Delivering talent: Careers of researchers inside and outside academia

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Executive summary

Europe is a knowledge-based society: it crucially needs to invest in human talent to drive innovation, progress and sustainability in society. Research universities are the training ground *par excellence* to deliver that talent into society, not only across Europe but across a global knowledge exchange system.

After their initial training, some researchers continue in academic careers at universities and many - increasingly a majority – sooner or later leave academia to pursue a career elsewhere. Multiple pathways exist: in the private sector or in the public sector, in research or in non-research jobs. Some researchers make deliberate choices to change sector, others who like to continue an academic career face fierce competition for limited openings for permanent jobs in universities.

Employment perspectives outside academia for early-stage researchers are good. The labour market both demands and accommodates the talent trained at research universities in many sectors and places in Europe. But perceptions are often different, and the links between various employment sectors are not as strong as they should or can be to enable attractive career perspectives and effective mobility. LERU universities therefore innovate the training and career support for their researchers and invest in new ways for delivering talent to society, in the context of the rapid developments in the research environment and the knowledge-based society.

This paper brings an elaborated vision of LERU on the careers of researchers. It is intended for all stakeholders who play a role in the careers of researchers (universities, employers outside academia, doctoral and postdoctoral researchers, supervisors and principal investigators, research funding bodies, and governments). It is enriched with good practice examples of career policy and career support from LERU universities. Core elements of the vision are:

- Universities and research institutions commit at the highest level and throughout the organisation to develop policies and initiatives to improve the attractiveness of careers of researchers with a three-fold objective: a) to train new generations of researchers prepared and ready to take up a large variety of jobs inside and outside the university, b) to nurture and retain a pool of researchers within academia to ensure that frontier research breakthroughs, a hallmark feature of research-intensive universities, continue to find fertile ground in universities, and c) to encourage productive knowledge exchange between all stakeholders in research capital.

- Universities and research institutions recognise postdoctoral researchers as a growing and distinct category in their policies and initiatives.

- Universities and research institutions ensure that pursuit of diversity is deep-rooted in procedures for recruitment and promotion and in career development programmes.

- Employers outside academia engage in discussions with universities and research institutions on the development of skills training programmes that enable successful transfer of researchers and in discussions about removing barriers for mobility from and to universities.

- Supervisors and principal investigators do not solely focus on the perspectives within academia for their staff but adopt a broader view on pathways. They recognise and discuss possible discrepancies between expectations of doctoral and postdoctoral researchers about the probability of an academic career and the reality.

- Doctoral and postdoctoral researchers take the opportunities for professional development that universities and research institutions offer. This includes qualification in research and teaching, but also in transferable, professional and soft skills. Stakeholders work together to take away cultural ambivalence about taking up training that appears to take time ‘away from the lab’ and/or is focused on career pathways outside academia. Universities and research institutions commit to making reasonable time available (e.g. ten days per annum) for personal and career development activities that do not relate solely to current research capability.

- Research funding bodies ensure that funding schemes supporting the employment of early-career researchers fund both research work and researcher development. The funding for researcher development includes scope for developing their own independent research ideas and allows them to gain further skills apart from the research itself, e.g. via participation in conferences, talks, posters, teaching, networking, courses, and career development programmes.

- Governments facilitate flexible career pathways to ensure mobility connecting academia, the private and the public sector. In order to achieve permeability between the systems, universities are relatively flexible with respect to salary.

The vision leads to seven high-level recommendations:

1. Researchers should be trained for a multitude of roles in society.
2. A shift of perspective is required: from a straight career track to multiple career pathways.
3. The mechanisms by which early-career researchers find their way from academia into society need to be strengthened.
4. More cross-sector mobility at senior levels should be achieved.
5. More effort is needed to accelerate progress of women in senior and leadership positions and to enlarge diversity ambitions.
6. Universities and supervisors have to strengthen career support.
7. Research stakeholders must engage together in supporting careers of researchers.

Facts and figures in a nutshell

Quantitative and qualitative studies about the careers of researchers have shown that

In a decade, the number of doctoral degrees awarded by universities in the EU has risen by 27%, from 102,000 in 2005 to 130,000 in 2015.
Figures from LERU universities also show an increase in the number of postdoctoral researchers.

Doctoral graduates have generally good labour market prospects: the employment rate of doctoral graduates (universities, private and public sector) is higher than for any other level of education.

Early-stage researchers increasingly move from academia to the private or public sector at some point in their careers.

In the EU, 49% of employment in research and development is in the private sector, 39% in the higher education sector (essentially research universities), 12% in the public sector (for example in national research laboratories).

Doctoral graduates in natural sciences or engineering are more likely to continue a research career, doctoral graduates in social sciences or humanities more often move to jobs outside research, and at an earlier stage in their careers.

The private sector primarily employs doctorate holders in natural sciences or engineering, whereas doctoral graduates in social sciences or humanities are more likely to have a career in the public sector.

There is reluctance amongst early-stage researchers to make the transition to the private or public sector outside academia, and career support by supervisors or principal investigators tends to focus on the development of a career in academia.

1. Purpose and scope

1. This paper gives the vision of LERU on careers of researchers in the context of significant (ongoing) developments in the research environment and the rapid evolution of the knowledge-based society. These developments include the significant increase in the number of doctoral degrees, the expansion of postdoctoral positions, the shift towards research as a more collaborative effort, the movement towards open science, industrial engagement and increasing (international) mobility.

2. A highly qualified labour force is pivotal for the future of Europe as a strong knowledge-based society. Researchers in universities, industry and governments with first-class education and training, are a cornerstone of that labour force. This labour force is able to drive forward science, technology and knowledge about society. Researchers moving from research to jobs elsewhere or starting their own business have expertise, competences and skills that are essential for a wide variety of roles in the private and public sector.

3. The papers *Harvesting talent: Strengthening research careers in Europe* (LERU, 2010a) and *Doctoral degrees beyond 2010: Training talented researchers for society* (LERU, 2010b) are both based on the view that talent is the key output that society and business need from universities. This paper is an extension of this work.

3. The core idea of this paper is that careers of researchers nowadays do not follow a straight career track but multiple, diverging and converging, career pathways. After the initial training at a university a large number of possibilities open up: inside or outside academia, in research jobs or jobs outside research. In the course of a career researchers and professionals with a background as researcher have the expertise and skills that enable them to move from one sector to another. As a highly trained, agile and flexible workforce, researchers contribute to the development of society at large, in academic careers as well as in careers outside academia.

4. LERU universities are firmly engaged to support their researchers, throughout their career in their development and career choices. This requires coherent but distinct sets of skills training programmes, career support structures and human resources policies for various career phases: doctoral candidates, postdoctoral researchers, and senior researchers. At all stages a variety of challenging and sometimes competing perspectives need to be considered: the interests of universities to recruit and retain researchers who belong to the best of their generation, the demand for human talent from business and society, and, last but not least, the aspirations, expectations and abilities of researchers themselves.

6. The vision on the multiple career pathways for researchers and the recommendations of this paper are intended for all stakeholders who play a role in the careers of researchers: universities, employers outside academia, doctoral and postdoctoral researchers, supervisors and principal investigators, research funding bodies, and governments.

7. This paper uses the wording ‘careers of researchers’ as well as ‘research careers’. ‘Research careers’ (or ‘a career in research’) refers to progressive steps in research (inside or outside academia), whereas ‘careers of researchers’ (or ‘employment perspectives for researchers’) refers to all possible careers including mobility of researchers to jobs outside research. In this paper, the term ‘researcher’ refers to people that are actively doing research and not to all people that once did research in their professional career. Researchers can be doctoral researchers, postdoctoral researchers and senior researchers including, for instance, researchers in industry or professorial researchers.

2. Careers of researchers in the knowledge-based society

8. At the start of the 21st century, Europe formulated in the "Lisbon Strategy" its ambition to become the world's most competitive and dynamic knowledge-based society. Since then Europe has changed in many respects and its common future is more debated than ever before. The objective to foster and develop its knowledge-based strength remains widely shared and is, for example in the context of fast-growing economies in Asia, more relevant than ever before. This chapter identifies a number of key trends in the research environment and their relevance for the career policies of research universities.

Rise in education levels and increase of doctoral degrees

9. Recent decades have witnessed a steady increase in the proportion of the population in Europe that has completed higher education. In 2005, 30% of the 25-34 year-olds had some kind of tertiary education; by 2016 this percentage had risen steadily to 40%[1]. This increase is visible throughout Europe, with certain countries, especially in eastern and southern Europe, standing out. This increase is the result of different factors. Young people are eager to exploit their talent in full, and economic growth and government policies have enabled them to do so. At the same time, the demand for highly qualified labour has increased, as a result of mass production shifting to low-cost countries and the growing importance of knowledge-intensive industry.

10. Doctoral programmes, the most challenging and specialised university education, in which research universities such as the LERU universities are very active, have expanded strongly, too. The past decade has witnessed a steady increase in the number of doctoral degrees awar-

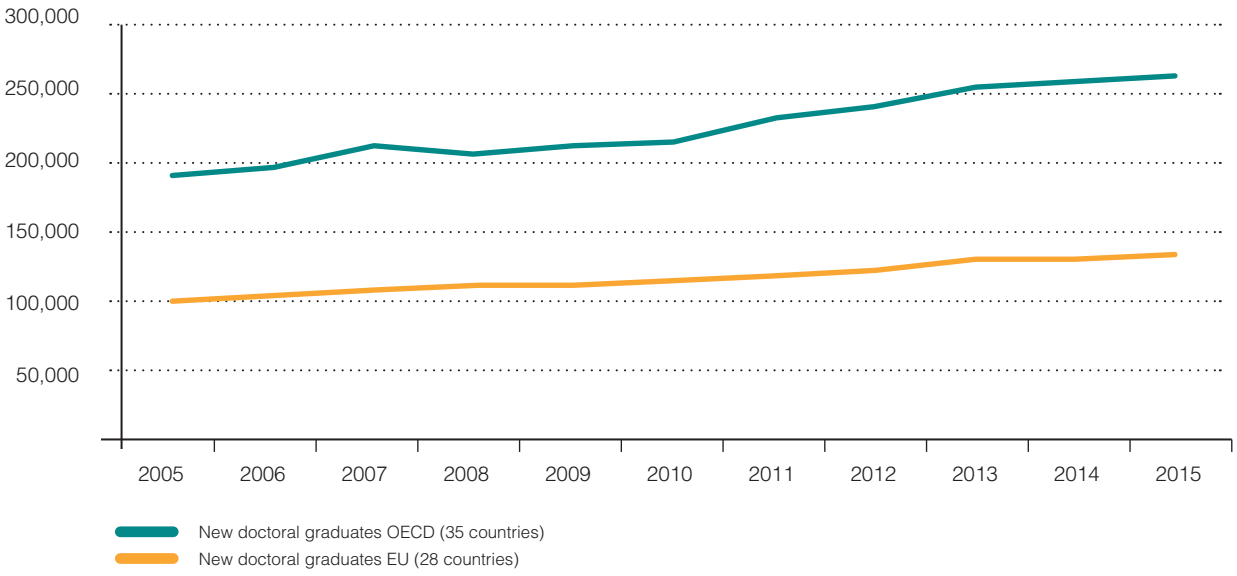

Figure 1: Number of new doctoral graduates in EU and OECD countries (2005-2015)[2]

1 2016 data for EU-22, OECD, Education at a Glance 2017, table A1.2
2 OECD, 2015 and Eurostat, 2016

ded in the EU area, from 102,000 graduates in 2005 to 130,000 in 2015. In the OECD countries there has been a comparable growth, from 192,000 new doctoral graduates in 2005 to 254,000 in 2014, as illustrated in figure 1.

More collaborative research, open science gets momentum

11. Research is increasingly a collaborative undertaking. Collaborative research appears in many shapes and degrees of more or less structured formats, for example through extremely large or very small research teams, through team science, international networks, informal exchanges and more, as argued in LERU (2016a). More and more research has an interdisciplinary character (LERU, 2016b). This requires that expertise from various disciplines is shared. Governments and funding agencies advocate programmes where universities and industry work together, often – in particular as EU programmes are concerned - on a transnational basis. Thanks to the efficient use of limited resources and the increasingly high pace of technological development it is natural and inevitable that equipment and other infrastructure are shared within and between universities, as well as in relation to other partners. While the importance of excellent individuals remains paramount, new competencies emerge as essential for new generations of researchers. Successful collaboration requires strong skills in communication, teamwork, project management and leadership, tailored at the various levels of responsibility and seniority, in addition to research skills.

12. Against the backdrop of these changes in the ways in which research is conducted, the movement towards open science is taking place. Recently, the European Commission has started to focus on the development of open science approaches and how to align career assessment with open science practices. Open science is a broad concept covering open access publication and data systems, citizen science, stakeholder engagement and research integrity. LERU has been fully engaged with the EU on research careers and is a strong supporter of open science (LERU, 2017, 2018b).

13. Many researchers increasingly adopt open science approaches, thus ensuring that the benefits which openness brings, such as the accessibility, reproducibility and transparency of research, are available to colleagues and to society as a whole. However, promotion or advancement processes (and also funding processes) still have to catch up with open science principles. They still tend to rely heavily on traditional ("closed science") thinking and one-dimensional systems primarily focused on journal impact factors. The move towards open science fits in nicely with a transition to assessing researchers' performance and skills set on a broader, multi-dimensional basis which includes researchers' open science activities and other dimensions, ranging from educational engagement, to teamwork and collaboration, supervision of junior colleagues, service to the institution, to the profession or to society at large, etc. It also is aligned with a move away from exclusively quantitative and metrics-focused assessment to a mixed quantitative and qualitative assessment, where the former is used to support, not to replace the latter (LERU, 2018b).

New dynamics in the labour market for researchers

14. Researchers are increasingly mobile, starting in the doctoral phase. Young people are exploring the options open to them, and universities strive to attract the best candidates for doctoral programmes. International mobility is growing rapidly. In the Netherlands, for example, the share of doctoral candidates that is recruited internationally has risen from 35% in 2006 to over 45% in 2017[3]. Data from Switzerland show a comparable picture[4]. Amongst the international doctoral researchers an increasing share comes from outside Europe, especially from Asia. Universities adapt their recruitment practice, settling-in procedures and facilities to accommodate larger shares of international staff. Attracting foreign talent is also a priority for the European Commission. The EU Blue Card is a residence and work permit for highly skilled migrants from outside the EU, implemented to attract highly skilled non-EU nationals to come to work in the European Union.

15. The rise in the number of doctoral graduates entails larger numbers of trained researchers active on the labour market. With strong demand for highly educated people in society at large, and limited possibilities for permanent employment in universities, an increasing share of doctoral graduates moves after finishing their doctoral programme, to jobs in industry, consultancy, education or government, or they start a company of their own.

3 Dutch Association of Universities, 2017
4 Figures from the University of Zurich

16. Temporary contracts are also a source of (more) mobility. It is becoming less and less common for permanent contracts in academia to be given at an early stage of a researcher's career. Young researchers are nowadays mostly employed on temporary contracts, often with different employers. Postdoctoral researchers, typically employed on short-term contracts for one to three years in a project led by a more senior researcher, are a category for which this is particularly true. Postdoctoral researchers gain additional research experience and valuable skills, which makes their positions an important gateway for a career that can develop in many directions.

17. Mobility inside Europe is facilitated by reduced barriers arising from European integration and European mobility programmes. Excellence-oriented programmes at supra-national level, such as those of the European Research Council and the Marie Skłodowska Curie Actions, and the portability of grants, are a further incentive for mobility. The prevalence of English as the first or second language in the doctoral programmes at more and more universities is a further enhancer.

Siobhan, former research staff in Department of Genetics at Trinity College Dublin and the Medical Research Council (UK) Human Genetics Unit, Edinburgh, pursued a career in research management

Transitioning: *Faced with the critical next step in a research career, securing grant funding to run my own research group, I asked myself whether this was the route I really wanted to take… It took a year and a half to decide that I wanted to leave research, have the impetus to do so, and complete my job hunt. The learning during that period was immense; in particular how to demonstrate to future employers a range of transferable skills… I decided to talk with a career coach to help me identify my strengths and potential job roles. This was really empowering: to 'hold the mirror up' to what I really wanted to do.*

Competencies: *Without my background knowledge as a researcher I would have not been a credible candidate for either of my posts since I left research. To carry out these roles successfully I've needed breadth of scientific knowledge rather than depth. Learning how to support doctoral students stood me in good stead for my subsequent staff management responsibilities.*

Career reflections: *As I was a researcher in high-profile labs where I was getting really good results, I felt under a lot of pressure to continue in a research career. I wish it hadn't taken me so long to gain the courage and empowerment to move out of research.*

Advice: *Don't feel that there's only one possible career after doing a doctorate. Make sure you understand your strengths and be ready to explore other options.*

Read the full story at https://www.vitae.ac.uk/researcher-careers/researcher-career-stories/what-do-research-staff-do-next-career-stories/siobhan-jordan

3. Employment perspectives for researchers

18. Early-stage European researchers have generally good employment perspectives. The number of jobs in research and development has increased over the last decade, and statistics show lower unemployment rates for doctoral graduates than for most other training backgrounds. But perceptions are often different. Many early-stage researchers worry about their career perspectives. This chapter gives an overview of the employment situation as shown by employment figures. The next chapters deal with mobility patterns, and the expectations of researchers.

Employment in research and development is growing

19. In the EU, 1.82 million persons (full-time equivalents) are employed in research and development, more than in China (1.52 million), the United States (1.27 million) and Japan (0.56 million)[5]. This makes Europe the single biggest labour market for research in the world. Researchers in Europe make up 1.2% of the labour force. In 2005 this was 1.0%. This is a considerable increase, but it should be realised that Europe's financial expenditure in research and development with just over 2% of gross domestic product (GDP) in 2015 is still well below the 3% EU target. The variations in the size of the research and development workforce between the different European countries are considerable. Austria, Belgium, Denmark, Finland, Luxembourg and Sweden have relatively the highest percentage of research and development personnel: between 1.5 and 2% of the labour force. Other countries are sometimes well below the average.

More employment in research and development outside than inside academia

20. Around half (49%) of employment in research and development is in the private sector (cf. figure 2). Less

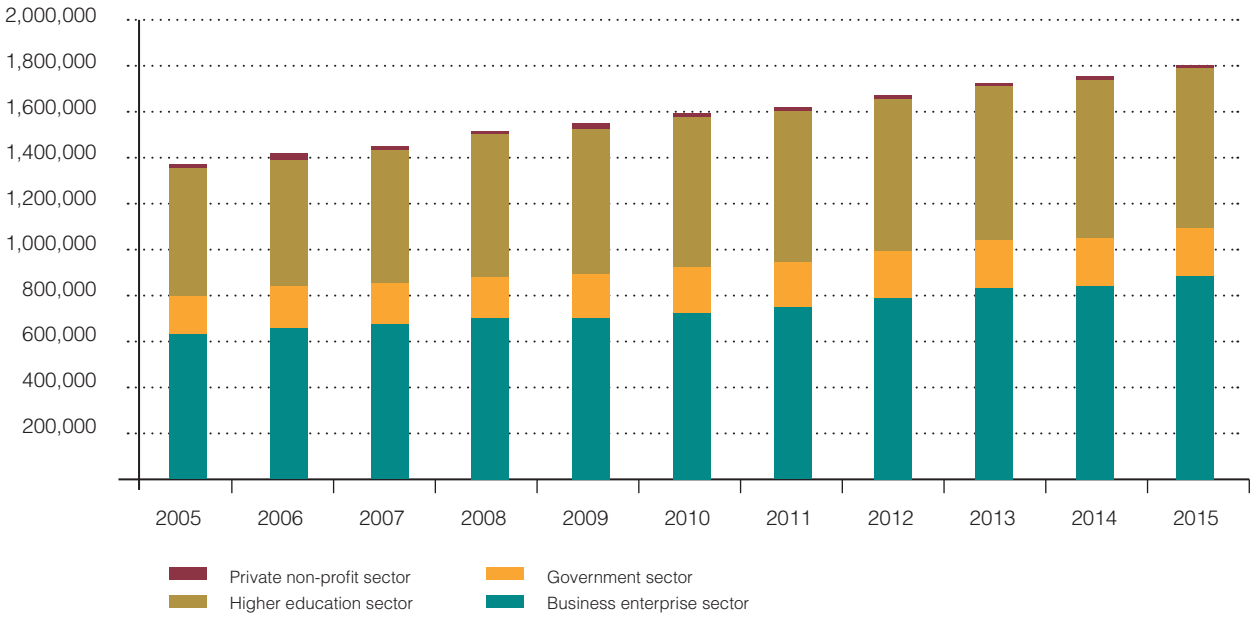

Figure 2: Employment in EU research and development, by sector (EU-28, 2005-2015, Eurostat, 2017)

5 Eurostat, 2017. The Eurostat definition is wider than the definition of researcher as used throughout this paper. It includes all persons employed directly on research and development, plus persons supplying direct services to research and development, such as managers, administrative staff and office staff. There are no figures available for academic staff only, but there is no reason to assume that these trends are different from the more broadly defined group.

than half of the workforce in research and development is in the higher education sector (39%, essentially universities), whereas a small share (12%) work in the public sector, for example in national research laboratories. The relative importance of the different sectors varies considerably across the EU member states. In Sweden, France, Switzerland and Austria, for example, the private sector comprises 60% or more of the workforce, whereas in other countries, especially in southern and eastern Europe, figures for employment in the private sector are below the average of 49%. In the largest economies outside the EU, the private sector offers relatively more jobs in research and development. In Japan 73% of the researchers are employed in the private sector, in the US 68% and China 62% [6].

A doctorate is an investment that pays off

21. While careers do not always develop according to the (initial) preferences of researchers, a doctoral education indisputably contributes to a good position on the labour market. The rate of doctoral graduates (25-64 year-olds) currently employed in Europe is, at 91%, higher than for any other level of education, with little variation between countries. This employment rate figure includes doctoral graduates working in research and those who moved from research to employment outside research[7].

22. The rate of unemployment (doctoral graduates currently unemployed and looking for a job, excluding those who are for one reason or another not available for the labour market) is another way to look at the labour market position of doctoral graduates. There are no EU-wide, comparable data. However, for the countries for which information is available, amongst which France, Germany, Italy and Spain, the percentage of doctoral graduates without a job is consistently lower than unemployment in other categories of educational attainment. In Germany, for example, the general unemployment figure is 4.4%, whereas for those with a doctoral education, it is less than a third of that (1.4%). In the United States the situation is comparable, with very low unemployment figures for people with a doctoral education or equivalent[8].

23. Some doctoral graduates continue a career in research, either inside or outside universities, others take up employment outside research. Across countries for which data are available, at least 50% of doctoral graduates work in research, the others having moved at some stage in their career to non-research jobs. In Portugal and Poland, more than 80% of doctoral graduates continue to work as researchers, whereas the percentages are lower (close to 60%) in Belgium, the Netherlands and the United States[9].

24. There are various studies on the question of the impact of a doctoral degree on income over the years. Findings vary depending on approaches and differ by country, gender, field of study and type of doctorate programme. Still, the general picture shows that doctoral graduates can expect a higher income than master graduates, and not only in research. Doctoral graduates tend to have on average a (slightly) higher income than their master counterparts employed in the same sector, also after correction for the number of years of professional experience[10].

Variations between disciplines

25. The labour market for researchers is quite different from discipline to discipline. Researchers in sectors with a strong connection between the academic discipline and professional occupation, as is the case for e.g. medical doctors or lawyers, typically choose for careers in their discipline. For many careers outside research, the academic skills and interests of the incumbent are more important than the discipline in which the researcher is trained. Industry primarily employs doctorate holders in natural sciences or engineering[11]. Doctorate holders who graduated in social sciences or humanities are more likely to have a career in public research or in government. In general, doctorate holders in natural sciences or engineering are more likely to continue a research career. Doctorate holders who graduated in social sciences or humanities more often move to jobs outside research, and at an earlier stage in their career. But the situation can be quite heterogeneous. Within the social sciences, for example, labour market dynamics in law or economics are much more similar to natural sciences than to other social disciplines.

6 Idem
7 2016 data for EU-22, OECD, Education at a Glance 2017, Table A5.1. Other studies, for example from the European Science Foundation (ESF, 2017), also show high figures, especially in the early career phase.
8 2015 data for selected countries, OECD, Education at a glance 2016, Table A5.2
9 Auriol et al., 2013
10 Mertens and Röbken, 2013; Van der Steeg et al., 2014; Skovgaard Pedersen, 2016
11 Auriol et al., 2013; ESF, 2017, Figure 19

Underrepresentation of women

26. Women are still underrepresented in research jobs in general. Women account for 33% of the EU-28's researchers workforce in 2014, a modest increase from 30% in 2003. There are important differences between disciplines, sectors and countries. In the business enterprise sector only 20% of the workforce is made up by women, in higher education the figure stands at 41%[12].

27. In academia, as in research careers in general, a significant part of female talent vanishes at successive career stages. Women make up 59% of university graduates, 46% of doctoral students, but only 21% of full professors, as shown by the EU-level *She Figures* and illustrated in figure 3[13]. These numbers also show minimal progress between 2007 and 2013 (from 18 to 21%, i.e. about half a percentage point annually). The number of women employed as heads of universities or institutions entitled to deliver doctoral degrees is 15% (EU-28 average, 2014), showing a similarly slow growth rate to that of women grade A academics (i.e. academics working at the highest post at which research is normally conducted)[14]. LERU (2012, 2018a) has argued this represents an unacceptable loss for academia, the economy and society, and has formulated recommendations for action.

28. Women face particular pressures, many of which often combine to make a research career less attractive to them. These can be related to maternity or other caring responsibilities (which are still disproportionally carried out by women), to issues of international mobility and dual careers (more women have academic partners than vice versa), to issues of implicit bias. The latter has been shown to play a significant role in recruitment, promotion and funding, and more (LERU, 2018a). Many molehills make a mountain: women progressing in an academic career encounter numerous obstacles. Each small obstacle may not be insurmountable but the cumulative effect is evident in the leaky pipeline. Clinical research careers are an illustrative case in point: while the demands to prove expertise in research, teaching and clinical work at the same time are challenging for all early-stage clinical researchers, it is the case that women tend to have more clinical and teaching time, at the expense of research time, which is valued most for career prospects. Whatever the explanations may be, the point is that active support, protection and reward of the research role, in clinical and other research careers, is crucial to women wanting to advance their careers as researchers.

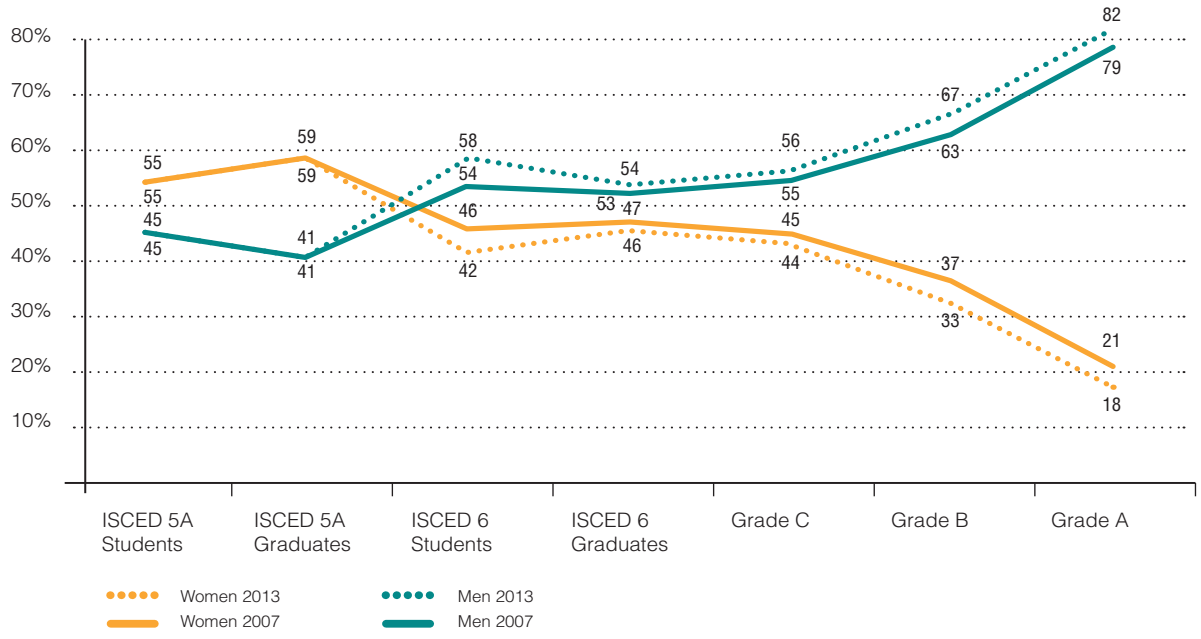

Figure 3: The 'leaky pipeline', negatively affecting women in academic careers in Europe

12 Eurostat, 2017
13 European Commission, She Figures 2015, Figure 6.1.
14 European Commission, She Figures 2015, Table 6.4.

4. Mobility between academia, the private sector and the public sector

29. Mobility between academia and other sectors takes many forms. Early-stage researchers often move to positions outside academia immediately after obtaining a doctorate. Others make that shift at a later stage, for example after completing a postdoctoral position. Less frequent, but important and not always sufficiently valued, is the mobility between academia and the private and public sector, in both directions, of senior researchers.

Mobility of early-stage researchers

30. There are few Europe-wide systematic data on the mobility of early-stage researchers to jobs in the private or public sector, but from studies concerning countries or individual universities a clear picture rises. In France over 11,000 doctorates were awarded in 2007, while in 2008 3,000 new positions with a perspective of an indefinite contract, were offered overall in academia (universities, CNRS, etc.), which means that only a small part of a doctoral graduates cohort is able to continue a career in academia[15]. According to a more recent study, one year after obtaining their degree, 60% of Belgian doctoral graduates work outside higher education and this percentage increases as the years elapse[16]. In Catalonia 66% of those who recently got a doctorate work outside a university[17]. Over half of University of Copenhagen's postdocs work outside of university after their postdoctoral appointment[18]. A Vitae survey[19] amongst (former) research staff with respondents from various European countries, albeit mainly from the UK, shows a comparable picture and illustrates the wide variety of sectors and jobs to which researchers move, including 10% self-employment. The situation in the US shows similar patterns: for example, less than 15% of life science doctoral graduates holds a tenure-track position in academia five years after graduation[20].

31. The mobility of early-stage researchers from universities to other sectors is sometimes perceived - within the group itself as well as by stakeholders in society - as lack of opportunity within academia. This is not the view of the LERU universities. Research universities prepare young academic staff for a multitude of roles in society. The human talent trained at universities, in particular (but not only) the large cohorts of doctoral and postdoctoral researchers, finds its way to a wide variety of positions in society. Having acquired highly expert knowledge and skills as researchers at universities, some of them (increasingly a minority) will continue in academic careers at universities and many will sooner or later leave the bench, the laboratory or the library to pursue other careers. Many of these careers need the highly developed research skills that they bring.

32. In the course of their research many doctoral and postdoctoral researchers are already engaged in collaboration programmes with the private of public sector. This allows them to broaden their experience at an early-stage of their career. A study commissioned by the EU[21] has shown that almost 20% of doctoral researchers have worked outside the university setting for some period during their doctoral programme. LERU universities support an increase of this intersectoral exchange. It is essential that the moment and duration of the exchange is well embedded in the planning of the work and training of the individual researcher.

33. Although the labour market in many sectors and places in Europe both demands and accommodates the talent trained at universities, the links between academia and other employment sectors (private, public and other) are not optimally utilised. Many researchers have, at least initially, a preference for an academic career. For

15 Peretti et al., 2015
16 Boosten et al., 2014, Figure 4.1.1
17 AQU, 2017, Figure 12
18 University of Copenhagen, 2015
19 Vitae, 2016: The Vitae study was co-sponsored by LERU; the survey and most important findings are described in an appendix to this paper.
20 Sauermann and Roach, 2016
21 MORE3 study, 2017, Indicator ISM1. See also another recent EU study, recommending the development of new schemes for intersectoral mobility (EU, 2018)

jobs outside research, employers do not always value the broader set of skills and competencies that doctoral graduates bring to their organisation. Supervisors, universities and funding agencies tend to focus on academic achievements, not on exploring and maximising that broad set of skills for their careers beyond the doctoral or postdoctoral assignment. The links between academia and other employment sectors can and should be strengthened and improved.

Cross-sector mobility at senior levels

34. While senior researchers are often long-term committed to universities and their mobility is mainly between universities, there is also a stream of more senior university staff that move to positions in industry or the public sector at a later career stage. They sometimes retain a link with academia as part-time professors, paid or unpaid, often establishing themselves as an important liaison between research and education in the university on the one hand and activities in the private or public sector on the other. In the other direction, experts from industry or the public sector join or rejoin university. Examples can be found in a rich diversity: high-level specialists that participate in teaching academic programmes, managers with a research background that take up leadership responsibilities in academia.

35. There are longstanding, close ties between academia and professional practice. In some fields there is a significant category of academic staff simultaneously engaged in activities outside research and teaching. Researchers in medicine often practise in academic hospitals as doctors. Other disciplines with a long-established tradition of combining academic positions and professional activity outside academia are engineering, architecture and law. Frequently, professors in engineering or architecture are active in industry or in technical consulting. Law professors often have a paid, part-time position at a research university combined with a paid, part-time position as a practitioner at a law firm or an expert role in a government administration.

36. Various studies show that job mobility of doctoral graduates in later stages of their careers varies by discipline as well as by country. The general pattern is however that if doctoral graduates change jobs, they mostly stay in the same sector[22]. Experience of LERU universities shows the benefits of mobility of senior researchers between universities and other sectors, in either direction. Therefore, this paper recommends greater levels of cross-sector collaboration and exchange.

New career roads for researchers

37. Career tracks and mobility patterns of researchers are changing. Traditionally, the award of a doctoral degree was the main moment for researchers to decide whether to opt for a further career in academia or to move outside academia. The increased number of postdoctoral positions leads to new professional crossroads for early-career researchers. In addition, new forms of mobility between sectors, not linked to a specific career level, have appeared. Collaboration in EU and other programmes promotes closer ties between industry and academia, and leads to collaborations between scientists inside and outside academia, and to researchers more often moving jobs between universities and industry, in either direction. Similarly, knowledge transfer and exchange programmes and the rapid development and expansion of science parks in the vicinity of research universities, often home to spin-off firms initiated by researchers from the neighbouring university, lead to new career lines.

38. The boundary between research and non-research jobs becomes more permeable. For a long time a clear distinction between research and non-research jobs existed in many research institutions. Staff in support roles were indispensable, but their work required other competencies and skills, making mobility from a research to a non-research job inside a university a relatively rare event, with the exception of management positions and specialised positions in libraries and university policy departments, for example. Technological developments as well as new orientations in job crafting result in new types of professional positions, inside and outside academia, for which researchers are highly qualified. Typical examples are in the development and operations of high-tech research infrastructure and in data management.

39. Research universities increasingly encourage these interactions between academia and economic activity. It brings the need to innovate human resources policies, including setting new standards for part-time work, transparent procedures for compatibility and ethical issues, and adaptations of salary policy. Many research universities are developing programmes to increase their staff's knowledge of entrepreneurship and to facilitate start-ups and self-employment.

22 Auriol et al., 2016, Figure 4.12

Examples of innovative initiatives in academia-industry collaboration in relation to careers of researchers at LERU universities

University of Amsterdam - Academic Workplaces: Sarphati initiative
An Academic Workplace is a knowledge infrastructure in which practice, research, policy and education work together. In practice, this often means that policy professionals from one or more municipal health service(s) and their counterparts in the field systematically collaborate with university teachers and researchers. Collaboration between professionals in the field, such as municipal health service nurses and doctors, and researchers, rarely happens as a matter of course. The two categories have their own jobs to do, often work for different organisations and so rarely meet. That is a shame because they could learn a lot from each another. The interaction between practice, policy, education and research not only improves the quality of healthcare, but also has a motivating effect. A well substantiated recommendation encourages research into really essential themes. The Academic Workplace narrows the gap between practice, policy, research and education.

University of Cambridge – Postdocs to Innovators programme
In 2016 the Postdocs-to-innovators programme (p2i) was launched with a strong focus on international partnership. The project is a joint initiative between five leading EU universities and four global enterprises to support and strengthen the entrepreneurial mindset in postdoctoral researchers and encourage not just entrepreneurial activities but a breadth of approach to any endeavour, whether in or outside academia. This enables postdocs to take better advantage of opportunities across different global sectors (industry, public sector, third sector, etc.). It simultaneously assists employers of researchers to innovate, grow and engage with a new generation of skilled thinkers who view impact as key to their work. The initiative provides a shared model of leadership learning between the academic and industial partners.
https://www.p2i-network.eu

Leiden University – Entrepreneurial programmes
LURIS, the Knowledge Exchange Office of Leiden University and the Leiden University Medical Centre, has programmes for academics and students who want to become entrepreneurs. The programmes offer access to knowledge (how to start a business), funding and connections. LURIS energises the entrepreneurial spirit of the academic community. The service is closely involved with start-ups and spin-offs, who in many cases remain partners with research groups in the university or hospital. The Enterprise Leiden Fund lends up to k€ 30 per project and gives access to a network of relevant experts and contacts. For those who are making serious progress as a scientist entrepreneur and need money for, for example, a proof of concept, more substantial funding opportunities are offered by UNIIQ, an investment fund, which is an alliance between Leiden University, Delft University of Technology, a regional development agency and other partners.
https://luris.nl/for-academics/entrepreneurship-start-ups-and-spin-offs/funding-instruments-elf-pre-seed-uniiq

KU Leuven – Leuven Community for Innovation driven Entrepreneurship (Lcie)
The Leuven Community for Innovation driven Entrepreneurship (Lcie) is an initiative launched at KU Leuven in order to stimulate entrepreneurship and entrepreneurial thinking with students, researchers and professors. Via a bottom-up approach a variety of supporting activities within the community is made available for those that want to engage in entrepreneurially related projects. This includes inspirational activities, courses, advice, networking, coaching and funding.
http://lcie.be/en/

University of Zurich - BioEntrepreneur-Fellowships
With the UZH BioEntrepreneur-Fellowships, the University of Zurich (UZH) provides funding, advice, and support to young researchers in life sciences and related fields who intend to start a company based on their own research carried out at UZH. UZH BioEntrepreneur Fellows are given the opportunity to further develop their technology, product or novel service and to evaluate the potential for the commercialisation before founding the company. An UZH BioEntrepreneur-Fellowship amounts to CHF 150,000 and is given for a period of 18 months. Fellows are free to decide how to spend the money (e.g. for their own salary, the employment of co-workers or for consumables). As part of the fellowship and next to their work on the project, fellows take part in a BioEntrepreneurship & Innovation Program that conveys the fundamentals of business start-up and management.

University of Zurich - Life Science Zurich Young Scientist Network
The Life Science Zurich Young Scientist Network (LSZYSN) is a non-profit organisation created and run by a group of graduate students/post-docs of the University and the ETH Zurich. Its main mission is to reduce the existing gap between academic research and the life science industry by hosting events to allow young academics to explore the world of biotechnology and to stimulate constructive interactions between people from various life science sectors. The Zurich Life Science Day, as the main event, brings together around 800 young scientists every year. In two parallel sessions with around 20 presentations, the participants gain an insight into careers in industry, academia, consulting, non-governmental positions, start-up companies and others. During breaks between sessions, companies sponsoring the event with a booth have the opportunity to meet the most talented young scientists in the company exhibition.
http://www.lifescience-youngscientists.uzh.ch/en.html

5. Motivations and expectations of researchers

40. To recruit new generations of researchers it is essential that research jobs and career prospects for researchers are attractive, both in a national and international context. In general, research jobs are sought after, both at entry level and at later stages, and researchers are almost invariably highly motivated for their jobs. There are however a number of important issues that affect how attractive research careers are perceived to be. Two of them stand out, and get much attention amongst researchers as well as in public debate: the uncertainty of early-stage researchers about their career perspectives, and the fierce competition for talent world-wide.

Early-stage researchers, especially postdoctoral researchers, are uncertain about career perspectives

41. The doctoral programmes of research universities prove successful. Surveys amongst doctoral researchers show high levels of satisfaction of the group (de Goede et al., 2014; Woolston, 2017). They appreciate their work, the degree of independence and the coaching from their supervisors. For the vast majority, the research experience confirms their commitment to research, and they like to continue working in research. The surveys also indicate serious concerns. Amongst others things, work-life balance, wellbeing, mental health issues and worries about future employment consistently dominate. While this is partly inherent to young people at the beginning of their career, there is also - as will be discussed later - room for widening and strengthening the skills training and career support.

42. Postdoctoral researchers are typically recruited in competitive procedures amongst the best doctoral graduates, many of them moving between institutions, nationally or internationally. They often aspire to a long-term career in academia[23], while only few of them will acquire a permanent position at a university or research institution. Surveys show that postdocs are less satisfied than other researchers with their degree of independence, opportunities for advancement, salary and work-life balance[24]. The time-limited position is often a particular source of uncertainty among this group (Höge et al., 2012; Fitzenberger and Schulze, 2013; Van der Weijden et al., 2016). Female postdocs have a stronger sense of job uncertainty (Höge et al., 2012). This could be a cause for leaks in the academic pipeline. Many LERU universities have or are currently working on a dedicated policy for postdoctoral researchers. The next chapter will show good practice examples.

43. Various studies show a striking discrepancy between the relatively positive labour market perspectives of young researchers, and the reluctance, at least initially, amongst them to make the transition to industry or the public sector outside academia. Part of the reason may be a culture in which taking up a non-academic job is seen as a failure to climb the academic career ladder (Editorial Nature, 2014). This culture is already changing, but should further open up to the myriad of career possibilities open to researchers.

44. There is diverging information on the levels of satisfaction of researchers who have shifted from academia to the private sector. In general, doctorate holders who moved to non-research positions are less satisfied with their job than doctorate holders who continued working in a research position (Auriol et al., 2013). However, it is important to note that this also includes researchers outside academia. The Vitae (2016) report (cf. paragraph 30 and appendix) suggests the majority of those who moved away from academic research are satisfied in the end with their employment, and only a small fraction continue to aspire to an academic career. Nonetheless, many respondents report challenges in making the transition to other employment, with the loss of social identity coming through as a strong theme particularly for those researchers who are “still an academic researcher at heart” (Vitae, 2016, p. 46). Important in job satisfaction seems to be a match between the job, and education and skills: when doctoral graduates can apply their body of knowledge and skills, they are more satisfied with their jobs (Bender and Heywood, 2009; Di Paolo and Mañé, 2016; Waaijer et al., 2017).

45. While the responsibility for career choices in the first place rests with young researchers themselves, the various career studies show that universities have to put in more effort into informing junior staff about career opportunities and in preparing and supporting them in their choices (cf. key messages in the Vitae (2016) report described in the appendix).

23 See for example Grinstein and Treister, 2017: 71.3% of the surveyed (US) postdocs began their fellowship with the goal of pursuing a tenure-track academic position.
24 MORE2 study, 2013, p. 97; Grinstein and Treister, 2017. The latter mentions “a surprisingly unhappy postdoc community with low satisfaction with life scores“.

Competition for research talent

46. The large number of early-stage researchers on temporary contracts may suggest that universities have no problem in recruiting for permanent positions. This is not the case. Universities, and in particular research universities such as the LERU members, compete for the most talented researchers, in order to maintain or strengthen their leading positions in science. Researchers that have proven to be amongst the very best, for example by the award of research grants, are mobile, looking for the most promising career options wherever they may be.

47. Studies among academic researchers show that career perspectives and research autonomy are determining factors in the choice of a position. The choice for a career in research is in general driven more by the challenges of the job than by salary or employment conditions. Both early- and late-stage research positions in higher education are more attractive if they accommodate a fair balance between teaching and research[25]. At a later career stage, though, researchers are more likely to value the material aspects of a job: tenured positions, salary, attractive grant systems, minimal administrative burden and the ease of starting new lines of research.

48. For many positions in research, the labour market is highly international, within Europe and worldwide. While Europe itself is attractive for many researchers in the world, the US is a pole of attraction for many researchers from Europe. Mobility to and from the US is generally driven by choices based on academic development and factors related to the research environment, but salaries and employment conditions are definitely factors to be considered. While US universities provide relatively low remunerations to early-career researchers (both with regard to stipends but to a lesser extent also with regard to salaries), the higher the career level, the higher the salaries (at purchasing power parity) are in the US compared to EU and other countries. Some of the difference may be compensated for by better levels of social security provision in Europe, but this is difficult to quantify[26].

49. In most countries, doctoral graduates working as researchers are better paid in the business sector than in the higher education sector. This is often considered to be compensated by the fact that a large share of doctorate graduates favour research careers in the higher education sector over the business enterprise sector[27]. However, in a variety of disciplines, for example in tax law, informatics or drug development, the gap in employment conditions is such that it turns out to be extremely difficult to attract and retain sufficiently qualified researchers in academia.

50. To increase the attractiveness of research careers in the European Union, the European Commission adopted the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers in 2005, has made research careers one of the ERA priorities, and has developed initiatives such as the HRS4R, the Euraxess portal and the pension scheme Resaver. LERU strongly supports those initiatives, but stresses at the same time that sufficient funding levels at national and European level are the basis for the viability and development of excellent research, and the attractiveness to top scientists.

Ed, former research staff in biochemistry at the University of Cambridge, pursued a career in the private sector

My experience as a researcher has been invaluable as a reference point for almost everything I've done with respect to understanding our customers – it has enabled me to speak on the same terms as our scientists, our product managers and our executive team.

What do I wish I'd known when I was research staff? The sheer multitude and number of different roles that are available to people that have a research background…Most people in research have no idea that these roles exist and my wish would have been to have had a better understanding of the potential career landscape.

Advice: *If you love doing research, publishing papers, getting grants, etc., then keep going. We need people like you. If you're thinking of doing something else, don't despair – there are lots of roles out there that need your skills.*

Read the full story at https://www.vitae.ac.uk/researcher-careers/researcher-career-stories/what-do-research-staff-do-next-career-stories/ed-ralph

25 MORE3 study, 2017, p. 6
26 MORE3 study, 2017, p. 24
27 OECD doctorate study, p. 27, supported by for example IGAENR report on French situation

6. Career policy and career support for researchers

51. The paper *Harvesting Talent* (LERU, 2010a) formulated three central objectives for research careers policy:
    - to attract highly talented graduates from the international, not merely European, pool of talent,
    - to support the realisation of a researcher's potential for creativity, and
    - to maximise the benefit to knowledge, learning and society.

    The current paper extends the view on the second and third objective. It builds on the concept of the four career stages of researchers[28], developed in *Harvesting Talent* (LERU, 2010a). New elements arise from a broad view on the careers of researchers, considering the changing imperatives of research and new labour market landscape in which researchers increasingly move to research in the private and public sector and to non-research jobs. In this chapter a number of challenges in development of career policy and career support are identified and discussed. Many LERU universities are already engaged in new initiatives. Examples of good practices are presented at the end of this chapter.

Need for a wide variety of skills training for early-stage researchers

52. The trajectory from doctoral researcher to independent researcher is characterised by training on the job. From the early days of modern universities, this has proven a successful way of developing new generations of researchers. It is, however, no longer sufficient.

53. The traditional, gradual development of a researcher needs to be supplemented by explicit, dedicated development of skills in presentations, communication, project management, leadership, and writing research proposals, depending on the needs of different research and employment areas. The skills training has to go beyond the needs of the current positions in academia. For doctoral researchers LERU elaborated a view a broad range of skills in the paper *Doctoral degrees beyond 2010*. Much progress has been made. In some institutions this training is organised by graduate schools. In others the programmes are a responsibility of central services, in particular HR departments. At some universities, training plans are systematically made, including training aimed at a formal teaching qualification as a mandatory part of the programme.

54. While doctoral researchers benefit from formal training programmes, and many universities allow postdoctoral researchers to participate in such activities, only a few universities have so far created bespoke personal and career development programmes for postdoctoral researchers. For this group more, and more structured, efforts are necessary to support their careers beyond the postdoctoral position. Many universities already offer training facilities, and strive for more balance in job descriptions by involving postdoctoral researchers in teaching and other tasks such as outreach activities and committee work, but the support for this distinct and growing category of staff needs further development. It is important to recognise there are both commonalities and specificities with regard to the needs of doctoral and postdoctoral researchers in terms of career development and support. Whereas a variety of more or less joined-up approaches is possible, it is fair to say that a common approach does not necessarily mean that both populations are offered the same training or career development courses.

55. There is considerable work to be done. In an illustrative study concerning Flanders in Belgium, doctoral graduates were asked to which extent they acquired certain skills during their doctoral training. The extent was juxtaposed against the extent to which they require these skills in their current jobs. The study showed that research and personal effectiveness skills were acquired sufficiently. However, communication, team and (especially) management skills

28 In Harvesting Talent (LERU, 2010a), the four stages are labeled as 1/ doctoral candidate 2/ postdoctoral scientist 3/ university scientist, and 4/ professor. They are similar to the profiles developed by the EC, which uses the following classification: R1: First Stage Researcher (up to the point of a doctoral degree), R2: Recognised Researcher (doctoral graduates or equivalent who are not yet fully independent), R3: Established Researcher (researchers who have developed a level of independence), and R4: Leading Researcher (researchers leading their research area or field). See https://euraxess.ec.europa.eu/europe/career-development/training-researchers/research-profiles-descriptors

were needed to a greater extent than they were acquired during the doctoral programme. The mismatches occurred in all sectors, but were especially significant for management skills in industry. These findings are corroborated by a survey of employers of doctorate holders: the employers want doctorate holders to have both technical skills as well as general management skills, such as business and project management skills (De Grande et al., 2014).

Diverse and inclusive universities

56. LERU universities aspire to be diverse and inclusive universities, ensuring that women are attracted to research careers in universities and wherever their career pathway leads. Attracting, retaining and promoting women and other diversity categories to senior and leadership positions is a particularly demanding challenge, which LERU universities have been tackling and continue to work on with much dedication. Gender balance and diversity in general - diversity in ethnic origin, race, age, sexual and religious orientation - should be seen as a powerful driver for excellence (LERU, 2012; 2018a). New initiatives should enlarge the diversity ambitions, for universities and for the knowledge-based society at large, by developing talent from underrepresented diversity backgrounds as well as by continuously ensuring diversity in ideas, interests and (international) experience. Equality, diversity and inclusion is the subject of a separate paper under development by LERU.

The role of supervisors and principal investigators in career support of early-stage researchers needs strengthening

57. Timely and good quality career support is essential for doctoral and postdoctoral researchers to find their way into society. At research universities this support is, typically, given in two ways:
    - by the supervisors and the principal investigators who are responsible for the development of early-stage researchers, in formal and informal conversations,
    - through career advice professional services, at the central level of the university, decentralised in faculties, in graduates schools, and/or externally organised.

58. While the career preparation programmes and career advice by professional services generally offer a broad view on career opportunities, the support from supervisors and principal investigators tends to focus on the development of a career in academia. In a recent *Nature* survey amongst doctoral researchers (Woolston, 2017), many respondents said that conversations with supervisors about non-academic careers are conspicuously absent, and disagreed or strongly disagreed with the statement that their supervisor has useful advice for careers outside academia. LERU universities believe that a change in culture is necessary. Supervisors and principal investigators should support their supervisees in exploring a variety of career pathways, and should signpost them to relevant support structures.

59. Particular attention is needed for the support of postdoctoral researchers, whose numbers are growing in many universities. Their needs are both specific and different from those of doctoral researchers. While in some places, for example through Concordat in the UK important steps have made, the issues of postdoctoral researchers have not been addressed as strategically or structurally as those of doctoral researchers.

60. LERU universities see a critical need for the further development and determined implementation strategies for skills training programmes and career support. It requires not only a range of concrete activities but also a culture change in which the focus on the university career ladder develops into an image of a rich variety of directions in which the careers of researchers can develop. A key responsibility lies with the supervisors and principal investigators. As scientific peers, it is part of their inherent role to discuss possibilities and impossibilities with the doctoral and postdoctoral researchers in their group, and advise them where necessary. Administration and support services within universities should provide supervisors and principal investigators with the tools and structure needed to support doctoral and postdoctoral researchers, while reducing or limiting their administrative workload as much as possible. Further development of skills training programmes and career support can also help to increase (post-)doctoral researchers' sense of wellbeing and to counteract mental health problems, which have been reported in some recent studies and surveys.

Effective career support requires differentiation, especially for senior staff

61. To be effective career support needs to be tailored, taking into account the career phase of the and discipline in which a researcher is active. The need for differentiation in

career support is especially strong for senior staff. Most of them are in permanent positions and have chosen a long-term career in academia. They generally have a range of responsibilities: world-class research, research-based teaching, acquiring resources from funding agencies and industry, supervising junior staff, outreach to society, and often managerial responsibilities in committees or other bodies. Many of them are engaged in professional activities and interests outside the university. The mix of responsibilities vary by individual researcher and each role brings its own requirements in career support. And while this paper argues in favour of more exchange between academia and the private and public sector, this does not mean that all senior researchers should be prepared for cross-sector mobility. The support that universities offer should be differentiated according to researchers' talents and interests, and the relevant links of their field with society at large. The development of career policy and career support at research universities should pay special attention to initiatives facilitating steps into emerging new career pathways, as discussed before in this paper, around science parks, entrepreneurship and data management, for example.

The role of research funding agencies

62. Many early-stage researchers are working in the context of a research project funded by a national research council, the EU or other funding agencies. An externally funded project gives prestige and can be a career-boosting factor, but has also a drawback. The focus on a specific project is often too limited for the individual to acquire the necessary expertise and experience to qualify for other positions, especially outside research. Without compromising on their key function, more and more universities engage doctoral and in particular postdoctoral researchers in teaching and other university roles. It has the added benefit of developing a wider variety of skills that are also valuable in careers outside academia. This process should be facilitated by funding agencies offering special programmes for postdoctoral researchers and by allowing that part of a research grant is used to let researchers be temporarily employed on a project to prepare themselves for their further career[29]. Flexible, non-complex grant requirements are key here.

Anna, former research staff in genetics at the University of Heidelberg, pursued a career in academic publishing and set up her own consultancy and training company

About leaving research: *Support from colleagues in the same institute but different labs was crucial, particularly other women. My PI supported me in so far as he encouraged me to apply for a non-lab job, told me I would be good in publishing and gave me a good reference… In that first six months I wondered about applying for jobs back in research, but it didn't take long for me to be sure I wanted to stay out of the lab for good.*

Career reflections: *I wish I had realised earlier that resilience was a crucial skill for a scientist. In hindsight I lost so much confidence at every knock when others might have bounced back. If I'd realised that this was the thing I should work on above all else, and ask for help with, I might have done some even more amazing things than I have!*

Advice: *To change to a career away from research, or even if you stay, the most valuable thing you can get is contacts. Networking is crucial… So if you are good at something and some people know it, get out there and get to know more people and ask them to recommend you. Network continuously, online and in person, and you never know where the rewards will come. And networking can also tell you about options you hadn't thought about… My final piece of advice is to continuously work on your communication skills, whether you want to stay in science, work in science communication or publishing or do something else. Get good at giving talks, writing for scientists and the general public, talking to strangers, and using online networks of all kinds.*

Read the full story at https://www.vitae.ac.uk/researcher-careers/researcher-career-stories/what-do-research-staff-do-next-career-stories/anna-sharman

29 See in this context Science Europe, 2016.

Good practice examples of career support

- **University of Amsterdam - Faculty of Science Career Service pilot**
  In 2016, the Faculty of Science launched a pilot aimed at offering support to temporary academic staff (PhD candidates, postdoctoral researchers, lecturers): 'Career Service'. Career Service proactively seeks out both its target group and those around them (supervisors/operational management staff) in order to get them thinking about career orientation and optimising their position in the job market. A former postdoc is available for a number of half-days a week via Career Service to act as an expert guide in making the switch to opportunities outside academia. Career Service offers individual career consultations, refers further where appropriate and takes the initiative in organising regular career events, including discussion groups and network meetings.

- **University of Barcelona – Career support initiative at UB School of Economics**
  The University of Barcelona launched a project to enhance the postgraduate programmes and research activity in the field of economics. The UB School of Economics coordinates all career support actions for doctoral and postdoctoral researchers, including individual advice meetings with researchers who have recently started a successful career in research; interview trainings in order to improve their skills and their future performance; travel grants to help them attend job market meetings; and workshops and panel discussions to boost their career prospects during the 'Careers Month' on topics such as communication, CV, LinkedIn and job search strategies. This centre also offers complementary activities during the PhD, such as weekly research seminars, PhD workshops in which doctoral candidates are invited to present a paper from their thesis and complementary courses on STATA, LaTeX, MATLAB and research skills.
  http://www.ub.edu/school-economics

- **University of Cambridge - Careers Service for postdocs**
  For over ten years, Cambridge University Careers Service has developed and successfully implemented a comprehensive careers programme specifically for Cambridge University's large postdoc population (approximately 4,000). Three broad themes are covered: securing a career in academia, research outside academia and non-research careers. A team of five careers advisers work with postdocs within and across School academic discipline boundaries. Support ranges from individual careers appointments to hands-on short career workshops, webinars and day-long in depth career events. The service is highly valued and respected within the postdoc community and the University. So much so, that local non-university research institutions, such as the Medical Research Council Laboratory of Molecular Biology (MRC-LMB), pay to access the support.
  http://www.careers.cam.ac.uk/pdoc/

- **University of Copenhagen – Information brochure**
  The University of Copenhagen (UPCH) made a brochure targeted at postdoctoral researchers. It presents the main results from a labour market survey and directs staff to the kind of career support that UPCH and other partners have to offer. It also provides valuable advice from staff members and UPCH postdoctoral researchers.
  http://www.bric.ku.dk/phd-and-postdoc-programme/postdoc-career-programme/

- **Imperial College – Postdoc and Fellows Development Centre**
  The Postdoc and Fellows Development Centre is a centre within the UK which offers bespoke development opportunities to maximise the potential of Imperial postdocs and fellows. The aim is to launch the postdocs successfully into the next stage of their careers.
  One key way to stay abreast of the needs and issues facing postdocs at Imperial is through the postdoc representatives (Postdoc Reps). The reps are a bridge between the PFDC and postdocs. They act as a conduit for information from and to the PFDC. The reps can influence the nature of what the PFDC offers by being involved in planning and decision-making processes via reps meetings and the Postdoc and Fellows Development Committee, which is comprised of three postdoc representatives from each faculty. Each department/division should have between two to three postdoc reps, one of whom should be available to attend relevant postdoc termly meetings. Departments or divisions based across different campuses are encouraged to recruit two reps per campus.
  https://www.imperial.ac.uk/postdoc-fellows-development-centre/

- **University of Freiburg – Freiburg Career Advancement**
  Supporting academic careers and offering academics excellent prospects: The University of Freiburg's "Freiburg Career Advancement" (FCA) programme combines various institutions and departments focusing on career development, including special qualification programmes for doctoral researchers (International Graduate Academy) and for postdoctoral researchers (Science Support Centre). Particular attention is paid to the career path of tenure-track professorships. The university's human resources development concept for academic staff delineates the wide range of possibilities for development: The university supports researchers and teachers

at all stages of their careers, from the doctoral and postdoctoral qualification phases to the professorship or another permanent position in academia. This involves providing comprehensive services for research and career support, for the extension of teaching skills, and for transdisciplinary qualification.
http://www.uni-freiburg.de/career/freiburg-career-advancement?set_language=en

- **KU Leuven - YouReCa Career Center**
  To address the specific career questions of young researches (PhD candidates, postdocs, tenure-track professors) the KU Leuven set up a specialised office: the YouReCa Career Center. In "putting the needs and questions of Young Researchers' Careers first", the YouReCa Career Center offers the opportunity to sign up for collective and/or individual career guidance. It offers information and advice about the labour market (external, internal, academic, non-academic), job application training, and how to write a CV.
  http://www.kuleuven.be/personeel/careercenter/youreca-career-center/yourecaENG/indexeng

- **University of Zurich – Graduate Campus**
  The Graduate Campus of UZH supports PhD candidates as well as postdocs with transferable skill courses and grants for interdisciplinary initiatives and travel. In order to support and strengthen the postdoc community, the representatives of postdoctoral researchers of the Graduate Campus organise a "Meet up!" on a topic of interest for postdocs twice a year. In addition, PhD candidates and postdocs are offered career counselling as well as entrepreneurial skill courses and fellowships. All information and offers for PhD candidates and postdocs are gathered on one website.
  www.graduates.uzh.ch/en.html

- **National and supranational codes and guidelines**
  The "European Charter for Researchers" and the "Code of Conduct for the Recruitment of Researchers": https://euraxess.ec.europa.eu/jobs/charter
  Horizon 2020 beneficiaries must take measures ("best effort obligation") in order to implement the principles set out in the Charter and Code, according to article 32 of the Annotated Model Grant Agreement, in particular regarding working conditions, transparent recruitment processes based on merit, and career development. One way to comply is if the beneficiary institution holds the "Human Resources Excellence in Research" logo conferred by the European Commission.
  https://euraxess.ec.europa.eu/spain/services/article-32-horizon-2020-grant-agreement

The UK "Concordat to Support the Career Development of Researchers" is an agreement between funders and employers of research staff to improve the employment and support for researchers and research careers in UK higher education. Vitae leads on the management and implementation of the Concordat, which is currently being reviewed.
https://www.vitae.ac.uk/policy/concordat-to-support-the-career-development-of-researchers
https://www.ukri.org/skills/policy-and-frameworks/review-of-the-concordat-to-support-the-career-development-of-researchers/

RCUK (now UKRI) funding terms and conditions require UK universities to adhere to both the "Concordat to Support the Career Development of Researchers" and the "Concordat for Engaging the Public with Research"
https://www.ukri.org/files/legacy/news/grant-fec-tcs-january-2018-v1-pdf/

The "Researcher Development Framework", developed by Vitae, is a widely endorsed framework in the UK underpinning professional development for researchers at all levels. It can help universities to comply with the Concordat. It is structured into four domains of knowledge, behaviour and attitudes of researchers:

A. Knowledge and intellectual abilities: knowledge base, cognitive abilities, creativity
B. Personal effectiveness: personal qualities, self-management, professional and career development
C. Research governance and organisation: professional conduct, research management finance funding and resources
D. Engagement, influence and impact: working with others, communication and dissemination, engagement and impact

https://www.vitae.ac.uk/researchers-professional-development/about-the-vitae-researcher-development-framework/developing-the-vitae-researcher-development-framework

The Wellcome Trust allocates a cost line for formal training of staff funded on their awards: https://wellcome.ac.uk/funding/managing-grant/finance-and-employment, and under "Managing grant budgets"

The Max Planck Society has developed guidelines for the postdoc stage:
https://www.mpg.de/10978233/guidelines-postdocs.pdf

7. LERU's vision on multiple pathways for the careers of researchers

63. This chapter states the main tenets of LERU's vision on multiple pathways for the careers of researchers, describing the roles of not only universities and research institutions, but also of employers outside academia, academic supervisors and principal investigators, doctoral and postdoctoral researchers, research funding bodies and governments. These roles should not be compartmentalised; on the contrary, it is crucial that people in different roles engage with each other.

What universities and research institutions do:

- Universities and research institutions commit at the highest level and throughout the organisation to develop policies and initiatives to improve the attractiveness of careers of researchers with a three-fold objective: a) to train new generations of researchers prepared and ready to take up a large variety of jobs inside and outside the university, b) to nurture and retain a pool of researchers within academia to ensure that frontier research breakthroughs, a hallmark feature of research-intensive universities, continue to find fertile ground in universities, and c) to encourage productive knowledge exchange between all stakeholders in research capital.

- Universities and research institutions support doctoral and postdoctoral researchers to develop their careers whatever pathway they chose. This includes skills training and career support. Universities and research institutions commit to making reasonable time available (e.g. ten days per annum) for personal and career development activities that do not relate solely to current research capability.

- Universities and research institutions recognise postdoctoral researchers as a growing and distinct category in their policies and initiatives. Postdoctoral researchers are expected to develop further, deeper skills than doctoral researchers, by learning to explore future research areas, by learning to lead research and innovation, by learning research management, and by learning about communication of ideas and concepts beyond their specific research area.

- Universities and research institutions promote new career tracks in academia and career tracks outside academia (such as entrepreneurship) with information, training and mentoring. Incubator programmes support doctoral and postdoctoral researchers to develop their research findings further so that they may start their own spin-out.

- Universities and research institutions promote mobility back into academia on the doctoral, postdoctoral and senior researcher level within their recruitment procedures.

- Universities and research institutions ensure that pursuit of diversity is deep-rooted in procedures for recruitment and promotion and in career development programmes. Sustained efforts are in place for the advancement of women in science, because they remain chronically and structurally underrepresented in many areas, particularly in leadership positions. In addition, new initiatives pay attention to other types of diversity, in particular to train more researchers from underrepresented backgrounds.

- Policies and initiatives stimulate supervisors and principal investigators to actively engage in the professional development of early-stage researchers under their responsibility, for example in appraisal and/or development interviews, in parallel with the career support offered by specialised internal or external services.

- Universities and research institutions collect data on the careers of doctorate holders to allow for effective career policies and career support for new generations of researchers.

What employers outside academia do:

- Employers outside academia fully use the potential, in research as well as non-research jobs, of researchers moving from academia to the private or public sector.

- Employers outside academia engage in discussions with universities and research institutions on the development of skills training programmes that enable successful transfer of researchers and in discussions about removing barriers for mobility from and to universities.

What supervisors and principal investigators do:

- Supervisors and principal investigators coach their research staff in acquiring as much expert knowledge as possible but also encourage them to develop other relevant expertise, for example concerning outreach, public engagement and open science. They support their staff in activities to get further skills and provide information and counsel about career pathways.

- Supervisors and principal investigators do not solely focus on the perspectives within academia for their staff but adopt a broader view on pathways. They recognise and discuss possible discrepancies between expectations of doctoral and postdoctoral researchers about the probability of an academic career and the reality. Supervisors and principal investigators contribute to take away cultural ambivalence about taking up training that appears to take time 'away from the lab' and/or is focused on career pathways after academia.

- Supervisors and principal investigators openly discuss career options in career talks with their staff. Those who seem unlikely to pursue an academic career (for whatever reason) receive clear and timely advice.

What doctoral and postdoctoral researchers do:

- Doctoral and postdoctoral researchers are aware that they are responsible themselves to manage their career.

- Doctoral and postdoctoral researchers are open to and reflect on the various career pathways that they may follow. Doctoral and postdoctoral researchers make conscious decisions about their future career steps.

- Doctoral and postdoctoral researchers take the opportunities for professional development that universities and research institutions offer. This includes qualification in research and teaching, but also in transferable, professional and soft skills.

- Doctoral and postdoctoral researchers are aware of all their skills when looking for the next career step.

What research funding bodies do:

- Research funding bodies ensure that funding schemes supporting the employment of early-stage researchers fund both research work and researcher development. The funding for researcher development includes scope for developing their own independent research ideas and allows them to gain further skills apart from the research itself, e.g. via participation in conferences, talks, posters, teaching, networking, courses.

- Research funding bodies offer funding schemes for early-stage researchers (with the postdoctoral researcher being the principal investigator) and not only for projects (with the professor being the principal investigator).

- Research funding bodies offer funding schemes for postdoctoral researchers for developing leadership within their own grant, e.g. with a small research group.

- Research funding bodies offer funding schemes for postdoctoral researchers for developing businesses, for postdoctoral positions in the private or public sector and for intersectoral mobility.

- Research funding bodies should incentivise mobility of senior researchers from the private or public sector into academia by offering respective funding schemes.

What governments do:

- Governments facilitate flexible career pathways to ensure mobility connecting academia, the private and the public sector. In order to achieve permeability between the systems, universities are relatively flexible with respect to salary.

- Governments offer support programmes for start-ups and spin-outs to help doctoral graduates and postdoctoral researchers to overcome the difficult starting phase with an own company.

- Governments support, incentivise and reward universities research institutions to act in accordance with the principles set out for universities and research institutions.

8. Recommendations

64. The vision set out above is the basis for seven high-level recommendations which LERU offers to universities, researchers and research stakeholders.

R1. Researchers should be trained for a multitude of roles in society.
Europe is a knowledge-based society: it crucially needs to invest in human talent to drive innovation, progress and sustainability in society. Universities are the training ground *par excellence* to deliver that talent into society, not only across Europe but across a global knowledge exchange system. Through the expertise, experience and skills they acquire, early-stage researchers should be enabled to either embark on an academic career or to take on many other types of responsibilities: jobs in the private sector, the public sector, but also entrepreneurial roles through start-ups and self-employment. While universities such as the LERU universities are very successful in continuously developing new generations of human talent, there are gaps between the competencies acquired and the competencies needed in the future career, in areas such as project management or communication. Therefore, following the lines set out in the LERU (2010) paper *Doctoral training beyond 2010*, universities need to strengthen the development of transferable, professional and soft skills of early-stage researchers. Reciprocally, researchers need to take responsibility for their careers by intensively exploiting opportunities for professional development.

R2. A shift of perspective is required: from a straight career track to multiple career pathways.
In order to better prepare researchers for mobility out of academia, universities, supervisors and principal investigators, and aspiring researchers themselves must shift the often still predominant view of straight career lines, where the ultimate goal is an appointment as a tenured or full professor, to a more sophisticated image of multiple diverging and converging career pathways that researchers may follow. Researchers should be able to choose among different career pathways to be followed, which may lead to different research and non-research roles and jobs within and outside of academia. The transition has started in many places, but a further, sustained, change of perspective on the careers of researchers is essential.

R3. The mechanisms by which early-stage researchers find their way from academia into society need to be strengthened.
The human talent trained at universities, in particular (but not only) its large cohorts of doctoral and postdoctoral researchers, finds its way to a wide variety of positions in society. Some of them will continue in academic careers at universities and many (increasingly a majority) will sooner or later leave the bench, the lab or the library to pursue other careers. Although the labour market both demands and accommodates this talent in many sectors and places in Europe, the links between academia and other employment sectors (private, public and other) are not optimally utilised. They can and should be strengthened and improved. Research universities should invest in these links by skills training to go beyond the need of the current position and job descriptions that enrich experience, for example by getting early-stage researchers more involved in education and outreach.

R4. More cross-sector mobility at senior levels should be achieved.
More and more university researchers are engaged in collaboration with industry, providing advice to government and other forms of professional activity outside the university. In addition to longstanding close ties between academia and professional practice in disciplines such as law, medicine and engineering, important new dynamics develop around knowledge transfer initiatives and projects funded by national or EU agencies. These interactions involve university researchers at all stages of their career. While many early-stage researchers move between sectors, the mobility of senior researchers, from universities to other sectors as well as from outside academia to universities, is often modest. This paper recommends greater levels of intersectoral collaboration and exchange.

R5. More effort is needed to accelerate progress of women in senior and leadership positions, and to enlarge diversity ambitions.

LERU universities aspire to be inclusive universities, ensuring that women are attracted to research careers in universities and wherever their career pathway leads. Gender balance and diversity in general should be seen as a powerful driver for excellence, as LERU has argued elsewhere. Attracting, retaining and promoting women and other diversity categories to senior and leadership positions is a particularly demanding challenge, which LERU universities have been tackling and continue to work on with much dedication. New initiatives should enlarge the diversity and inclusiveness ambitions, in particular in developing talent from underrepresented diversity backgrounds.

R6. Universities and supervisors have to strengthen career support.

To navigate the complex environment of career pathways in and beyond academia, early-stage researchers need comprehensive information, guidance and support from universities and from the supervisors or principal investigators to whom they report. LERU universities take this responsibility seriously and have been developing new ways of supporting the professional development of (early-stage) researchers, so that they understand and act upon the need to develop transferable skills that can be applied in any career path. This is particularly important for postdoctoral researchers, as their needs are both specific and different from those of doctoral researchers, and have not been addressed as strategically or structurally as those of doctoral researchers. The provision of career development in universities can and should be done without compromising the crucial development of intrinsic and in-depth research and teaching skills. Approaches and policies in career development and HR support can and should allow for variations between disciplines and other specificities within universities.

R7. Research stakeholders must engage together in supporting careers of researchers.

Differences exist across various sectors of Europe's labour market in terms of its needs for the talent flowing out of universities. Career opportunities outside academia for researchers with different backgrounds, be it in humanities, social, life and natural sciences, engineering and more, can vary considerably. Universities as well as other sectors and stakeholders have a joint responsibility to put into place processes to foster a culture of openness and to facilitate out-of-academia (as well as back-into) transitions. More attention is needed from all research stakeholders for supporting the careers of (early-stage) researchers. It requires all stakeholders to engage honestly and deeply with one another, with a long-term horizon to achieve productive interactions.

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10. Appendix

"What do research staff do next?" A survey study undertaken by Vitae, with the collaboration and support of LERU

In 2015, Vitae, in collaboration with Naturejobs, LERU, Science Europe and other partners, embarked on a European research project investigating the career paths of research staff (postdoctoral researcher, research fellow, etc.) who left research posts in European universities or research institutes to work in other occupations or employment sectors. The project aimed to understand the knowledge, views, attitudes and actions of researchers previously employed in higher education in relation to their careers, and to explore researchers' reflections of their professional and career development needs while in higher education.

The project used an online survey and structured career stories, producing both quantitative and qualitative results. LERU sponsored the project and promoted the survey across its network and on social media. Given the distributed approach, the results should not be taken as a representative sample in a strict sense, but the findings nonetheless represent illustrative and broadly typical experiences. Out of a total of 856 valid survey responses, 208 (24%) came from former research staff at 16 (out of then 21) LERU universities. 127 out of 208 responses (61%) were from LERU's UK members.

Vitae's report[30] reveals the range of employment opportunities open to research staff beyond higher education and indicates there is "a healthy and rewarding employment market for research staff who do move out of HE research" (Vitae, 2016, p.4). The majority of respondents are positive about their move away from academic research and are satisfied with their current job[31].

Many respondents report challenges in making the transition, whether it is the difficulty of giving up the idea of an academic career, of working out how to find suitable employment or of adjusting to different work cultures. Transferable skills and competencies acquired in higher education employment are seen as highly useful to help make the transition. To illustrate, a few quotes from LERU university respondents are included elsewhere in the paper.

The report provides practical advice to researchers (cf. table 1, reproduced with permission from the Vitae report, p.48).

Key messages to researchers in the report are:

- Don't see a move out of HE research as a career failure.
- Put yourself first and take action.
- Consider whether you want to maintain a dual identity.
- Apply your researcher competencies to investigate options and opportunities.
- Believe in your researcher competencies to help you get suitable employment.
- Prepare to find the transition period challenging.

The report also has useful messages for institutions:

- Commit to achieving and maintaining the HR Excellence in Research Award.
- Introduce a talent management strategy.
- Develop gender equality plans.
- Provide career development support for research staff.
- Use your research staff alumni.
- Manage and recognise career aspirations.

30 The Vitae report is available for downloading at https://www.vitae.ac.uk/vitae-publications/reports/vitae-what-do-research-staff-do-next-2016.pdf
31 40% of all respondents and 47% of LERU respondents are "very satisfied", while 38% and 34%, respectively, are "fairly satisfied".

Table 1. Advice to researchers in the Vitae report "What do research staff do next?"

Theme	Advice
Self-awareness	Understand what motivates you to stay in, or leave, HE research. Look at both positive factors, e.g. interests/passions, and negative ones, e.g. expectations of others, lack of opportunities.
Self-care	Find space to put yourself first, not your research. Be prepared for a lengthy transition process. Develop emotional and practical support networks.
Thinking ahead	Assess your prospects in HE research – be realistic. Have courage to change direction. Make a decision to research your next move before it becomes urgent – and then make career review a regular habit.
Focus on transferable competencies	Don't underestimate your transferable competencies. Assess them objectively: get help from mentors, friends, family, etc. Look at any gaps and take advantage of local provision (courses, careers services) and online provision to develop any important gaps.
Broaden experience	Get involved in work-related experiences beyond your research to explore what you might enjoy doing, and to develop and help evidence your capabilities to employers.
Research and assess opportunities	Be open-minded. Talk to a range of people and research different types of employment that could fit your values and competencies. Get insights into different employers. Consider whether you need to take a step down to get where you want to be in the longer term.
Use networks	Personal and professional networks are a huge resource for information, ideas, practical help and emotional support. Talk to former research staff who have made successful transitions.
Self-belief	Have confidence in what you offer employers. Be patient and persevering. Don't rush into an unsuitable job.
Getting and accepting job offers	Get professional and informal help to ensure you make strong applications and interview well. Know enough about the new work environment to feel confident you can be happy there.
Culture shock	Anticipate the need to adapt to a different type of role, typically with less autonomy, multiple activities and different pace of work. Draw on your existing competencies and attitudes to adjust successfully.
Identity change	Recognise that losing your academic identity could be difficult. Focus on the positives in your new role. Understand the pros and cons of keeping your links with academic research.

LERU

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ABOUT LERU

The League of European Research Universities (LERU) is an association of twenty-three leading research-intensive universities that share the values of high-quality teaching within an environment of internationally competitive research.

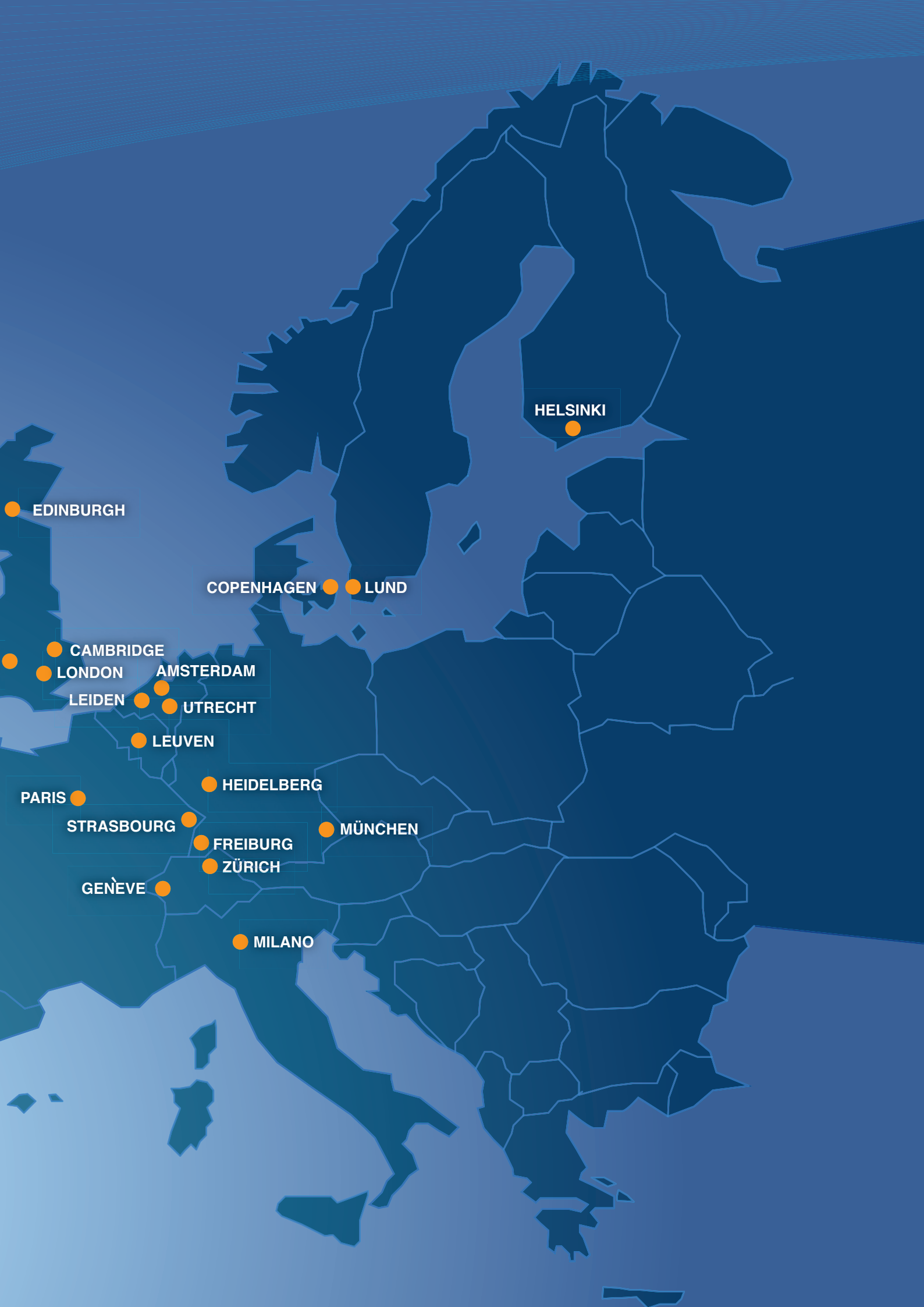
Founded in 2002, LERU advocates:

- education through an awareness of the frontiers of human understanding,
- the creation of new knowledge through basic research, which is the ultimate source of innovation in society, and
- the promotion of research across a broad front in partnership with industry and society at large.

The purpose of the League is to advocate these values, to influence policy in Europe and to develop best practice through mutual exchange of experience.

FACTS AND FIGURES

- LERU member universities account for more than 750,000 students.
- More than 60,000 academic staff and 60,000 non-academic staff work at the member institutions (hospital-only staff not included).
- Over 230 Nobel Prize and Field Medal winners have studied or worked at LERU universities.
- In 2016, LERU universities contributed €100 billion to the European economy and supported 1.3 million jobs.
- Every job directly created by the LERU universities supports almost six jobs throughout the European economy.
- Research universities support the diffusion of knowledge by providing high quality graduates for the labour market as well as through their commercialisation activities, such as spin-out companies and intellectual property licensing.
- Research universities impact wider society by improving social cohesion, facilitating social mobility, encouraging better health and well-being and greater civic engagement.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LERU publications

LERU publishes its views on research and higher education in several types of publications, including position papers, advice papers, briefing papers and notes.

Position papers make high-level policy statements on a wide range of research and higher education issues. Looking across the horizon, they provide sharp and thought-provoking analyses on matters that are of interest not only to universities, but also to policy makers, governments, businesses and to society at large.

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