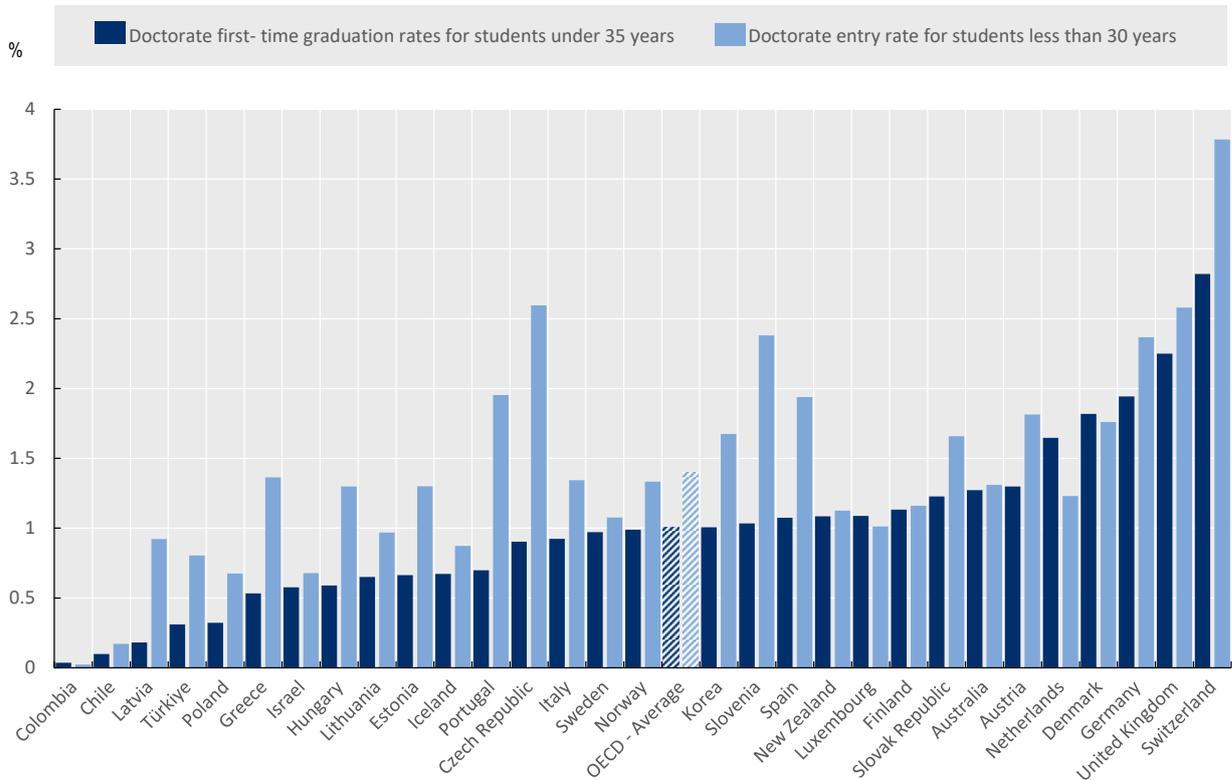
Source: OECD (2023[35]), "Education at a glance: Graduation and entry rates", OECD Education Statistics (database), https://doi.org/10.1787/f36b1100-en (accessed on 22 March 2023).
For general and country-specific notes, please refer to https://www.oecd.org/education/EAG2022_X3.pdf

Note: Entry and graduation rates represent an estimated percentage of an age group expected to enter or graduate, respectively, a certain level of education at least once in their lifetime. Entry rates in most countries are higher than graduation rates and in several countries the difference is double or more. This can be the result of expanding systems where younger cohorts are participating more in doctoral education, or it can be the result of people dropping out of doctoral studies without completing them or taking longer than expected to graduate. In a few instances, graduation rates are higher than entry rates, which may mean that in those countries there is a declining number of people entering doctoral education. In 2020, the OECD entry rate for doctoral education for those under 30 was 1.398%, whereas graduation rate for those under 35 was markedly lower: only 1.005%.

The question of ability on entry and the quality of doctoral education, raised by Cuthbert and Molla (2014[13]) (see Section 2), is further corroborated by international data on adult skills. On average, in the OECD, only 0.5% of adults reach the maximum level 5 in literacy proficiency, and only 1.0% reach level 5 in numeracy proficiency in the OECD Survey of Adult Skills[1] (OECD, 2019[36]). The description of level 5 is arguably the best match to what is required as described in the definition of the International Standard Classification of Education for doctoral level attainment (OECD, 2015[3]) or the Dublin Descriptors for the third-cycle

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1 The OECD defines literacy and numeracy across six levels. People with Level 1 or below literacy/ numeracy skills are considered to have very poor literacy/ numeracy skills, while Level 3 is considered the minimum literacy/ numeracy skills required for coping with everyday life. Level 5 refers to advanced understanding and analytical skills.

qualification (EHEA, 2005[37]). Current OECD doctorate level attainment above 1% does not seem to be in line with the observed level of advanced skills in the population.

The distribution of new entrants to doctoral education by field of education varies markedly across countries (Figure 4), but the majority are in the sciences in most countries (natural sciences, mathematics and statistics; information and communication technologies; engineering, manufacturing and construction; agriculture, forestry, fisheries and veterinary; health and welfare). The exception is Mexico, with a majority in the arts, humanities, and social sciences fields (education; arts and humanities; social sciences, journalism and information; business administration and law).

Figure 4. Distribution of new entrants into doctoral education by field of study (2020)
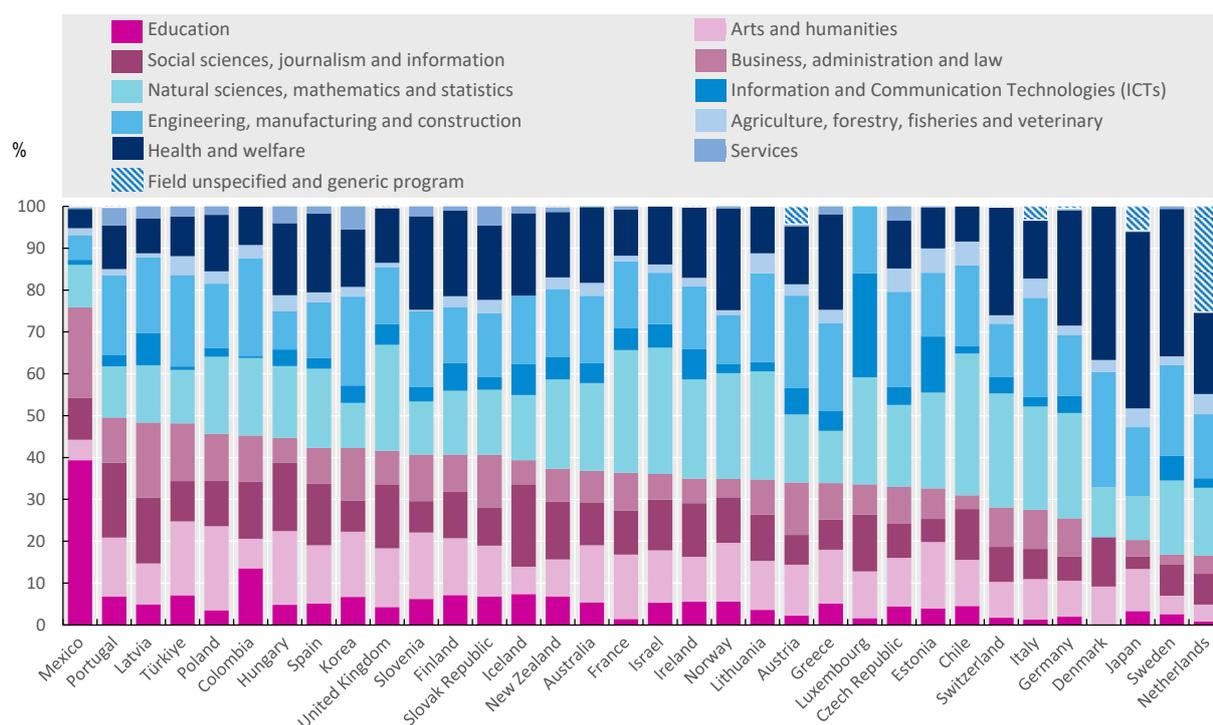
Source: OECD (2023[38]), "Education at a glance: Graduates and entrants by field", OECD Education Statistics (database), https://doi.org/10.1787/0d5ea7b3-en (accessed on 23 March 2023).

In most countries for which comparable data is available (mainly European countries, and last updated in 2012), the majority of doctorate holders work in the non-commercial sector (education; human health and public administration) (Figure 5). Most doctorate holders that work in the business sector, do so in professional services and related market services. Only a small minority work in manufacturing, agriculture, mining, and other industrial activities.

According to the results of the survey on *Doctorate Recipients from U.S. Universities: 2021*, for the first time the business sector became the major destination for newly graduated doctors in the United States (National Center for Science and Engineering Statistics, National Science Foundation, 2022[39]).

Figure 5. Distribution of doctorate holders by economic activity (2012)
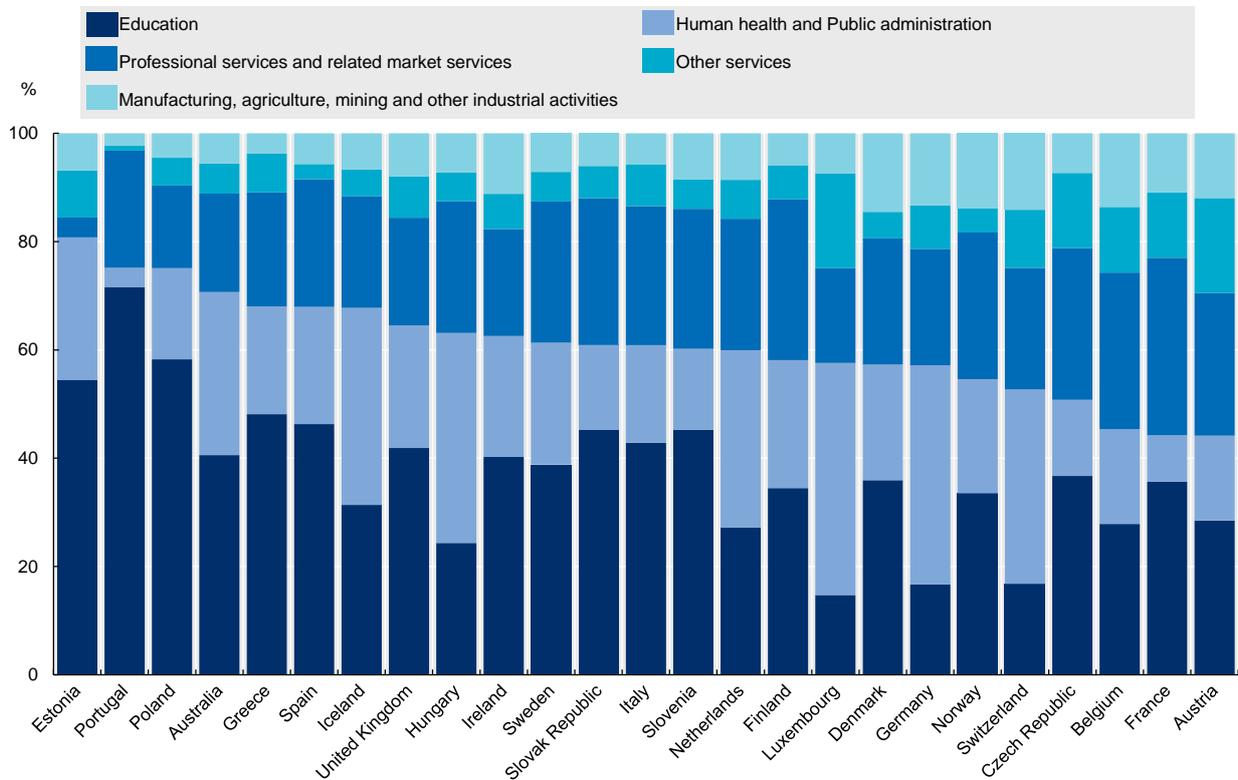
Source: OECD (2015[40]), "Doctorate holders by economic activity, 2012: As a percentage of all employed doctorate holders", in OECD Science, Technology and Industry Scoreboard 2015: Innovation for growth and society, OECD Publishing, Paris, https://doi.org/10.1787/sti_scoreboard-2015-graph86-en based on OECD calculations based on OECD/UNESCO Institute for Statistics/Eurostat data collection on Careers of Doctorate Holders 2014; EU Labour Force Survey (micro-data) and United States Current Population Survey, July 2015.

For the 16 countries for which there is data, the vast majority of researchers with a doctorate work in the higher education and the government sectors (Figure 6). Korea and Austria are notable for the fact that more than 1 in 5 researchers with a doctorate work in the private sector. In combination with the information in Figure 5, the fact that most *researchers* with a doctorate work in the HE and GOV sector, it means that many doctorate holders that work in the other sectors as described in Figure 5 are not classified as "researchers". This raises the question whether these doctorate holders continue to do research activities or use their research and advances skills in the jobs they perform, even though they are not classified as "researchers".

Figure 6. Researchers with a doctorate by sector of employment (2019) for a selection of countries
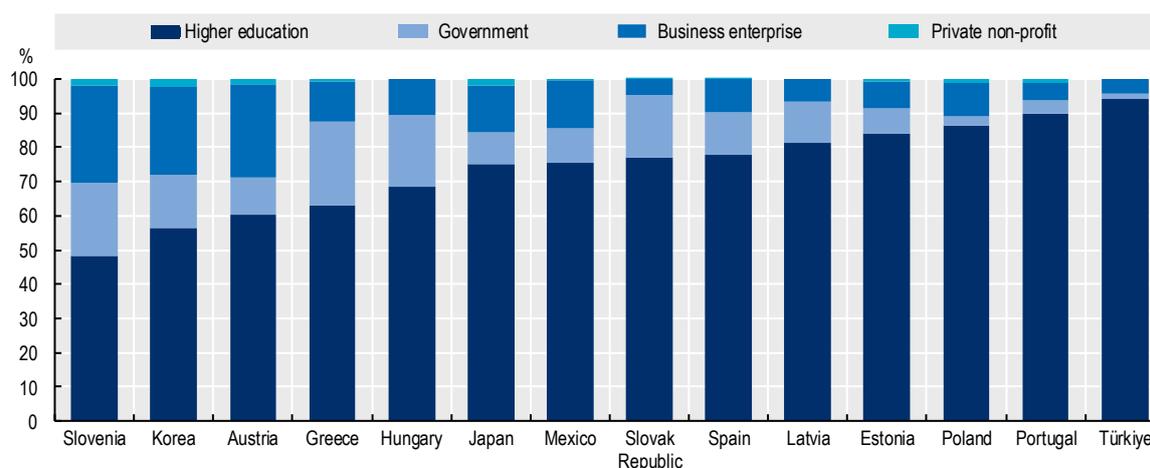
Source: OECD (2021[41])"Research and Development Statistics: R-D personnel by sector of employment and qualification (Edition 2021)", OECD Science, Technology and R&D Statistics (database), https://doi.org/10.1787/6da6e839-en (accessed on 22 March 2023).
Notes: Difference from the Frascati manual methodology are observed for Austria, Greece, Hungary, Italy, Japan, Latvia and Poland. Estimated for Mexico.

International information on policies

As a complement to the quantitative international data that can be used to compare countries, the EC-OECD STIP Compass provides qualitative data on STI policies. The STIP survey, which is conducted every 2 years includes two questions that are particularly pertinent for this project: one on research careers – *What policy initiatives exist to make research careers more attractive?;* one on doctoral and postdoctoral research – *What policy initiatives exist to specifically support doctoral and postdoctoral research and education?* The main areas of focus across countries for policy initiatives on research careers and on doctoral and postdoctoral research are synthesised in Table 5.

Table 5: Current policies on research careers and doctoral and postdoctoral research

Research careers
- Improve job security and financial stability: e.g., tenure-track posts, financial support for young researchers, subsidised housing for young researchers   - Diversify the research workforce: e.g., inclusion of women and other under-represented groups   - Better overview of career opportunities: e.g., career guidance, survey of post-PhD labour outcomes   - Increase international mobility: e.g., removing financial, legal, and cultural barriers, money follows researcher schemes   - Increase intersectoral mobility: e.g., removing administrative and cultural barriers, involve industrial partners in PhD training, portability of pension rights across sectors

Doctoral and postdoctoral research
• Tracking and analysing career paths: e.g., creation of observatories of research careers • Encouraging employment outside academia: e.g., grants for students in companies, fiscal incentives for businesses to employ doctorate holders, explain the value of PhDs to non-academic actors • Funding for postdoctoral research: e.g., postdoctoral fellowships and grants • Support for doctoral education: e.g., predoctoral contracts and grants • Support for the enrolment of students: e.g., enrol public sector institutions' employees, support a faster track through the PhD • Assessment of the quality and efficiency of doctoral education: e.g., assessment leading to proposals to the Ministry towards reform

This project has also been informed by the findings of the third round of the OECD International Survey of Science (ISSA3) – see Box 1.

Box 1. Findings from ISSA3

The OECD International Survey of Science (OECD-ISSA)[1] is an exploratory instrument to monitor the status of and major issues impacting on the scientific community at regular intervals. The initiative started as a sample survey of scientific authors with corresponding email addresses (ISSA1, ISSA2), but it has been transformed to a crowd-sourced instrument open to all scientists, allowing for authentication via their personal ORCID[2] identifier. ISSA3 covered around 3 000 researchers and claims no representativity of the population of researchers. Among respondents, 81% are doctorate holders, 41% women, 72% work in higher education (HE), 16% in the government sector (GOV), and 9% in the business enterprise sector (BE). The 2021 survey paid specific attention to scientific careers, impact of COVID-19, and engagement between academia and the business sector.

Provisional results indicate that average annual earnings of respondents in BE (around EUR 57 K) are substantially higher than in the GOV and HE sectors (around EUR 50 K and EUR 48 K, respectively). HE has the highest level of respondents in fixed-term contracts (around 35%), in contrast to the GOV (around 25%) and BE (just over 20%). Around 60% of respondents would like to engage more with the business sector, compared to just over 35% who want the level of engagement to stay the same, and less than 5% who want less engagement. Those in the Agricultural and Veterinary Sciences and the Engineering and Technology fields of research have almost 20 percent points more willingness to engage than those in the Social Sciences. The perception of an engagement deficit between HE and BE differs across countries and is higher than 60% in countries such as Colombia, Spain and Portugal and lower than 50% in the United Kingdom, France and Germany.

The principal reasons for those considering engaging professionally with the business sector include access to financial resources to pursue scientific or related interests, an opportunity to have an impact beyond their domain, access to expertise and non-financial resources to pursue scientific or related interests, and very relevant to this project – expanding possible career paths. There are several factors that are perceived as preventing or limiting professional engagement, including high cost in terms of time, effort and missed opportunities, and a lack of personal skills and experience about the business world.

1. More on OECD-ISSA available at http://oe.cd/issa
2. More on ORCID available at https://orcid.org/

Findings from country data and information

The evidence presented in this section is derived from the content analysis of collected data and information in the dedicated country notes that were produced for this project and discussion during the international workshop [see the Belgium country note as an example (Bebiroglu, 2022[42])]. This information has been supplemented with references to public documents, where these are available.

Context

Most countries report that a significant share of public research funding is awarded on a competitive basis for projects having a fixed duration, as well as an increase in external funding from third-party sources for contract research. The share of non-competitive block funding to universities and public research organisations is decreasing in many countries. This means that there is an increasing amount of funding for fixed-term contracts for doctoral and postdoctoral researchers, and that their numbers are increasing, but less predictable funding for stable, long-term positions in academic research.

The high levels of precarity in academia have led to concerns regarding the wellbeing of researchers, the capacity of academia to continue to attract and retain the best talent, and ultimately the quality of science being produced (OECD, 2021[1]). Although the diagnostic and main causes of precarity are clear, and recommendations to address the problems have been made, complex governance and funding arrangements with distributed responsibilities that vary across national systems, continue to be an obstacle to effective change.

The clear increase of doctorates awarded in most countries is not being accompanied by a commensurate increase in the number of permanent academic positions and most countries have seen a substantial increase in the number of doctoral and postdoctoral researchers employed in short term posts in academic research. Many researchers experience long periods supported on successive postdoctoral contracts before they eventually secure a permanent position or, more frequently, transition to the labour market beyond academia, for which they are not necessarily well prepared.

Despite the decreasing chance of being able to stay in academic research, most doctoral and postdoctoral researchers still show a preference for an academic career, and many economies show a low absorptive capacity for doctorate holders outside academia in positions that align with their advanced skills. Although, in most countries, the overall unemployment rate for doctorate holders is lower than the general population, there are serious concerns about the conditions in which they work during their passage in academia (short-term contracts, lack of long-term prospects, misalignment of skills and responsibilities, for example).

Although in some countries the majority of doctorate holders still work in HE, in many other OECD countries the majority are now working in the BE sector. Precarity is higher in HE than in other sectors because there are so few positions in the professoriate, but also because there are few permanent positions outside the professoriate track. Existing and newly emerging needs for professional research support staff are often filled by doctoral and postdoctoral researchers who substitute for long-term staff (such as staff scientists on indefinite contracts).

Unlike PhD programmes, the postdoctoral phase in most countries is very unstructured, with a lot of variability of experience among postdoctoral researchers. In addition, many countries have a poor information base on the careers of doctorate holders to inform policy in this area and to assess how doctoral education and postdoctoral positions are preparing (or not) people for the career trajectories they end up experiencing. There is little rigorous data to assess the needs of the labour market both within and beyond academia.

Universities have a lot of autonomy regarding the nature of doctoral education, and even more so for postdoctoral work. Many have introduced transferable skills development in their programmes, in addition to specialist academic training, career guidance, mentoring, internships, doctoral and postdoctoral forums, but there are many cultural and other barriers to the effective implementation of these initiatives. In the absence of data their real impact is difficult to assess.

In many countries there are no national policy initiatives to promote diverse careers, and initiatives are often institutionally based and small-scale. Change has often been more focused on alternative careers within academia rather than options beyond academia. This has to do with academic culture and reflects a lack of visibility being given to careers beyond academia. Other potential employment sectors do not necessarily have an explicit demand for doctorate holders or a clear understanding of their value and often give preference to hiring master's graduates instead.

Some countries report serious concerns about brain drain – with a net outflow of doctorate holders from these countries because of lack of opportunities within and beyond academia. This represents a loss of talent and, from an economic perspective, raises questions about return on investment.

Policy concerns

Countries are concerned that there are not enough opportunities for professional development for early-career researchers that can prepare them for diverse careers within and beyond academia. Even when opportunities exist, researchers may not be encouraged, or even be tacitly or actively discouraged, to participate in them. This are a combination of reasons for this, including a culture of prioritising traditional academic activities, a competitive and demanding environment that directly or indirectly forces early-career researchers to prioritise research activities, and an enduring image of the doctorate as the first stage of an academic career, with alternative paths being considered as a "Plan B".

There is also a general consensus that early-career researchers do not have enough information to make informed decisions regarding their careers, and that many harbour unrealistic expectations of a career in academia. Countries feel that there is a need to promote intersectoral mobility during the doctoral and postdoctoral phase to make young researchers aware of the alternatives. There are particular concerns about late selection and lack of preparation for a transition to other sectors. There is a need to support young researchers, through career guidance, in making informed choices early on in order to make subsequent transitions smoother.

There are concerns about the (lack of) "permeability" of academia: that once a researcher has transitioned to employment beyond academia, a return to the academic career path from other sectors is difficult or almost impossible. This may be at least partly explained by the performance assessment metrics pervasive in academia, that effectively hinder the chances of a return for those who have stopped publishing in top academic journals. In this respect, some countries are supporting partnership-building between academia and the BE, GOV, and PNP sectors to promote inter-sectoral mobility during and after the doctoral and postdoctoral career stages.

Another issue high on the policy agenda is international mobility in an increasingly global labour market for researchers. This has implication in terms of retention of doctorate holders in the country where their doctorate was awarded, supporting incoming foreign researchers, and providing prospects for those

returning to their original country after a period abroad. This raises practical issues such as the support for dual career couples, contribution to national insurances schemes, portability of pension rights etc.

Related to international mobility but going further to include access to career advancement opportunities and access to professional networks, many countries are concerned about equity, diversity, and inclusion. This relates to access to both academic and non-academic scientific careers, as well as to the recruitment and retention of researchers from diverse backgrounds in academia.

Finally, the quality of doctoral education is a preoccupation in terms of a perceived lack of skilled people to lead the fourth (and fifth) industrial revolution, and a sense that current doctoral training is not adequately preparing doctoral and postdoctoral researchers for careers beyond academia.

National and international evidence

Almost everywhere there is a decreasing percentage of doctoral and postdoctoral researchers transitioning to permanent jobs in academia. In many countries there is parity between men and women in the early stages of a research career, but women's progression in the academic career remains slower than men's and there is a prevalent 'glass ceiling' effect across most research domains.

In terms of labour market outcomes, the employment rate of doctorate holders in the population as a whole is better than that of other graduates. Stability of employment and pay is normally better in non-academic jobs, although there is mixed evidence on income relative to other graduates, especially master´s graduates. There is also mixed evidence on skills match but a general perception that doctorates could be better trained for careers outside academia.

In many economies, the doctorate is not fully appreciated by employers beyond academia. Some employers question the value of the doctorate viz-a-viz a master's degrees. Non-academic employers of doctorate holders seem to value knowledge and expertise, research skills, and cognitive skills, but often consider that doctorate holders lack other skills, such as communication and teamwork skills.

The following sections of this report – 6.4-6.8 – provide an overview of 'good practice' policy initiatives mainly from the 16 countries that were represented on the Expert Group that oversaw this work. Boxes are used to present more detailed information on a small selection of these, which were presented during the international workshop in November 2022. These initiatives are illustrative and a full analysis of all relevant policy initiatives is beyond the scope of this report. However, a more comprehensive list of policy initiatives and actions is provided for reference also in Annex C.

Policy initiatives – Regulation

A number of countries have been enacting regulatory policy initiatives through national legislation and/or collective bargaining, to promote the diversification of the career of doctorate holders.

In Germany, the Academic Fixed-Term Contract Act limits the period researchers can stay in academia on fixed-term contracts depending on their qualifications in order to oblige researchers who have not been granted permanent employment to move to other sectors in a timely manner. However, these restrictions do not apply for contracts paid out of external funding sources, which dominate many areas of research. The Academic Fixed-Term Contract Act will be amended in 2023. The reform intends to provide a higher degree of certainty and transparency for researchers with regard to career plans and to promote a better reconciliation of work and family life.

The Sauvadet Law (2012) in France promotes the transformation of fixed-term contracts into permanent contracts for those that are continuing research activities in public research organisations. France offers a seniority bonus for doctorate holders recruited to certain public sector categories. The doctorate is now included in the national directory of professional skills (RNCP), aligned with the European framework, a

common reference for employers. The doctorate is associated with the following transferable skills, irrespective of the discipline: design, elaboration and development, implementation, valorisation and transfer, scientific and technological supervision, training and dissemination, management of teams. The Research Programming Law (LPR, 2020) requires annual reporting at university level on the career development of doctoral graduates in the five years preceding the diploma. Since 2022, the regulations governing the doctorate were modified to reinforce quality assurance. This includes the mandatory training of supervisors, establishment of individual monitoring committees whose members do not include the doctoral researcher supervisor, and an oath on graduation to respect scientific integrity throughout their career. A national body is responsible for evaluating institutional doctoral education policies. Both doctoral and postdoctoral researchers have employment contracts, and a new category of junior chairs has been created in order to retain young talent in academia.

Norway has developed a new national strategy for the recruitment of researchers and career development (2021). This aims to: broaden the scope of career possibilities to all sectors; create a predictable framework for the research career; and reduce the precariat by making future regulations clearer, especially regarding the criteria for postdoctoral fellowships to qualify for first positions through independent research. In addition, the Research Council of Norway has recently adopted a new policy for recruitment to research and early careers. The new policy is a continuation of the Recruitment Policy (2016-2020) and identifies measures that help build up the national research and innovation expertise. There is a strong emphasis on intersectoral mobility and the need for research expertise across society. It includes schemes to increase co-operation between academia and industry, to enhance intersectoral mobility, promote entrepreneurship, and recognises the need for evolution in research assessment.

Portugal recently launched a contract for the legislature 2020-2023, where the expectation is that at least 50% of new doctorates by 2030 will be carried out in 'co- work' environments with a diverse range of public and private institutions. It has been restricting the granting of post-doctoral stipends, reducing their duration, and promoting the professionalisation of researchers in academia with employment contracts. Like France, Portugal offers fiscal incentives to companies (SIFIDE) for the recruitment of doctorate holders.

Spain introduced the issue of research career diversification in the Science, Technology and Innovation Law passed in 2011.This was mainly connected to increasing the employability of doctorate holders in private firms. More recently it passed legislation in 2022 imposing severe conditions and limits on the use of temporary contracts in the private and public sectors to a maximum period of six months. This included additional actions to facilitate intersectoral mobility between the public and private sector, offering 'movers' a right to return to the public sector for up to five years. See Box 2 for a similar possibility of secondment in Thailand.

Box 2. Talent Mobility programme in Thailand

Thailand launched the programme Talent Mobility in 2015 to address the gap between business and researchers and the reluctance of researchers to collaborate with industry. To facilitate the mobility of researchers from governmental agencies and higher education institutions to industrial sectors, researchers are authorized to go on secondment full-time or part-time to industrial partners for periods between 3 months to 2 years. Since the establishment of the programme, it has attracted more than 700 companies and has supported more than 1 200 doctoral researchers and lecturers in industrial placements.

Based on the presentation of Sampan Silapanad, Vice-President, Chief Thailand Business Strategist, Western Digital, Thailand, OECD-GSF Workshop on the research workforce of the future: promoting diverse career options for doctoral and postdoctoral researchers. Paris, 22-23 November 2022.

South Africa has been developing several policy initiatives, including a Higher Education Qualifications Sub-Framework, which creates the potential for both general and professional doctorates. A 2019 White Paper proposes tax breaks for industry hiring doctorate holders, industrial doctorates, and joint appointments between academia and industry. In academia and public research institutes, postdoctoral fellowships are tax exempt up to a certain level. The 2016 Human Capital Development Strategy proposes a role for science councils in absorbing unemployed doctoral graduates in the context of developing international partnerships.

In Switzerland, recent changes to an otherwise highly restrictive national policy on immigration facilitate access to work permits for degree holders from Swiss HE institutions. This regulation increases the possibilities of employment opportunities beyond academic research – in addition to the retention of qualified young researchers from other countries.

Policy initiatives – Funding

Funding plays an important steering mechanism for governments to promote change in the career prospects of doctorate holders.

The Flemish Community of Belgium funds fellowships for doctoral and postdoctoral researchers during which they can do internships and perform part of their research in organisations outside academia. It also offers funding targeted at career guidance for doctoral and postdoctoral researchers.

Canada funds internships for doctoral and postdoctoral researchers in posts beyond academia through the Mitacs programme, which is conducted in partnership with academia, industry, and government. It also provides dedicated funding to promote equality, diversity and inclusivity.

In Switzerland, significant funding has been provided for the creation of transferable skills training programmes in higher education institutions. Innovation and entrepreneurship are also supported by diverse initiatives, in alliance with technology transfer offices. These activities are being embedded in institutional frameworks for early career researchers.

Chile has the Associative Research Program, PIA, funded by the National Research and Development Agency, which includes a competitive call for partnerships between the science sector and private companies.

Germany's federal states (*Länder*) and the Federal Ministry of Education and Research joined forces to launch the Joint Federal Government-Länder Funding Programme for Junior Academics, which supports tenure-track posts. The goal of the programme is to make the journey towards a lifelong professorship more transparent and predictable for young academics, since the only clear condition associated with the transition to a professorship is the successful completion of a tenure evaluation.

Another good practice example in Germany is the Programme for Women Professors (*Professorinnenprogramm*) which is a central funding programme of the federal and state governments to promote equality between women and men in academia. The programme links the appointment of women professors with structural changes in institutions of higher education. The aim is to increase the share of women researchers in top positions, to promote gender equality and sustainably by improving women's representation at all qualification levels with the aim of achieving parity.

Hungary has recognised the growing importance of start-ups in its economy, as proxied by venture capital investment, by developing the Co-operative Doctoral programme with scholarships and funding for doctoral schools, focused on applied science and technology. In this programme, the research topics of doctoral studies are closely connected to needs of the private sector. Although the transition takes time, traditional doctoral programmes that had focused exclusively on academic research are now changing, by incorporating training in business activities, such as IP management. At the same time the importance of

academic freedom and university autonomy is acknowledged and the quality assurance for a co-operative doctorate is as rigorous as that for an academic doctorate.

Japan has been funding a tenure tracking system, a programme to diversify career paths and to promote mobility, and to reform doctoral education.

France has had an industrial convention for training through research (CIFRE) programme since 1981. This programme allows companies to benefit from funding to support the recruitment of a doctoral researcher in partnership with a public research organisation that will award the doctorate. The CIFRE aims to promote collaboration between public research organisations and other sectors of the economy, and the employment of doctorate holders in companies and other organisations. Currently, it supports more than 2 000 doctoral researchers per year. France also offers a research tax credit, CIR, to encourage the recruitment of doctorate holders by companies. More recently, in 2022, France launched a similar programme to CIFRE for State employers to host doctoral researchers: the convention for training through research in administration (COFRA). In addition, France funds the creation of businesses by doctorate holders through its i-PhD competition.

The Korea Initiative for fostering University of Research & Innovation (KIURI) is an industry-university co-operation platform targeted at postdoctoral researchers and supporting their independent programme of work. Brain Korea 21 (BK21) is a programme that aims to improve the educational environment and R&D capabilities of graduate schools. It differs from other research funding programs in that it directs most of its funding towards supporting master's and doctoral students and young researchers. One of the main goals is to improve the competitiveness of new industries by fostering talented researchers who will lead the way in industrial and societal problem solving. In its latest edition, BK21 Four, a 'Graduate School Innovation Program' has been included. This focuses on career management activities, such as building career road maps, and provides start-up support for graduate students.

Norway funds an industrial PhD scheme alongside a public sector PhD scheme. Under the Industrial PhD scheme, a company collaborates with a university or university college on a doctoral project. The doctoral project is carried out by an employee and must be of clear relevance to the company's activities. The public sector PhD scheme is quite similar, but the doctoral project must be based on an issue of relevance to the public body. It is intended to expand research activities in public sector bodies, to increase researcher recruitment within the public sector and to promote greater collaboration between academia and the public sector.

Portugal funds Collaborative Laboratories (CoLABs), which must include at least one company and a public research organisation. One important criterion for eligibility is the direct and indirect creation of jobs for doctorate holders.

Spain has funded a number of new initiatives since 2022 to promote the incorporation and retention of talent in the private sector. This includes: a) Grants for hiring research staff in the private sector and an Industrial PhD programme; b) Mentoring programs to promote the mobility of research staff towards the private sector; c) Promotion of collaboration with companies, temporary mobility, and facilities for the creation of spin-offs; d) More favourable conditions for attracting technology-based entrepreneurs and e) Tax incentives and bonuses in the social security charges. These new actions are based on long-standing funding instruments, such as the "Torres Quevedo" Program for promoting employability of PhDs in companies, and its predecessor the IDE (Initiative for Doctorate holders in Firms). The new Laws of Science, Technology and Innovation and on Start-ups have reduced the cost for researchers of launching Start-ups.

South Africa has been shifting resources from established to next generation researchers, through the increase of funding for doctorate holders, the increase in the expected qualifications of academics, and the funding of South African nationals as Research Chairs for up to 15 years. The overall aim is to attract and retain talent in public universities. It also funds doctoral and postdoctoral researchers through the

Black Academics Advancement Programme to promote the development of black south African academics and academics with disabilities. The New Generation of Academics Programme (nGAP) is another prestigious programme which recruits highly capable scholars as new academics and has equity and disciplinary balance as central criteria.

In the United Kingdom the Cabinet Office is trying to broaden the range of people from different specialist areas working in the civil service, which currently attracts more people from Arts, Humanities and Social Sciences than from the Natural Sciences. The government has identified a need for people who can connect with academic research to support the work of the civil service, either in long-term positions or for shorter terms. The UKRI policy fellowships programme supports this endeavour by funding academics to collaborate on research to address national and global challenges, to inform policy, and to improve the knowledge exchange between policy and academic institutions (see Box 3).

Box 3. UKRI Future Leaders Fellowships and Innovation Scholars

The United Kingdom launched a funding scheme called Future Leader Fellowships in 2018 to support early career researchers not only in academia but also in business and other independent research organisations. The scheme aims to promote interdisciplinary research, inclusivity, and international mobility. Academic hosts are required to commit to providing an open-ended position to the selected fellow. The programme launched with few applicants from firms and did not fund any placements in businesses in the first round, but after 6 rounds, 15% of awards were made to the business sector. Three angles need to be considered: funders, applicants, and reviewers. For funders, the criteria and language need to be carefully selected to be appealing to all sectors. For example, the use of "research and innovation" might result in the exclusion of many businesses. The awareness in the community is another issue, as many companies are unaware of government funding opportunities. Attention must be paid to unexpected side effects, as well as demography and characteristics of fellows (e.g., gender, ethnicity), by encouraging specific sector applicants. Regarding applicants, it is important to provide training, such as writing application workshops, and interview training, especially for applicants from Small and Medium Enterprises, because they often lack sufficient organisational support. As for reviewers and panellists, they need to be aware of differences in terms of typical track records for applicants from different sectors, including expectations for scientific publications, and how terminology like "world-leading" translates in different sectors. The assessment process for the scheme is moving away from quantitative indicators towards evaluation of more inclusive narrative CVs.

UKRI has also implemented another programme called Innovation Scholars which is targeted at academics who wish to take secondments beyond academia. This covers a wide range of areas: biomedical sciences, data science in health, architecture and design.

Based on the presentation of Stephen Meader, Director of the UKRI Future Leaders Fellowships, United Kingdom, OECD-GSF Workshop on the research workforce of the future: promoting diverse career options for doctoral and postdoctoral researchers. Paris, 22-23 November 2022.

Policy initiatives – Information

Another important policy lever is the collection, analysis, and dissemination of data and information on the careers of doctorate holders. This is needed to inform policy as well as for supporting individual researchers and institutions in their choices with regards to training and career development (see box 4).

Box 4. Insights from data on doctoral and postdoctoral researchers at the University of Toronto

The University of Toronto has been collecting and analysing data on its doctoral and postdoctoral researchers and obtaining important insights. There is a career trajectory difference between researchers from the humanities and social sciences (HSS), and the physical sciences. In general, it takes longer for researchers from HSS to complete a degree, while physical sciences' researchers subsequently spend more time in postdoctoral work. Precarity in academia exists for around a third of postdocs, another third obtains tenure-track jobs. A quarter of postdocs go to the private sector, largely to biotech and information technology industries. The data shows there are major differences in the career trajectories among doctoral researchers and postdocs even within one institution, and one country. Publishing data on the career of doctorate holders helps doctoral researchers understand the potential outcomes of their programmes. It also helps a university understand where its graduates and postdocs work, so that the university can develop institutional partnerships with employers. The data also helps in the design of training programmes, which can support the career transition process and prevent sequential postdocs becoming the norm.

Based on the presentation of Joshua Barker, Dean, School of Graduate Studies at University of Toronto, Canada, OECD-GSF Workshop on the research workforce of the future: promoting diverse career options for doctoral and postdoctoral researchers. Paris, 22-23 November 2022.

The French Community of Belgium has set up the Observatory of Research and Scientific Careers, which has published several studies on the employment status of doctorate holders, the education-job match of doctorate holders, job transitions after the doctorate, and the views of employers of doctorate holders. The Flemish Community of Belgium has established a Centre for Research & Development Monitoring (ECOOM), an inter-university consortium with participation from all Flemish universities. The centre has developed a manual of R&D and Innovation indicators for government. This includes a Human Resources in Research module with information on the doctoral trajectory and tracking postdoctoral careers within and beyond academia.

The Swiss Federal Statistics Office biennial survey on the employment of higher education (HE) graduates one year and five years after their degree was revised in 2021 to provide greater detail on the career paths taken by doctorate holders, including their preparation for careers beyond academia. The Swiss Science Council has recommended greater focus on informing early career researchers on career options, while also making further improvements to the statistical tracking of postdoctoral careers.

France has a biennial national survey, L'Enquête IPDoc, to assess the professional integration of doctorate holders one, three and five years after graduation. It provides comprehensive data on career intentions on graduation, sectors of employment, employment rates, rate of return of foreign doctorate holders and international mobility. The national network of doctoral schools (RCND) also conducts a survey of employers regarding their perspectives on the doctorate and the employment of doctorate holders.

Japan conducts regular surveys on postdoctoral employment and careers, tracking of the career path of doctorate holders, and research and development activities in the private sector, including recruitment of doctorate holders by firms.

In Korea, the Science and Technology Policy Institute (STEPI) conducts the Korean Survey of Careers and Mobility of Doctorate Holders, and the Korea Research Institute for Vocational Education and Training (KRIVET) is routinely conducting the New PhD Survey. Nevertheless, it is felt that the evidence base on the career paths of doctorate holders still needs to be more comprehensive and efforts are continuing to develop this further.

In Norway, a national recruitment and career monitor for researchers has been developed and is publicly available, hosted by Statistics Norway since 2022. It enables users to follow research career paths based on solid registry data. In the future, the further development of relevant indicators should provide an opportunity to assess the impact of specific challenges, or policy interventions, related to the careers of researchers.

Portugal has conducted a survey on the career of doctorate holders since the prototype was first developed by the OECD and Eurostat in 2006. It has recently launched the Observatory for the Employment of Academic Researchers and Teachers to monitor the implementation of a new Scientific Employment Stimulus programme for doctorate holders in HE.

South Africa recently published its first national PhD tracer study (Mouton et al., 2021[43]). This tracks the mobility and career paths of doctorate holders, their perceptions and of those of their employers about career opportunities and factors influencing career choices.

Policy initiatives – Organisational

 Policy initiatives in several countries go beyond regulation, funding, and information provision, and attempt to harness the power of organisations and relevant stakeholders to come together to co-ordinate change.

In Switzerland, a differentiated academic career system is emerging in some institutions, with support for "third space" careers focused on professional support for research and teaching activities. These are complemented by institutional efforts to better structure the postdoctoral phase and introduce permanent senior researcher posts. Institutional initiatives are being made to increase the visibility and social value of careers beyond academia, including career fairs and related informational events for doctoral and postdoctoral researchers.

In France, several organisations promote the employment of doctorate holders. Doctoral schools have been set up to support the career development of doctoral researchers and follow up on their career. An agency whose remit is the employment of professional executives, APEC – *Agence pour l'emploi des cadres,* now has a team – France PhD – in charge of the employment of doctorate holders. The National Network of Doctoral Schools (RNCD) promotes the recognition and valorisation of the doctorate. The Association Bernard Gregory (ABG), founded in 1980, promotes the value of the doctorate as well as the professional development of doctorate holders in companies. The PhD Talent platform connects companies with PhD holders and organises an annual PhD Career fair.

Korea's KIURI programme, mentioned previously, includes an industry-university co-operation platform. Korea, like several other countries, also has a regional innovation programme based on a platform for co-operation among universities, local government, and local businesses. Whilst this is not exclusively focused on promoting different career options, it facilitates the partnerships and exchange between sectors that can make individual career transitions easier.

In Norway, the *Research School for Quality and Relevance* aims to support projects to increase the relevance of doctoral education to the labour market, by improving collaboration between academia and partners in industry, the public sector, and other organisations involved in research training.

In Portugal, Collaborative Laboratories (CoLabs) have been set up since 2019 as private entities, enterprises, or non-profit organisations, to conduct R&D activities based on collaborative arrangements between research and higher education institutions and other economic, social, and cultural partners. They aim to create qualified employment, directly and indirectly, in research. As a complement, Technology and Innovation Centres have been recently set up as well, to promote entrepreneurial skills, train staff and managers in the field of technology and business management, and generally act as intermediaries between science, technology, and innovation.

South Africa has seen the emergence of new models of doctoral education, such as professional doctorates and cohort supervision, to transform the doctoral education environment. These have emerged mainly as bottom-up initiatives from institutions to respond to the needs of industry and business. Since 2013, the national Higher Education Qualifications Sub-Framework has included two variants of the doctoral degree: general and professional, in recognition that the labour market for doctoral graduates has expanded beyond an academic career. It maintains that both types of doctorates must demonstrate the same level of research-related intellectual achievement. Nonetheless, the professional PhD is still relatively rare.

In the United States a new kind of model of doctoral education has emerged in several universities that blend academic ideas with industrial resources, through industry-based doctorates and postdoc positions, enabling researchers to get acquainted with prospective employers early on. Some universities are also introducing internships in their programmes that help students to establish ties to industry, gain new skills and remain motivated (Kreier, 2023[44]).

In the Netherlands, the national association of universities, together with the research funding councils has launched the *Recognition & Rewards* initiative (see Box 5), which promotes the diversification of career paths within academia. Other countries have similar initiatives. In Norway, the assessment of academics has been on the agenda for some time, and in 2021 Universities Norway issued the *Norwegian Career Assessment* Matrix (NOR-CAM) – a toolbox for recognition and rewards in academic careers and also a vehicle to implement the principles of the *Coalition for Advancing Research Assessment* (CoARA) and the *San Francisco Declaration on Research Assessment* (DORA), which is currently being adapted by the higher education institutions in Norway. Norway has a new national strategy for the recruitment and career development of young researchers which recognises the ongoing shifts in assessment.

Along the same lines, the United Kingdom also wants to support culture change in the sector and has recently published the *R&D People and Culture Strategy* that seeks to ensure that careers in research and innovation are open to people from diverse backgrounds and that researchers are working within environments that nurture and get the best out of them.   Linked with this is a new resumé for research and innovation, which is a flexible CV template that individuals can use to showcase a variety of skills and experience.

In Spain, following from the OECD report on *Improving knowledge transfer and collaboration between science and business in Spain* (OECD, 2021[29]), the Spanish Parliament recently approved, with multi-partisan endorsement, the creation of a knowledge transfer roadmap[2], involving all relevant stakeholders. This includes actions to promote the recruitment of doctorate holders by firms and project-based collaboration during doctorate programmes.

There have been a number of bottom-up initiatives for a new approach to PhD evaluation based on competences and self-defined impact, instead of traditional quantitative assessment metrics that are perceived as having failed to promote the wider professional development of doctoral researchers. The Young Science in Transition association, which represents early career academics in the Netherlands, is playing a leading role in promoting a worldwide agenda to move away from the dependence on bibliometrics to measure research performance. Such 'bottom up' initiatives, are leading to new PhD quality guidelines at some institutions.

Box 5. Recognition & Rewards Initiative in the Netherlands

Vision and ambition

In November 2019, the Universities of the Netherlands (UNL), the Netherlands Federation of University Medical Centres (NFU), the Royal Netherlands Academy of Arts and Sciences (KNAW), the Dutch Research Council (NWO) and the Netherlands Organisation for Health Research and Development (ZonMw) published the position paper 'Room for everyone's talent'[1]. In the paper, these institutions expressed their aim to more broadly recognise and reward the work of academic staff by devoting greater attention to the various key areas in which academics are active. A great many academics still perceive there to be an excessively one-sided emphasis on research achievements, often to the detriment of other areas including teaching, social impact, leadership, and patient care.

The position paper outlines five main goals:

1. Diversifying and revitalizing career paths: enable more diversity in career paths and profiles for academics.
2. Achieving balance between individuals and the collective: assess academics based on both their individual and their team performance.
3. Focusing on quality: in assessing of academic performance, focus on quality, content and creativity.
4. Stimulating open science: encourage academics to share their research outcomes with society.
5. Stimulating leadership in academia: stimulate good academic leadership at all levels.

With this position paper, the parties aim to realise a fundamental change in behaviour and leadership with regard to the recognition and rewards system for academia. This represents a major cultural shift that requires collective action.

Programme structure

The Dutch Recognition & Rewards programme was launched in 2020 in order to realise the goals set out in the position paper. The programme consists of two layers. On the one hand, each of the institutions involved appointed its own local change programme, co-ordinated by an organization-wide Recognition & Rewards committee. These committees have been working to promote the desired cultural change at institutional level, while academics have been able to provide input on recognition & rewards through dialogue sessions held at all institutions. Based on those dialogue sessions, each of the local committees has translated the ambitions set out in the position paper into a vision document that is appropriate for their specific organisation. These documents reveal a wide and inspiring range of approaches.

In addition, there is a national change programme, involving all of the above parties, co-ordinated by a broad steering group. Experimentation, inspiration, co-creation, sharing good practices and learning from each other are key elements of this joint programme. Because the programme supports the scientific policy priorities in the Netherlands, the Ministry of Education, Culture and Science (OCW) has made a subsidy available for the 2022-2026 period.

1. Available at: https://www.universiteitenvannederland.nl/recognitionandrewards/wp-content/uploads/2019/11/Position-paper-Room-for-everyone%E2%80%99s-talent.pdf.

Provided by Johan van de Worp, Programme Secretary Recognition & Rewards.

Other relevant practices, programmes, and initiatives

Open co-ordination between European member states and other voluntary jurisdictions, has produced soft law mechanisms, such as standards and guidelines, benchmarking and sharing of best practices, in the management of human resources in research. It has resulted, among other things, in the European

Charter for Researchers (2005) and the associated Human Resources Excellence in Research award, the Code of Conduct for the Recruitment of Researchers (2005), the Principles of Innovative Doctoral Training (2011), and the European Doctorate label. All of these are potentially important contributions to improve the management of researcher careers.

The European University Association (EUA), a representative association of universities in 48 countries, has also produced a number of important agreements in this area, such as the Salzburg Principles and Recommendations on doctoral programmes and research training (2005, 2010 and 2016). EUA has established a Council for Doctoral Education (EUA-CDE) to bring together academic leaders and professionals to develop doctoral education in Europe in accordance with the Salzburg Principles and Recommendations.

At the end of 2022, the EC, the EUA, and Science Europe launched the *Coalition for Advancing Research Assessment* (CoARA) that advocates for a balance between qualitative judgement or peer review and the responsible use of quantitative indicators. This can contribute to the diversification of career prospects for researchers by acknowledging diverse contributions to science and society, and valorising transferable skills related to collaboration, knowledge exchange and civic and social engagement.

Even if not underpinned by national policies, countries report that many universities and other academic institutions have been developing bottom-up initiatives (see, for example, Box 6), such as:
- Training in transferable skills
- Career development: information sessions, workshops, guidebooks
- Career counselling
- Mentoring
- Intersectoral mobility: internships, collaborative doctorates
- Support for knowledge transfer and entrepreneurship
- Collaboration in doctoral education with external partners

Some of these initiatives are inspiring national policy that aims to scale them up.

Box 6. PhD Career Hub at Ghent University

Ghent University has been developing initiatives on career guidance and career development for its doctoral and postdoctoral researchers through its PhD Career Hub (https://www.ugent.be/en/careerhub). At this institution, 85% of researchers are doctoral researchers or postdocs, all on fixed-term contracts, and nine out of ten doctorate holders eventually build careers beyond academia. The fundament of Career Hub is an online portal that combines all the information the university has on careers (career development, career guidance, workshops, job fairs, networking activities). The portal is structured in line with four crucial career steps: 1) explore yourself (self-assessment), 2) explore careers that are relevant for doctorate holders (academic careers, careers beyond academia, entrepreneurship), 3) focus on goals (information on training on transversal skills, leadership, LinkedIn, how to network, career development plan), and 4) take action (write the CV, prepare the job interview). It includes three modes of training: e-learning tracks, collective programmes and one-on-one support are provided sequentially in addition to the online portal and toolbox, in order that researchers can easily access more information and support.

Based on the presentation of Nel Grillaert, Co-ordinator PhD Career Hub, Ghent University, Belgium, OECD-GSF Workshop on the research workforce of the future: promoting diverse career options for doctoral and postdoctoral researchers. Paris, 22-23 November 2022.

Concluding remarks and a policy toolkit

The diversification of career options for doctoral holders is a common concern among OECD countries and is in large part prompted by the increased number of doctorates and increasing precarity of the academic research career. This report presents a number of policy recommendations to address the issue, and offers several policy options for each recommendation, inspired by what is being done already in different jurisdictions, at national level, but also by bottom-up initiatives at the local institutional level.

The precarity of academic research careers is a threat to the well-being of researchers, making doctoral education less attractive for some, harming the retention of talent, and impeding efforts to improve diversity in the research workforce. Ultimately it is affecting research choices and having a detrimental effect on the quality of science. These are strong drivers to change doctoral training and postdoctoral conditions to promote diverse research career options for doctorate holders and make a research career more attractive to a diverse and talented group of people.

This project collected and analysed data and information from countries on how they are promoting diverse research career options. Eight general policy recommendations emerge from this analysis (Table 6). For each recommendation, several policy options are proposed, and these will be more or less applicable in different contextual settings in different jurisdictions. These options are informed by initiatives already being implemented or developed in several countries (see annex C).

Table 6. Policy toolkit: Recommendations and Policy options

Recommendations	Policy Options
1. Promote the engagement and interaction of academic institutions and their funders with employers beyond academia	• Survey employers of doctorate holders on how to better prepare doctoral and postdoctoral researchers for career options beyond academia. • Organise events for doctoral and postdoctoral researchers with employers outside academia (e.g., recruitment fairs, company visits). • Review doctoral education and postdoctoral work frameworks to explicitly include engagement and interaction between institutions and employers outside academia. • Review the governance systems of universities and public research organisations to increase their engagement with society
2. Provide doctoral and postdoctoral researchers with experience and skills for diverse careers within and beyond academia	• Fund and organise collaborative doctorates between institutions and employers. • Offer skills training programmes at institutions for doctoral and postdoctoral researchers. • Develop mentoring programmes with mentors from within and beyond academia. • Involve doctoral and postdoctoral researchers and their supervisors in collaborative projects with organisations beyond academia. • Offer the possibility of a variety of placements within academia in other academic institutions and beyond academia.

Recommendations	Policy Options
3. Render more visible and encourage valorisation of diverse career options within and beyond academia	• Track the career of doctorate holders in all sectors using both quantitative and qualitative data. • Analyse and publish data on the career of doctorate holders at the systemic level. • Publish information on the career trajectories of doctorate holders in institutional websites.
4. Offer career development and guidance on career options for doctoral and postdoctoral researchers and their supervisors	• Offer personal career development plans and programmes to doctoral and postdoctoral researchers. • Support career offices to offer guidance to doctoral and postdoctoral researchers on their career options and employment opportunities. • Engage supervisors in the design and implementation of career development activities for doctoral and postdoctoral researchers
5. Promote inter-sectoral mobility with the business enterprise sector	• Fund doctoral and postdoctoral researchers in enterprises. • Fund placements of academic researchers in enterprises, and researchers from enterprises in academia. • Funders and institutions support and facilitate the transition of doctoral and postdoctoral researchers to start-ups, spin-offs, and the creation of own companies through, for example, science parks. • Use tax instruments to make more attractive the employment of doctorate holders as researchers by the business enterprise sector. • Institutions recognise professional experience outside academia in their recruitment and promotion processes. • Address the portability of pension rights between different sectors.
6. Promote inter-sectoral mobility with the government and the private not-for-profit sectors	• Fund doctoral and postdoctoral researchers in national, regional and local government, and in social sector organisations. • Fund placements for academic researchers in the public and social sectors, and for researchers from the public and social sectors in academia. • Institutions recognise professional experience outside academia in their recruitment and promotion processes. • Address the portability of pension rights between different sectors.
7. Reconfigure traditional academic career models and support diverse careers in academia	• Organise national forums with relevant stakeholders (i.e., funders, policy officials, representative associations of researchers such as trade unions, representative associations of academic research organisations such as university employers' associations) to discuss issues of concern regarding the working conditions, rewards and recognition, and career paths of academic researchers. • Relevant stakeholders agree on common principles regarding academic research careers via a concordat or national framework. • Institutions implement initiatives to support inclusion, diversity, and equity in academic research (e.g., open and transparent recruitment and promotion processes, bias awareness and cultural-inclusion training, targeted recruitment, mentor programmes for traditionally under-represented groups, cross-training between groups). • Promote changes to academic culture, evaluation systems, and incentives and rewards, so that different career paths within academia are valued and the experience of doctorate holders outside academia are valued within academia.

Recommendations	Policy Options
8. Support international mobility	• Funders support outgoing and incoming researchers to facilitate international mobility and a fluid global labour market for researchers. • Regulatory arrangements facilitate the integration of returning and foreign researchers, removing existing barriers. • Institutions support the integration of foreign researchers and ensure a level-playing field with national researchers. • Address the portability of pension rights across countries.

The diversification of research career options covered in this report is a general concern across OECD countries, but, as always, there are differences between countries, and across jurisdictions within countries, and even across research performing organisations. As such, despite some commonalities, the priority and appropriateness of each recommendation will be different from country to country, as well as the feasibility of the policy options offered to implement the recommendations. In addition, the actors responsible for implementation will also depend on the governance arrangements in each science system.

The fact that the report offers several recommendations is testimony that the diversification of research career options cannot be solved by a silver-bullet solution, but instead relies on concerted and systemic effort from a multitude of stakeholders, operating in diverse science systems, addressing a multi-variable problem. Preparing the research workforce of the future requires consistent effort and a united vision across different stakeholders. Foresight exercises are one way to develop such a vision and explore how it can be achieved (see Box 7). Involving multiple stakeholders in such exercises can be a first step in promoting collective action.

The ongoing policy and institutional initiatives in Annex C represent a good starting point for the future. They illustrate the diversity of what is already being done to promote the diversification of research careers and the flexibility of career trajectories. Ultimately this should contribute to increased satisfaction, diversity, and productivity in the research workforce across all sectors of society.

Box 7. A 2035 Visioning Exercise – Research Careers in Times of Disruption

Foresight can help to develop a shared mobilising vision for the future and set targets for communities, organisations, and different individual stakeholders. By better anticipating possible futures, it makes participants better prepared. Towards the end of this project a rapid foresight exercise was conducted with the OECD-GSF Expert Group (EG) that had been overseeing the work, to reflect on research careers a decade from now. The focus was on the wider system and how the pieces in the system link together and may evolve in the future.

In a first step the EG was asked to consider an 'ideal' future vision for research and the related implications for research careers. Members were then invited to identify the principal obstacles to achieving that vision and the steps that would need to be taken to overcome those obstacles. In a final step, this vision and pathway were challenged by the introduction of several 'major disruptors', which tested the resilience of the envisioned future.

The main outcomes of this exercise are reported here. They should in no way be interpreted as predictive or prescriptive, but they did help to reinforce and expand on the prior information and data analysis that provide the main basis for the recommendations in this report. The overall conclusion was that many issues relating to research culture, research environments and careers need to change.

1)   Elements of a future vision for research careers

The nature of the workforce. The workforce is **representative**, which means gender equality at different levels of the career, as well as being more demographically representative of the wider population. The

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academic workforce is **connected** to business, government, and wider society, and motivated, with good work-life balance and energy to engage.

Conditions. Working conditions are **fair** and offer some **stability**. Researchers have the flexibility to pursue a variety of career paths and **mobility** between sectors and countries is encouraged, by conducive **attitudes** and an academic **culture** that is open towards other sectors of activity. The incentives to develop relationships with business and other sectors are there from the doctoral and postdoctoral career stages but, at the same time **academic freedom** is strongly maintained. Increasingly researchers are prepared to work in **transdisciplinary teams**, which is supported by **diverse training** portfolios - formal and experiential.

Skills. Researchers possess strong **digital skills**. They are more **problem-oriented**, as a result of being more connected and having **responsible engagement** with different communities. Some young researchers can readily envisage operating in an **entrepreneurial** space, developing new opportunities for themselves and others.

2)   Obstacles to achieving the vision

Structural and institutional issues:

- Rigid academic system and unwillingness to change, e.g., traditional apprenticeship model with single supervisor, who has always worked in academia
- Silos: doctorate and research competence need to be valued outside academia
- Gender bias; equity, diversity and inclusion (EDI) issues; and cultural barriers
- Power relations and lack of voice for doctoral and postdoctoral researchers
- Lack of data and information on career possibilities
- Policy measures lack teeth, re. autonomy of universities

Culture, skills, expectations and incentives:

- Narrow training, e.g., lack of entrepreneurial skills
- Doctoral education not related to demographic change, social needs, or business requirements
- Focus in career development and evaluation on prior attainment rather than potential
- Wrong incentives and measures focusing on individual performance and publications only
- Doctoral education and research careers are unattractive

Funding challenges:

- Not necessarily the main challenge
- Short-term funding model and hyper-competition
- Lack of investment in R&D

3)   Critical steps to achieve vision

Structural and institutional change:

- Joined-up policymaking, re labour market needs and training
- Innovation in processes and the organisation of HEIs
- Meaningful social dialogue with all partners on all aspects of research careers
- Open-up and incentivise alternative career paths within academia

- Improved data and policy intelligence on research career paths

Culture, skills, expectations and incentives:

- Promote scientific and innovation culture across sectors

- Mainstream the EDI agenda in funding bodies and HEIs

- Break down disciplinary silos and promote transdisciplinary research and activities

- Monitor and review doctoral programmes and mainstream training for mentors and coaches

- Bias awareness training

- Reform research assessment and evaluation

- Experiment with novel researcher training and supervision models, e.g., a cohort model

- Prioritise critical analytical thinking at all levels of education

Funding:

- Government commitment to long-term research funding including targeted funding for under-represented groups and high-risk research

- More cross-sectoral collaboration, e.g., internships, fellowships, collaborative platforms

- Mobilisation of public and private means to create a fair and sustainable labour market for scientists

Many of these challenges are long-standing and result from structural issues related to incentive structures and enduring cultural factors.

Many sources of change and disruption, i.e., megatrends, can be identified related to factors such as the Economy (e.g., risk of decreased funding for science), Democracy (e.g., threats from populism and autocracy, democratic renewal), Public trust in science (e.g., biosecurity scares, misinformation and disinformation), Technological change (e.g., automation, AI), Geopolitics (e.g., bifurcation of the world into two rival blocks), Environment (e.g., climate change, biodiversity loss), Demography (e.g., longevity, population growth in Africa, declines in China and Europe), Societal norms (e.g., work-life balance expectations, teleworking), that can affect research careers, directly and indirectly.

Propositions or hypotheses as to how these factors may impact the workforce, their working conditions, and the skills they will need were discussed, as well as their upsides and downsides, and what measures could be taken to mitigate the negative consequences, seize the opportunities presented, and becoming somewhat prepared for the uncertainties.

The rich discussion showed some of the possibilities in thinking in a structured way about the future of research careers. A main take away was that it is important to prepare for the future and anticipate some likely scenarios and begin to address some of the structural issues now, by exposing them to the big trends and drivers that are likely to have an impact in the future on research systems and careers.

In foresight exercises the important things tend to rise to prominence. An important conclusion for promoting diverse career options for researchers is the need to look not just as the system as it is and focus on immediate incremental changes, but to consider what might need to happen at the systemic level and may require more radical change. The issue of **transdisciplinarity** came up repeatedly, as did the need to overcome the **isolation of academic institutions**. Despite the good examples that exist and had been identified in the analysis for this project, there was a strong sense that action needed to be scaled up. There is a need to infiltrate foresight into thinking about research careers.

Based on a Research Careers in Times of Disruption: A 2035 Visioning Exercise at the OECD GSF International Workshop on the Research Workforce of the Future - Special Session for Expert Group Members moderated by Michael Keenan and Carthage Smith on 23 November 2022.

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Annex A. Scoping Group and Expert Group Membership

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BEL	Neda Bebiroglu	Fonds de la Recherche Scientifique
CAN	Michael A. O'Neill	Canada Foundation for Innovation
CHE	**Verity Elston (chair)**	Careers Advice for Doctoral and Postdoctoral Researchers at the Graduate Campus of the University of Lausanne
CHL	Juan Asenjo	Chilean Academy of Sciences; CeBiB, Centre for Biotechnology and Bioengineering
DEU	Ina Fuhrmann	Federal Ministry of Education and Research
DEU	Jan-Christoph Rogge	Federal Ministry of Education and Research (replaced by Ina Fuhrmann)
DEU	Stefan Ossege	Federal Ministry of Education and Research (briefly replaced Jan-Christoph Rogge)
ESP	Luis Sanz Menéndez	Ministry of Science and Innovation and CSIC Institute of Public Goods and Policies
FRA	Sylvie Pommier	University of Paris-Saclay, Réseau National des Collèges Doctoraux (RNCD)
FRA	Marie-Helene Prieur	Ministry of Higher Education and Research
GBR	Ewan Nicholas	UKRI
GBR	Anthony Whitney	Head of Public Engagement with Research, BEIS
GBR	Kirsty Grainger	Talent and Skills Strategy, UKRI (replaced by James Donald)
GBR	James Donald	UKRI (replaced by Ewan Nicholas)
JPN	Toshiyuki (Max) Misu	Hiroshima University, Global Career Design Center
JPN	Takako Oka	Ministry of Education, Culture, Sports, Science and Technology (MEXT)
JPN	Yoshihide Miwa	Ministry of Education, Culture, Sports, Science and Technology (MEXT) (replaced by Takako Oka)
KOR	Kawon Cho	Science and Technology Policy Institute (STEPI), Korea
NLD	Kim Huijpen	Universities of the Netherlands (VSNU)
NLD	Ruth Van Veelen	Universiteit Utrecht
NOR	Johannes Waage Løvhaug	Department for Research and Innovation System at The Research Council of Norway (RCN)
POL	Przemyslaw Wewior	Ministry of Education and Science (left group due to new functions)
PRT	Daniel Ferreira	Foundation for Science and Technology
ZAF	Pradeep Kumar	Wits University
ZAF	Heidi Prozesky	Stellenbosch University
TUAC*	Rob Copeland	ETUCE Higher Education and Research Standing Committee
TUAC*	Louise Hoj Larsen	Education International (replaced by Rob Copeland)
OECD	Carthage Smith	Senior Policy Analyst, Lead Co-ordinator, OECD Global Science Forum (GSF)
OECD	Frédéric Sgard	Administrator, GSF
OECD	Masatoshi Shimosuka	Policy Analyst, GSF
OECD	Chrystyna Harpluk	Project Co-ordinator, GSF
OECD	Cláudia Sarrico	Consultant, GSF

* Trade Union Advisory Committee to the OECD

Annex B. Template for country note

National context

- Brief description of the national context with a bearing on research careers
  - o Budgetary pressures
  - o Research funding models
  - o Labour market for researchers
  - o Relevant national and administrative or survey data on research careers (e.g. evolution of number of doctorates awarded annually, number of postdoctoral researchers and/or doctorate holders in research positions with fixed-term contracts outside tenure-track (or equivalent), those on tenure-track, those with tenure, or equivalent indefinite contracts)
  - o Differences between the higher education, government, business enterprise and private non-profit sectors, where relevant (e.g. number of researchers employed in each sector, working conditions, attitudes to employing researchers)
- Synthesis of strategic reports or reviews of initiatives to promote diverse career options for doctoral and postdoctoral researchers in higher education, government, business enterprise, and private non-profit sectors.
- Doctoral education framework (e.g. national policies, formal requirements, doctoral schools, average time-to-degree, coursework, internships, funded and self-funded places, etc.)
- Brief description of any relevant policy initiatives to deal with the effects of the Covid-19 pandemic on research careers.

National policy concerns

- Brief description of main policy concerns regarding careers for doctoral and postdoctoral researchers. When relevant, distinguish between the higher education, business enterprise, government and private non-profit sectors.

Available national and international evidence

- Brief synthesis of any scholarly or policy analysis studies on the careers of doctoral and postdoctoral researchers in your country or transnational in nature
- Evidence of differences in career paths between population groups (e.g. socio-economic status, gender, ethnicity, indigeneity, citizenship), type of research (i.e. basic vs. applied research), or discipline.
- Evidence of the views of the employers of doctorate holders (e.g. perception of employability, perception of value added of doctoral education and postdoctoral work, recognition of doctoral and postdoctoral experience, etc.)

Information on policy initiatives

Provide information on policies that are being implemented to diversify the careers of doctoral and postdoctoral researchers (working within and beyond academia), and promote workforce diversity and inclusion:

- Purpose of the policies

- Content of the policies
- Policy levers used (e.g. regulatory, funding, informational, and organisational policy levers to involve relevant stakeholders)
- Inclusion of measurable targets
- Observed effects of the policy
    - Describe observed, and if available, measured impact of the policies on the diversification of career options for doctoral and postdoctoral researchers and workforce diversity and inclusion.
    - Describe factors that have enabled (incentives) or hindered (barriers) the effectiveness of the policies (e.g. funding mechanisms, research assessment criteria, recognition and reward systems, incentives of supervisors, timing, academic and research culture, etc.)

Information on existing practices, programmes and initiatives[3]

Provide information on good practices, programmes, and initiatives to diversify the career options of doctoral and postdoctoral researchers (e.g. career orientation and diversification of career paths, involvement and partnerships with diverse employers, training in transferable skills, exchange of researchers between academia and other sectors, intra- and inter-sectoral mobility, international mobility):

- By funders, universities, public research organisations, other employers of researchers, representative associations of researchers.
- Indicate any barriers or enablers to participate in any of these practices, programmes, and initiatives by different population groups (e.g. socio-economic status, gender, ethnicity, indigeneity, citizenship), type of research (i.e. basic vs. applied research), or discipline.
- Evaluation processes and criteria used in the recruitment and progression of doctoral and postdoctoral researchers with a bearing on their career options.

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[3] Please re-use the information provided for the previous GSF project on the precarity of academic research careers or for the STIP Compass, where relevant.

Annex C. Illustrative initiatives to promote diverse career options for doctoral and postdoctoral researchers[4]

1. Engagement and interaction of institutions and funders with employers beyond academia
[BEL-WAL] "Recruiting Talents" survey of employers of doctorate holders
[BEL-VLG] FWO researchers may spend up to 20% of their time on development activities other than doctoral or postdoctoral research
[BEL-VLG] Framework for young researchers "OJO": contribution for the supervision and guidance of young researchers
[BEL-VLG] "OJO": beneficiary organisations shall organize a single career event for doctoral and postgraduate researchers with a particular focus on a non-academic career, with the participation of the industrial sector and, where relevant, with other universities, colleges, research centres and the public sector
[BEL-VLG] "OJO" involving future employers in policy development on the training and guidance of young researchers so that supply meets the needs of the labour market.
[BEL-VLG] "Survey of Employers" survey of employers on doctorate holders.
[BEL-VLG]: PhD Talent pool: Flemish recruitment platform designed to better and faster align the supply and demand for PhD talent.
[BEL-VLG]: interuniversity job market for young researchers: job market that brings together young researchers and companies interested in hiring PhD holders.
[BEL-VLG]: Stakeholder Engagement Panel – VLIR. The panel aims to facilitate at least twice a year a thematic Exchange between the broad Belgian labour market and universities.
[CHE] Swissuniversities: provides framework for collaborative doctorates, several institutional collaborative doctorates
[CHE] Institutional limits on duration of doctoral and postdoctoral contracts to promote transition to other employment
[FRA] Association Bernard Gregory (ABG): association subsidized by the ministry to support doctoral students in their professional project before and during the doctorate. It organizes seminars, meetings, trainings, and works to promote the doctorate in companies.
[FRA] PhD Talent: service company that puts in contact companies and PhDs for accessing expertise or recruitments. It organizes the PhD Career fair annual event with seminars and stands where companies come to meet PhD holders.
[GBR] Industrial Co-operative Awards in Science & Technology (iCASE) provide funding for doctoral studentships where businesses and related organisations take the lead in arranging projects with an academic partner of their choice. More info.
[GBR] Competitively awarded Centres for Doctoral Training and Doctoral Training Partnerships may encourage commercial partners to co-fund studentships.
[JPN] Survey by NISTEP on Research and Development Activities of Firms in the Private Sector.
[NOR] Research Council of Norway policy for recruitment to research and early careers: further development of Industrial PhD, Public Sector PhD, national PhD schools, doctoral school with focus on building competences for career outside of academia, use of fourth year of PhD education for practicum in industry or public sector.
2. Experience and skills for diverse careers within and beyond academia
[AUS] The Increase Workforce Mobility Initiative of the University Research Commercialisation Action Plan: approximately 1,800 Industry PhD and 800 Fellowship places to be funded over 10 years to support Australia's highest quality researchers to lead ground-breaking

industry-linked projects

[BEL-WAL] "Win4Doc" aims to support any industrial research project conducted with a view to completing a doctoral thesis within a company whose headquarters is located in Wallonia

[BEL] Innoviris "Applied PhD": the doctoral researcher spends at least 50% of their time at the partner company or public authority.

[BEL-VLG] Baekeland Programme: targets researchers wishing to carry out a doctoral project in close co-operation with Flemish companies.

[BEL-VLG]: Industrial research funds: allocated to university associations (university and higher education colleges) to support strategic basic research and applied research with an economic or societal aim (including stimulating spin-offs).

[CAN] The Early Career Researcher Action Plan: includes support opportunities for doctoral and post-doctoral researchers to acquire experience and training opportunities, including outside of academia

[CHE] Several institutional transversal skills programmes

[ESP] Industrial doctorate (*Doctorados Industriales*): Grants for contracts for the training of doctoral researchers in companies

[FRA] CIFRE (industrial conventions for training through research) makes it possible to prepare a doctoral thesis in a company

[FRA] COFRA (convention for training through research in administration) experimental programme to facilitate the realization of doctorate in administrations or public services

[GBR] United Kingdom Research and Innovation's (UKRI's) Policy Internships scheme provides an opportunity for UKRI-funded doctoral students to undertake a three-month placement at one of a selected group of influential policy organisations, including government departments and the United Kingdom Parliamentary Office of Science and Technology (POST).

[JPN] Building of Consortia for the Development of Human Resources in Science and Technology (multiple universities in co-operation with companies)

[JPN] Program to Establish University Fellowships and Program of Support for Pioneering Research Initiated by the Next Generation (SPRING): encourage excellent students to enrol in doctoral education and secure their career paths after completion

[KOR] Korea Initiative to foster a Universities of Research and Innovation (KIURI) that promote entrepreneurship and have strong ties with industry.

[KOR] Brain Korea 21 (BK 21) long-standing funding scheme to improve the educational environment and R&D capabilities of graduate schools to improve industrial and societal problem solving.

[PRT] Target of at least 50% of new doctorates by 2030 to be carried out in co-work environments with public and private institutions

[PRT] Collaborative Laboratories

[PRT] Technology and Innovation Centres

[NOR] Research Council of Norway funds Industrial PhDs and Public Sector PhDs

[NOR] Normal length of PhD contract is 3 years, but 4-year contracts exist for candidates to dedicate 25% of their time to other activities

[ZAF] Policy statements on what should be done:

- Industrial doctorates
- NRF's Industry Partnership Strategy: collaborative training opportunities with industry targeted at outstanding PhD students, postdoctoral fellows, and ECRs
- "Widen their horizons": provide experiences outside their own university
- Expectations of supervisors: supervisors should recognise postgraduate studies as wider training opportunities and encourage and support students in developing their careers. Supervisors are expected to have personal development review meetings with students at regular intervals. Supervisors must ensure that the student undertakes at least 80 hours of academic service work per annum in the form of structured, university-determined academic support activities. These may include tutoring/ mentoring of other students; volunteering for orientation of new students and on career days; or science engagement activities.

3. Visibility and valorisation of diverse career options within and beyond academia

[BEL-WAL] Creation and long-term funding of the Observatory of Research and Scientific Careers - F.R.S.-FNRS. The results of surveys and analyses are systematically published on the dedicated website.

[BEL-WAL] "Future of PhD Holders" survey monitors doctoral training experience, transition to employment, current career, job satisfaction, and mobility.

[BEL-VLG] "Human Resources in Research Flanders" administrative database. ECOOM conducts "Survey of Junior Researchers", "Survey of Senior Researchers", "PhD career track survey" to follow the academic and non-academic career trajectory of doctoral and postdoctoral

researchers

[BEL-VLG] "OJO": the website of each beneficiary institution includes information on statutes, employment conditions and career paths

[BEL-VLG]: PhD Careers Flanders: website on the careers of doctorate holders.

[CHI] Survey of professionals with a doctorate degree in Chile 2019

[DEU] National Report on Junior Scholars, 2021, 2025

[FRA] Department of Statistics, Ministry of higher education, innovation and research (SIES-MESRI) publishes regular assessments , including an overall national analysis; a recent enquiry into doctoral schools and a report on the state of scientific employment

[FRA] PhD qualification is registered in the RNCP (national directory of professional skills), a reference system for employers

[FRA] University presidents must present each year to the board of directors a report on the evolution of the professional situation of the people to whom the university has awarded the doctorate in the previous 5 years.

[FRA] Biannual national survey "IPDoc" on the professional situation of PhDs graduating in France

[FRA] A more comprehensive and global role for the national evaluation body HCERES in doctoral education

[FRA] France PhD RNCD *Réseau national des collèges doctoraux*: promote the recognition and valorisation of the PhD degree.

[GBR] Survey of the Research and Innovation Workforce 2022, which highlights various current and future skills needed in R&I jobs

[GBR] The United Kingdom's Higher Education Statistics Agency (HESA) runs the Graduate Outcomes Survey, recording next steps of students 15 months after graduation, with the first outcomes data released in February 2022.

[GBR] The United Kingdom in 2015 created the Longitudinal Educational Outcomes (LEO) dataset which links higher education and tax data together to chart the transition of graduates from higher education into the workplace without imposing any additional data collection burdens on universities, employers or members of the public.

[GBR] UKRI's *101 Jobs that change the world* communications campaign promotes stories about the people who work, often behind the scenes, in fulfilling and interesting roles beyond the traditional image of a researcher or innovator.

[JPN] Regular reports on "Japan Doctoral Human Resource Profiling" and "The 2018 Survey on Postdoctoral Fellows Regarding Employment and Careers in Japan" by NISTEP and MEXT

[JPN] NISTEP "Attitude Survey on the Career Choices of Students in Master's Courses of Science and Engineering in Japan": reasons for master's to choose non-academic careers instead of pursuing doctoral studies

[KOR] MSIT/STEPI Korean Survey of Careers and Mobility of Doctorate Holders

[KOR] KRIVET New PhD Survey

[PRT] Observatory for scientific and teaching employment

4. Career development and guidance on career options for researchers

[BEL] Almost all universities now offer transferable skills training, career counselling, and organize specific career development events for doctoral and postdoctoral researchers.

[BEL-VLG] "OJO": beneficiary institutions offer high-quality career guidance, e.g., mentoring and career interviews

[DEU] Individual universities are starting to implement initiatives to prepare young academics for different career paths inside and outside of academia, e.g. see https://www.tum.de/en/lifelong-learning/all-employees/career-design-at-tum .

[FRA] Doctoral schools were introduced in legislation in 2006 to ensure the career development and follow up of the professional future of PhD holders

[FRA] Agence pour l'emploi des cadres (APEC) is a national agency with a public service mission and now has a team in charge of PhDs

[GBR] The Vitae Researcher Development Framework describes the knowledge, behaviour and attributes of successful researchers and provides a structure for continuing professional development and personal development planning for PhDs, research staff and academics at all career stages. More info.

[GBR] The Economic and Social Research Council (ESRC) requires universities applying for its funding to set out how they will conduct Development Needs Analysis for their students, providing a student-centred process that promotes engagement with, and reflection on, a range of research and professional development opportunities and enables the student to be aware of their own skill sets.

[GBR] the United Kingdom Council for Graduate Education (UKCGE) provides resources to support high-quality supervision, including Supporting candidates' personal, professional and career development.

[GBR] PROSPER is a new approach to career development that aims to unlock post-doctoral researchers' potential to thrive in multiple career pathways. It is evidence-led, having piloted a range of development interventions, methods and approaches, in 2021-23, working with

over 120 postdocs across two pilot cohorts, drawn from across the Universities of Liverpool, Manchester and Lancaster.

[JPN] The Ministry for Research (MEXT) has formulated guidelines for universities and research institutes regarding employment and development of postdoctoral researchers

[KOR] Brain Korea 21 (BK21)a long-standing funding scheme for the first stages of a research career has recently added promoting career diversity to its goals.

[NOR] Research Council of Norway policy for recruitment to research and early careers: mandatory plans for career and development for doctoral and postdoctoral researchers funded by the RCN

[ZAF] Professional development programmes to support doctoral students at entry-level employment

[ZAF] Career advice both prior to and during postgraduate study

5. Inter-sectoral mobility with the business enterprise sector

[BEL] Various training courses offered to valorise the research activities of doctoral and postdoctoral researchers and support their entrepreneurship.

[BEL-WAL] Following the European Charter for Researchers, an official circular has encouraged researcher employers to recognize and value all types of mobility and research experience.

[BEL-WAL] the LiEU Network gathers French-speaking universities' Knowledge Transfer Offices to foster innovation, and collaborations between researchers and companies.

[[BEL-VLG] PhD and postdoctoral fellows of the Research Foundation Flanders (FWO) can perform internships in industry during their fellowship, during which they receive their usual salary.

[CAN] MITACS funded by the federal, provincial, and territorial governments delivers programmes and internships for post-graduate and post-doctoral students focusing on training and development, in Canada and internationally in the public and private sectors.

[CHE] National, regional and institutional initiatives to support innovation and entrepreneurship

[CHI] Conicyt PIA - Programa de Investigación Asociativa includes facilitating the transition of doctorate holders to industry

[ESP] Programa Torres Quevedo: grants for the incorporation of doctorate holders in companies (follow up to Acción IDE - Incorporación de Doctores a Empresas)

[ESP] Talent Attraction and Retention Plan, and Knowledge Transfer and Collaboration Plan, resulting from an OECD "road map" for knowledge transfer. The 2 plans aim to diversify research careers, including increasing the numbers of doctorate holders in the business sector and facilitating inter-sectoral mobility. This has been enhanced by the reforms of the Science, Technology and Innovation Act in 2022

[FRA] CIR: research tax credit for companies that do research to encourage the recruitment of PhDs

[GBR] Knowledge Transfer Partnerships (KTPs) connect businesses that have an innovation idea with the expertise to help deliver it. Each KTP is project managed by a KTP Associate – a talented graduate or postgraduate.

[JPN] Young researchers training program for promoting innovation (industry and public administration)

[KOR] Regional innovation program based on co-operation with local governments and universities

[NOR] Creation of mobility grants (salary funds) for doctoral fellows and postdoctoral fellows for internships of up to six months in firms.

[NOR] Creation of scholarships for entrepreneurship for PhD and postdocs with the aim of further developing research into a business idea.

[PRT] Fiscal incentives for the employment of doctorates by the business sector

[ZAF] Joint appointments and public-private partnerships

[ZAF] Tax breaks for industries investing in funding PhDs.

[ZAF] Technology and Human Resources for Industry Programme (THRIP): bursaries for PhD students and remuneration for postdoctoral fellows for applied R&D projects in science, engineering and technology.

[ZAF] Stellenbosch Technopark: a meeting place for academia and high-tech firms to work together and share or exchange personnel.

[ZAF] Gauteng Accelerator Program (mostly for start-ups): For innovators, researchers and entrepreneurs that are working on novel technologies that will improve the efficiency of government service delivery, increase the competitiveness of the local economy and enhance the quality of life of ordinary citizens.

6. Inter-sectoral mobility with the government and the private not-for-profit sectors

[BEL-BRU] Innoviris "Applied PhD": the doctoral researcher spends at least 50% of their time at the partner company or public authority.

[BEL-VLG] PhD and postdoctoral fellows of the Research Foundation Flanders (FWO) can perform internships in the government or not-for-profit sector during their fellowship, during which they receive their usual salary.

[CAN] MITACS funded by the federal, provincial, and territorial governments delivers programmes for post-graduate and post-doctoral researchers focusing on training, development, and internships in Canada and internationally in the public and private sectors

[FRA] Competitions for positions in the public service have been adapted to facilitate the recruitment of doctoral graduates

[GBR] The United Kingdom government's Civil Service Fast Stream has developed schemes to attract key skills, including for Science, Technology, Engineering and Mathematics (STEM) and the United Kingdom Government Economics Service.

[JPN] Young researchers training program for promoting innovation (industry and public administration)

[KOR] Customized postdoc support program for government-funded research institutes

[KOR] Regional innovation program based on co-operation with local governments and universities

[NOR] Creation of mobility grants (salary funds) for doctoral fellows and postdoctoral fellows for internships in the public sector and voluntary sector of up to six months.

[ZAF] Internships at science councils

7. Reconfiguration and support for diverse careers in academia

[BEL] EOS programme: promotes joint research between researchers in the Flemish and French communities

[BEL-WAL-BRU] Wallonia-Brussels Partnership for Researchers

[BEL-WAL] F.R.S.-FNRS: non-discrimination policy, gender equality plan, transparent recruitment, selection, and evaluation procedure

[BEL-VLG] "Amending various provisions of the Decree of the Flemish Government of 28 June 2013 on the framework of young researchers"

[BEL-VLG] "OJO": each beneficiary institution encourages open recruitment of doctoral and postdoctoral researchers in its own institution: vacancies shall, where possible, be published centrally

[BEL-VLG] "OJO": each beneficiary institution organizes gender and diversity training for promoters, doctoral and postdoctoral researchers.

[BEL-VLG] FWO: Equal opportunity policy, gender equality plan, Open, Transparent and Merit-based Recruitment of Researchers

[BEL-VLG] all Flemish universities follow the Open, Transparent and Merit-based Recruitment (OTM-R)principles and support the CoARA coalition for revised research assessment.

[CAN] federal earmarked money specifically to support researchers from minority or under-represented communities, notably black students and researchers

[CHE] institutional initiatives to increase number of tenure-track positions, third-space positions, improvements in postdoctoral career structure

[CHE] Several regional and institutions programmes supporting women in research careers

[DEU] Programme for Women Professors of the Federal Government and the Länder.

[DEU] Academic Fixed-Term Contract Act includes measures to counter the use of improper short-term contracts

[DEU] Tenure Track Programme: support tenure-track professorships nationwide

[[ESP] Ramón y Cajal Programme: support for national and international postdoctoral researchers for long-term contracts

[ESP] Component 17 of the National Plan for Recovery, Transformation and Resilience: Institutional reform and capacity building of the national science, technology and innovation system: includes measures for "achieving attractive and stable scientific careers" and "reinforcing the transfer of results from research activity to society"

[ESP] Law 17/2022, de 5 de September de 2022 limited the use of temporary contracts and widened the use of open-ended contracts

[FRA] "Sauvadet Law" allows the transformation of a fixed-term contract into a permanent contract for researchers having completed at least 6 years in the same public research organization

[FRA] Increase in the number of public doctoral contracts and increase in their minimum remuneration: with the objective in the long term that all doctoral students in initial training have dedicated funding to complete their thesis

[FRA] Creation of a private doctoral contract to complement the existing public doctoral contract for a maximum of 5 years

[FRA] Creation of a post-doctoral contract in public and private law, to facilitate the professional transition of doctoral graduates to permanent positions in public or private research, by allowing them to acquire additional experience under good conditions

[FRA] Creation of junior chairs for professors or research directors: "tenure-track", eligible for tenure after a maximum of 6 years

[FRA] Creation of special contracts based on the duration of research projects ("Contrats de projet ou de mission scientifique") to reduce precarity

[FRA] Upgrading salaries in public research: to bring them in line with those of comparable civil service bodies

[FRA] Support for employment in public laboratories: more engineers, technicians and administrative staff will be recruited than will retire

[GBR] Résumé for Researchers supports the evaluation of individuals' varied contributions to research. Originally created by the Royal Society, the United Kingdom government's principal research funder UKRI is rolling out Résumé for Research and Innovation (R4RI), a flexible narrative CV template designed to help research teams evidence a wider range of skills and experience than a traditional academic CV when applying for UKRI funding opportunities.

[GBR] TALENT is a project to advance status and opportunity for technical skills, roles and careers in United Kingdom higher education and research, including advocating and developing opportunities for technicians in the HE sector, ensuring technical careers are supported, developed, respected and aspired to. Increasingly the United Kingdom recognises that many technical roles require doctoral-level training.

[JPN] Program to Disseminate a Tenure Tracking System

[JPN] Strategic Development Program for Young Researchers to enhance their research productivity

[JPN] Promotion of longer-term contracts for young researchers, including postdoctoral researchers

[JPN] Initiative for Realizing Diversity in the Research Environment: support for women researchers

[KOR] Policy initiative for fostering female scientists and engineers

[NLD] 'Room for Everyone's Talent' initiative to promote differentiated academic career paths

[NLD] Dutch PhD Competence Model tool: new evaluation approach based on competences and self-defined impact

[NLD] Young Science in Transition (YoungSiT) represents a think-tank of early career academics in leading Dutch universities to advance fair and open research practice.

[NOR] Tenure-track positions introduced in 2015, although they are not widely used

[NOR] Ministry Strategy for recruitment of researchers and development of careers (2021) and Long-Term Plan for research and higher education (2023-2032): gender balance, inclusiveness, researchers in all sectors of society, more effective PhD education to get young researchers in careers at earlier age, more PhD students in technology environments, facilitate a comprehensive career policy at universities and university colleges, including reducing temporary employment through a new directive relating to HEIs.

[PRT] Establishment of the '2019-2023 Legislature Contract: promotion of scientific employment and the development of scientific and academic careers

[PRT] Alteration of the Research Fellowship Holder Statute to restrict the attribution of post-doctoral fellowships, reducing their duration and eliminating the diversity of existing types of fellowships.

[ZAF] The New Generation of Academics Programme involves the recruitment of highly capable scholars as new academics, based on equity considerations and in light of the disciplinary areas of greatest need in the higher education system.

8. International mobility

[BEL-WAL] ULYSSE-MISU funding supports highly qualified Belgian or foreign researchers, who do not hold a Fond National de la Recherche fellowship when submitting the application, and who currently have a scientific career abroad, to come and pursue their career in a French-speaking university in Belgium.

[BEL-VLG] Funding for attracting more foreign researchers and offering researchers in Flanders more opportunities to work abroad.

[ESP] Royal Decree 889/2022 that regulates the accreditation and recognition of foreign diplomas will facilitate access to the Spanish labour market by foreign graduates, including doctorate holders

[EUR] "European Doctorate" label: research internship period of at least three months in another European country

[GBR] Since 2021, up to 30% of UKRI funded studentships may be offered to international students, paying fees to the home level and stipend for living costs.

[GBR] The United Kingdom-Canada Globalink doctoral exchange scheme provides competitively awarded funding to UKRI-funded doctoral students to take placements in Canada.

[KOR] Foreign postdoc program: for young scientists in developing countries

[KOR] Brain Pool Korea: for outstanding scientists from overseas, including Korean researchers living abroad, to work in all sectors of the economy,

[NOR] Research Council of Norway policy for recruitment to research and early career: strengthening funding for international mobility of

young researchers

[ZAF] Co-operation agreements to attract recent doctoral graduates to South Africa.

[ZAF] International placements (in universities, aligned with industry programmes, or at industry partners) outside the borders of South Africa will be achieved by leveraging international partnerships (e.g. with Canadian Mitacs).

[ZAF] Global Knowledge Partnerships Programme: funds bursaries for full-time doctoral studies abroad in vulnerable disciplines and strategic areas where postgraduate training opportunities in South Africa are limited.

[ZAF] International research grants for PhD and postdoctoral researchers, with Switzerland, United States, France, and other BRICS countries.

Annex D. Panellists in the International Workshop

Name	Affiliation
Joshua Barker	Dean, School of Graduate Studies at University of Toronto, Canada
István Szabo	Vice-President of the Hungarian National Research, Development and Innovation Office, Hungary
Claudine Pierron	Transverse Project Manager, Association Pour l'Emploi des Cadres (Apec), France
Sampan Silapanad	Vice-President, Chief Thailand Business Strategist, Hard Disk Drive Operations, Western Digital, Thailand
Deok-Ho Jang	Professor, Higher education policy and administration, Department of Education, Sangmyung University, Seoul, Korea
Carmen Simón Mateo	Director of the Postgraduate and Specialization Department (DPE), High Council of Scientific Research (CSIC), Spain
Nicolas Gibney	Association of Doctoral Organizations in Norway
Nel Grillaert	Co-ordinator PhD Career Hub, University of Ghent, Belgium
Seraina Munton	Senior Research Advisor and Manager for ETH Zurich and University of Zurich, Switzerland
Annemijn Algra	Young Science in Transition, Netherlands
Clarisse Angelier	Déléguée Générale, Association Nationale Recherche Technologie, France
Stephen Meader	Director of the UKRI Future Leaders Fellowships, United Kingdom
Charl Albertyn	Doctoral Researcher, Stellenbosch University, South Africa
Andrew Kean	Director, Civil Service Human Resources Expert Services, Cabinet Office, United Kingdom
Göran Melin	Managing Partner, Technopolis Group, Sweden
Kolja Briedis	Researcher on the career of doctorate holders, DZHW Centre for Higher Education Research and Science Studies, Germany
Rob Copeland	Chair of Higher Education and Research Standing Committee, Education International, Trade Union Advisory Committee to the OECD (TUAC)
Koutarou Nakamura	University of Tokyo and student association BEAST, Japan
Denis Godin	Director, Scholarships & Fellowships Division, Natural Science and Engineering Research Council, Canada
Stephane Berghmans	Director of Research and Innovation, European University Association, Belgium

Note: Panellists are listed by order of appearance in the event