MORE3 study

Support data collection and analysis concerning mobility patterns and career paths of researchers

IDEA Consult, WIFO and Technopolis
December – 2017

Research and Innovation

MORE3 study: Support data collection and analysis concerning mobility patterns and career paths of researchers

European Commission
Directorate-General for Research and Innovation
Directorate B — Open Innovation and Open Science
Unit B2 - Open Science and ERA policy
Contact Emiliano Carozza
E-mail Emiliano.CAROZZA@ec.europa.eu
RTD-PUBLICATIONS@ec.europa.eu
European Commission
B-1049 Brussels

Manuscript completed in December 2017.

Luxembourg: Publications Office of the European Union, 2017

PDF ISBN 978-92-79-80918-7 doi:10.2777/710643 KI-02-18-356-EN-N

EUROPEAN COMMISSION

MORE3 study

Support data collection and analysis concerning mobility patterns and career paths or researchers

IDEA Consult, WIFO and Technopolis

2017

Directorate-General for Research and Innovation
European Research Area

Executive Summary

Researchers are at the core of a knowledge-based economy, both pushing outward the science frontier and contributing to the use of knowledge for economic and societal aims, helping to secure growth and jobs, but also tackling grand challenges such as climate change and resource scarcity. It is not surprising as a result that one of the core goals of many initiatives at the national and European level consists in safeguarding a sufficient number of researchers, as for e.g. in the European Partnership for Researchers and in the Europe 2020 Innovation Union initiative with its goal of completing the European Research Area (ERA). An ERA includes an open labour market for researchers based on transparent and competitive recruitment.[1] The MORE3 study updates and expands on MORE2 in order to meet the need for indicators over time and assess the impact on researchers of policy measures introduced with the aim of improving the attractiveness of careers in research in Europe.

The first part of this executive summary presents the main conclusions of the study and its implications for policy-making, with special attention to the implications in terms of attractiveness and development of the ERA. The second part gives an overview of the main findings of the MORE3 study.

Policy-relevant findings and implications of MORE3

STATE OF PLAY

When knowledge is the principal factor behind competitive advantage, leading to increasing competition for talented knowledge workers, the attractiveness of research areas is crucial for sustainable and dynamic knowledge economies.

There is something like a global mind-set on what makes for an attractive research career (in academia), or on which characteristics of research jobs are most conducive to a successful research career. Attractiveness – or international mobility - is driven by research job characteristics influencing a researcher's scientific productivity, such as international networking, career perspectives and working with high quality peers. "Material" working conditions related to remuneration, pensions and job security and other non-science related conditions influence job choice ceteris paribus, but are not decisive factors for job or mobility decisions. There is also a shared understanding on which skills and training (a PhD) matter for a research career and on which factors matter for recruitment and career progression in academia. Intersectoral mobility between higher education institutions and firms are regarded as less important for recruitment or career progression than international and interdisciplinary mobility.

By contrast, researchers' perceptions on how countries organise and structure research systems, i.e. the conditions they provide for researchers to reach their maximum creative research potential, are much more divergent. While diversity of research systems can be good and provide opportunities for learning, lower satisfaction levels with funding and financial security or high shares of fixed-term contracts are not a sign of positive diversity.

[1] European Commission (2010), Europe 2020 Flagship Initiative Innovation Union, SEC(2010) 1161, https://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication_en.pdf; European Commission (2008), European partnership for researchers, COM(2008) 317 final, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:ri0004; European Commission(2008), Better Careers and more Mobility: A European Partnership for Researchers, SEC(2008)1911; http://ec.europa.eu/research/press/2008/pdf/com_2008_31_1_en.pdf

The discrepancy between a 'global awareness' on what matters for successful research careers and the national differences in research systems gives rise to varying perceptions of attractiveness between countries, as well as varying patterns of international mobility, including asymmetric mobility or brain drain. This is not only pertinent at the global level between high-income countries with strong research systems and lower-income countries with weaker research systems, but also at the European level. MORE3 findings point to persistent heterogeneity among EU countries. This heterogeneity is not just a result of different higher education systems and career structures, but also of economic development influencing public budgets for research and hence research funding and salaries of researchers. **A continued and even increased emphasis on the reform priorities for ERA and EU higher education systems** (see, e.g., 2012 communication on the ERA, renewed agenda for higher education 2017) is hence a clear policy implication of MORE3, not only as regards the ERA aim of helping weaker research systems catch up to the top systems within the EU, but also in terms of helping the latter catch up to the globally top research systems. The nature of the relationship – win-win or win-lose – between the "Global Research Area" and the "European Research Area" will also depend to some extent on how level the playing field will be. Research institutions of similar attractiveness will lead to knowledge exchange and brain circulation, while major differences may lead to brain drain.

Next to heterogeneity, there are several other policy-relevant findings from the MORE3 study:

- On the one hand, there are **several positive developments**. Among these are the share of externally advertised positions, the agreement of researchers that recruitment and career progression are merit-based and transparent, the share of fixed-term contracts[2] and satisfaction with working conditions, although these results need to be interpreted carefully. These positive developments at the EU level mask strong country variation. In terms of gender balance, almost equal shares among early stage researchers are observed, but there is still a large imbalance in later career stages. It is not clear yet whether the balance in early career stages will be sustained to significantly change the glass ceiling phenomenon observed in most EU countries.
- Another important finding is that **research careers are attractive by nature**: intrinsically motivated researchers enjoy the intellectual challenge and the level of responsibility which comes with the activity of research. Increasing the number of researchers is hence less a task of building motivation, but of improving working conditions and career paths so that researchers are able to do what they are interested in. Weak working conditions lead to opting out of a research career or to "forced" international mobility. Attractive working conditions and career paths can also compensate for dissatisfaction with pay, where the EU is perceived to be worse than both non-EU OECD countries and BRICS countries.
- On the other hand, **several areas seem to be in further need of reform**. The heterogeneity of research systems has been pointed out at the beginning of this section.
- Interest in **intersectoral mobility or industry experience** among academic researchers currently working in EU HEI remains low, not just in terms of dual positions, or mobility stints, but also in terms of whether industry exposure or intersectoral mobility is perceived as important for PhD training, recruitment and career progression, or whether entrepreneurship and IPR rights are important skills for a research career. It is important to note that the findings reflect only the

[2] Fixed-term contracts are all employment contracts which are not open-ended, i.e. with a set end date.

perception of researchers currently working in the HE sector, while that of researchers who chose a career in industry is not included - unless they were in a dual position with academia. Nevertheless, beneficial effects from academia-industry interaction are expected and the low interest in this kind of experiences by academic researchers is a finding to take into account. Whether this is simply due to a lack of knowledge about career options outside academia needs further research. Further, it needs to be pointed out that this picture is not different in countries outside the EU. Important in this respect is that **scientific productivity is positively associated with commercialisation of research results**[3], so that fostering the first through reforms to research systems will also boost the second.

- Transferable skills are regarded by more than 80% of researchers in the EU as very important for career progression and recruitment, ranking just below international mobility. Yet only 33% of PhD candidates and recent graduates indicate that they actually received training in transferable skills such as time and people management, grant writing or communication and presentation skills.

As regards the perception of the attractiveness of the EU as a place to do research, several findings emerge among others:

- First, the more advanced the non-EU research system where researchers are coming from or in which researchers have worked, the less positive the EU is seen as a place to do research (and the other way around);
- Second, the EU's relative strong points are perceived to be working conditions that are not related to research itself: social and job security, pension plan and the quality of (undergraduate) education and training. The EU is perceived to be less good on balance than the most advanced research systems when it comes to working conditions influencing scientific productivity of researchers: particularly career paths, research funding and also the availability of suitable positions.
- Third, in terms of specific countries or regions, the US is perceived as being much more attractive than the European Union, as well as the EU Associated Countries included in the study (Iceland, Norway and Switzerland).
- Fourth, it is important to stress that the above findings are based on results for the EU as a whole, but that these findings are at the same time driven by large differences between Member States and institutions – with some institutions being very competitive at a global level.

This perception of attractiveness is consistent with recent bibliometric studies of EU research performance and various university rankings[4]. These results are hence different in emphasis to the report of the High Level Group on maximising the impact of EU R&I programmes, which sees excellent scientific knowledge production in Europe but deficits in turning this knowledge into innovation and growth. While there is definitely excellent

[3] See e.g., Perkmann, M., King, Z., & Pavelin, S. (2011). Engaging excellence? Effects of faculty quality on university engagement with industry. *Research Policy*, *40*(4), 539-552; Di Gregorio, D., & Shane, S. (2003). Why do some universities generate more start-ups than others?. *Research policy*, *32*(2), 209-227; Abramovsky, L., Harrison, R., & Simpson, H. (2007). University research and the location of business R&D. *The Economic Journal*, *117*(519); Van Looy, B., Landoni, P., Callaert, J., Van Pottelsberghe, B., Sapsalis, E., & Debackere, K. (2011). Entrepreneurial effectiveness of European universities: An empirical assessment of antecedents and trade-offs. *Research Policy*, *40*(4), 553-564.

[4] See, e.g., Rodríguez-Navarro, Alonso, and Francis Narin. 'European Paradox or Delusion—Are European Science and Economy Outdated?' Science and Public Policy. Accessed 22 May 2017; Albarrán, Pedro, Juan A. Crespo, Ignacio Ortuño, and Javier Ruiz-Castillo. 'A Comparison of the Scientific Performance of the U.S. and the European Union at the Turn of the 21st Century'. Scientometrics 85, no. 1 (20 April 2010): 329–44; Bonaccorsi, Andrea, Tindaro Cicero, Peter Haddawy, and Saeed-UL Hassan. 'Explaining the Transatlantic Gap in Research Excellence'. Scientometrics, 11 November 2016, 1–25. doi:10.1007/s11192-016-2180-2; Hunter, Rosalind S., Andrew J. Oswald, and Bruce G. Charlton. 'The Elite Brain Drain*'. The Economic Journal 119, no. 538 (2009): F231–F251.

research in the EU and the structure of some of the EU's basic research centers makes this excellence less visible, there is room for broadening research excellence in the EU. This is particularly important where there are large differences between the leaders in the EU and those lagging behind.

MOVING FORWARD: IMPROVING THE ATTRACTIVENESS OF THE ERA

Increasing the attractiveness of the ERA as a place to do research hinges on many factors which influence the scientific productivity of researchers. These factors are conceptualised in the study as **drivers and enablers of attractiveness**.

Research funding and the availability of positions are perceived to be the two biggest barriers to mobility across the board in MORE3. Improving them would reduce barriers to mobility and make it easier to become mobile. We therefore call these two areas **enablers** of attractiveness: factors that, if improved, will no longer form a barrier to mobility and enable all those interested in an international move to do so. Researchers cannot join an otherwise attractive research system when they face insufficient numbers of suitable positions and/or research funding. Further enablers of attractiveness – or barriers to mobility - which are not directly related to scientific productivity, in particular when a new job involves changing countries, relate to pension portability or immigration rules. However these administrative barriers are not perceived to be the main barriers to international mobility.

The quality of the working conditions influencing scientific productivity, such as e.g. working with leading scientists and long-term career perspectives (e.g. a tenure track model), research autonomy and the balance between teaching and research, are the main **drivers** of attractiveness of jobs in research: factors that drive the decision of researchers to become mobile. Previous evidence based on MORE2 indeed shows that researchers are "willing to pay", i.e. give up some salary, in exchange for higher quality-working conditions relevant for scientific productivity.

In sum: As a general takeaway, reducing administrative barriers to mobility, such as continuing to improve pension portability or liberalising entry regulations are important but will not on their own make the EU more attractive. What is needed in addition are attractive working conditions for researchers which help them implement their research agenda. This implies a **stronger policy focus on boosting conditions for scientific productivity** in all Member States and at EU level to foster symmetric mobility of researchers (brain circulation) and the attractiveness of the EU as a place to do research. The policy instruments for a stronger focus on scientific productivity are outlined in the section on the implication for the use of policy instruments below. First, an illustration is provided by policies for return mobility. MORE3 shows that return mobility of researchers is high during the early career stages – once they are established or tenured at a prestigious university it is very difficult to attract them back to their home country. This means that efforts aimed at recruiting the most promising researchers at early stages of their career rather than at later stages are likely to be more successful. In practice, this implies offering attractive career perspectives to early stage researchers e.g. based on a tenure track career model. Trying to recruit leading researchers during later career stages will be more costly by comparison, as they are less likely to move. This is not to say that return mobility policies are necessarily ineffective, but that they cannot replace an attractive research system for early stage researchers.

Implications for use of policy instruments: In terms of overall instrument use, increasing the attractiveness of ERA in terms of conditions for knowledge production can follow a four-pronged strategy:

- **To further increase research funding**, which continues to be perceived as the working condition in the EU with the least satisfaction; many EU initiatives are well targeted and evaluated, but their impact remains limited due to low success rates, e.g. generally in Horizon2020 or more specifically in European Industrial Doctorates.
- **To ensure that this money flows to the most promising researchers and research projects**, in particular in systems with an overall limited amount of public research funding, in line with ERA priority 1. This is also a focus of the renewed EU agenda for higher education in terms of financially rewarding research and teaching performance. The ERC and MSCA are funding schemes which are clearly successful in allocation money to highly promising researchers.
- **To attract the most talented researchers** based on attractive career paths and working conditions for research as outlined above; satisfaction with career perspectives is third-lowest among all working conditions in the EU, and researchers perceive in particular career perspectives to be better outside the EU than inside; several EU instruments in terms of an open labour market (ERA) and Open, Transparent and Merit-based (OTM) recruitment are also important here.
- **To ensure that knowledge is shared among policy makers** on how the first three elements are done most effectively, taking account of the heterogeneous nature of the national research systems in the EU.

Some specific qualifications need to be added:

- First, the satisfaction with the **balance between teaching and research** is second-lowest after funding. But what is an "optimal" balance between teaching and research? Research based on MORE2 data found that "research-only positions" are actually not a driver of attractiveness, and that some teaching is even preferred to no teaching at all. However, too much teaching clearly decreases the attractiveness of a job in research.
- Second, when a higher share of researchers is on a tenured position, care needs to be taken to **keep incentives for scientific productivity high over the life-cycle of researchers**. This can be done, e.g., through allocation of funding and through a flexible balance between time for research and time for teaching.
- An increased **emphasis on drivers of attractiveness does not mean that enabling conditions should be overlooked**. E.g. a general enabling prerequisite for international mobility, or people coming towards the EU, is also simply the ability to teach in English – not in terms of the researcher speaking English, but in terms of the university allowing the researcher to teach a course in English. This often limits international recruitment of researchers. Finally, several EU instruments are in place to improve social security/pensions portability (Euraxess, RESAVER).
- Also synergies between European funding for regional development and research excellence or innovation can be further explored with respect to what their role can be in terms of reducing the innovation gap.

MORE3 findings clearly call for a renewed impetus to increase the attractiveness of the EU as a place to do research. Such efforts could benefit from regular monitoring of the attractiveness of research systems in terms of attractive job offers. Such a regular "ranking" of research systems with respect to their attractiveness could provide reform incentives for policy-makers, similar to the rationale of the European Innovation Scoreboard (EIS), and is in line with EU aims at increasing the evidence base for reforms in higher education (cf. for example the renewed agenda for higher education).

POLICY IMPLICATIONS FOR MOBILITY

International mobility both mirrors and affects attractiveness. International mobility drives international collaboration, which in turn is positive for individual research performance, so that mobility perspectives in a job affect its attractiveness. On the other hand, attractiveness of regions, countries or systems to do research is mirrored in the mobility flows. As stated above, asymmetric mobility flows reflect heterogeneity in the national research systems across Europe. Many of the above mentioned ideas on attractiveness of the ERA will thus also affect international mobility.

In particular, the study points at **voluntary mobility**, driven by scientific productivity conditions, as the type of mobility that will foster knowledge exchange, return mobility and strong international networks. It will therefore be important to continue policy efforts to improve international mobility conditions (enablers and drivers), as well as to focus on symmetric mobility by reinforcing the attractiveness of national research systems and research excellence as first precondition thereof - as stated above.

The analysis of international mobility motives, barriers and effects has further shown significant differences for research in different career stages. Even though the drivers of mobility for **early stage researchers** are generally the same as those of post-PhD researchers, they are at the same time more focused on their training, on the value of their experiences for their further career, and on how to combine their mobility with their family situation. In this respect, actions can be addressed more towards young researchers by taking these specific needs into account.

Interdisciplinary mobility, defined as moves between fields and collaboration with other fields, are regarded as a positive factor for recruitment and career progression. The extent to which interdisciplinarity is necessary or beneficial for researchers might depend on the career type and research topic. But in general, where policy supports interdisciplinarity, it supports also individual researchers in their careers. MORE3 data indicates that former MSCA and ERC grantees currently display higher levels of interdisciplinary mobility and collaboration than the general population of researchers. An opportunity lies in this kind of programmes and initiatives to put forth a clear-cut definition and continue monitoring the numbers and effects of interdisciplinarity in research.

Intersectoral mobility is thought to be one of the solutions to close the gap between academia and industry. However, as indicated above, MORE3 findings show that interest on intersectoral mobility among researchers currently working in EU HEI remains to be low. Next to mobility to other sectors, more forms of exchange and collaboration should be fostered to exploit the potential of industry-science linkages and transfer of ideas. Good examples are the MSCA co-funding of doctoral programmes or the MSCA Research and Innovation Staff Exchange (RISE), which are based on flexible inter-sector (within Europe) and international (with third countries) exchanges of highly skilled research and innovation staff.

POLICY IMPLICATIONS FOR GENDER EQUALITY

Although international competition for talents has accelerated, to a certain extent women's talents are underexploited in various areas of social and economic life. While a quantitative catching-up of women in access to academic positions has been observed in recent decades, this trend has stagnated and literature and statistics agree on ongoing gender inequalities in terms of recruitment and career advancement in higher education systems. The MORE3 indicators confirm that women are still underrepresented in HEI positions and in particular in later career stages. Findings indicate that the glass ceiling continues to exist. It is not clear to what extent the better balance in early career stages is an indication of this glass ceiling or, rather, points at improvements for the future if

this balance continues to hold also in later career stages. Besides the omnipresent wage-gap between women and men, literature finds that the inequality also holds in more qualitative aspects of researchers' lives, such as status, satisfaction with teaching loads, the likelihood of having children and access to full-time positions[5]. Again, this is also observed in the MORE3 study. The scope of gender inequality, of course, differs by career stage, field of science, and country.

A wide spectrum of measures targeting different aspects of gender issues, national and EU-wide, has been implemented to reach the targets and objectives of the strategic engagement for gender equality. At present it remains unclear which of these measures are the most effective and lead to persistent improvements. **Gender monitoring** is already in place in the large majority of ERA countries[6]. More evidence on what really works could feed into **mutual learning exercises**. Even given better evidence, however, it is likely that there is no "silver bullet" which will reduce gender equality. Continuing and intensifying a broad range of comprehensive initiatives seems the most promising strategy.

[5] E.g. Goastellec G. & Pekari N. Gender differences and Inequalities in Academia: Findings in Europe. In Teichler U. & Höhle E. (2013) The Work Situation of the Academic Profession in Europe: Findings of a Survey in Twelve Countries. Springer, Dordrecht, DOI 10.1007/978-94-007-5977-0; Monroe, K., Ozyurt, S., Wrigley, T., & Alexander, A. (2008). Gender equality in academia: Bad news from the trenches, and some possible solutions. Perspectives on Politics, 6(2), 215–233; and Toutkoushian, R. K., Bellas, M. L., & Moore, J. V. (2007). The interaction effects of gender, race, and marital status on faculty salaries. Journal of Higher Education, 78(5), 572–601.

[6] A screening of the ERA NAPS shows that gender is addressed through many measures.

Key figures and findings of the MORE3 study

The MORE3 study, entitled "support of data collection and analysis concerning mobility patterns and career paths of researchers", is carried out under the framework contract "provision of services in the field of research evaluation and research policy analysis" Lot 2 "Data collection and performance indicators to monitor the European Research Policy". It foresees **to update, improve and further develop the set of indicators** of the MORE2 study in order to meet the need for indicators over time and assess the impact on researchers of policy measures introduced for the development of an open labour market for researchers. The MORE3 study provides new surveys and thus new indicators to meet emerging policy needs and priorities.

The main objective of the MORE3 study is defined as:

"***Carrying out two major surveys and developing indicators to help monitor progress towards an open labour market for researchers"***

For this, four tasks are identified:

I. Carry out a survey of researchers currently working in the EU (and EFTA) in higher education institutions (HEI) regarding their mobility patterns, career paths, employment and working conditions (Task 1);

II. Carry out a global survey of researchers currently working outside Europe regarding their mobility patterns, career paths and working conditions (Task 2);

III. Update the set of internationally-comparable indicators on researchers (Task 3);

IV. Draft a final report that provides a comparative, policy-relevant analysis of the mobility patterns, working conditions and career paths of researchers (Task 4).

Box 1 shows the main dimensions that were analysed in the MORE3 study. First, it investigated the situation in Europe with regards to human resources (number of researchers and PhD candidates across countries, career stages and fields of science. Second, the study looked into the main characteristics of researchers´ career paths and working conditions. It combined information on these dimensions (e.g. types of contracts) with data on researchers´ perceptions (e.g. satisfaction with career progression, remuneration, balance between teaching and research; etc.). Third, the MORE3 study analysed researchers´ patterns of mobility and collaboration. International, intersectoral and interdisciplinary types of mobility and collaboration are the main focus of the study.

Box 1: Main dimensions analysed in the MORE3 study

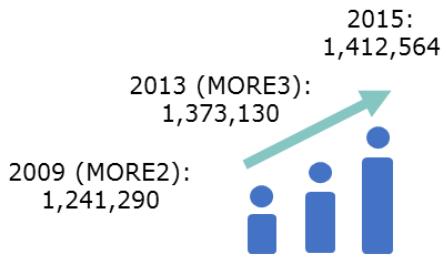
- *Human resources: numbers and training*
- *Career paths*
- *Working conditions*
- *Mobility and collaboration:*
  - *International mobility and collaboration*
  - *Interdisciplinary mobility and collaboration*
  - *Intersectoral mobility and collaboration*

First, visualisations provide an overview of the key figures from the MORE3 study. Next, the main findings are summarised in text per dimension of analysis (cf. Box 1).

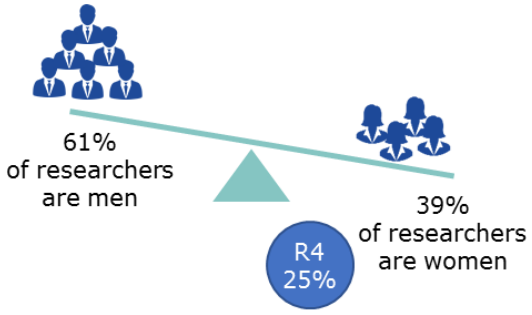
OVERVIEW OF KEY FIGURES

MORE3 key figures

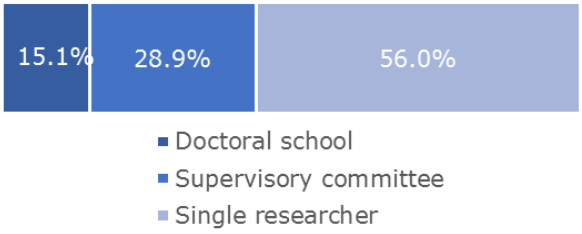
Number of researchers in EU28+3



Gender balance in EU28+3



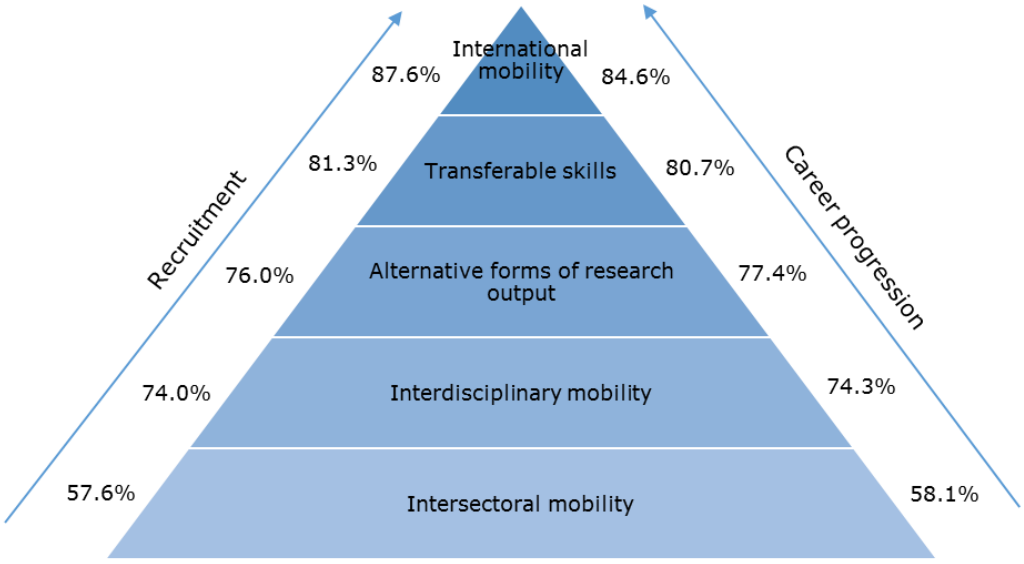
PhD training in the EU28



Share of researchers receiving training in transferable skills during PhD **33%**

81% Share of researchers finding transferable skills training important

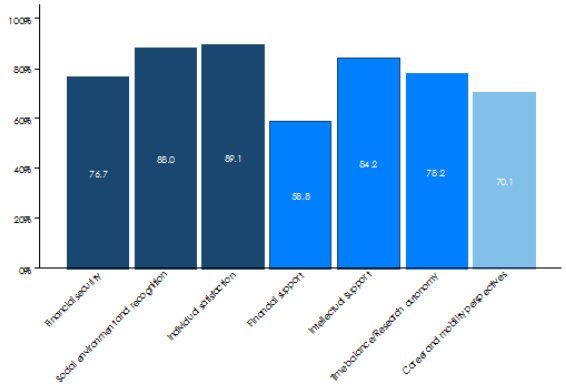
Positive factors for recruitment and career progression in HEI the EU28



Vacancies are sufficiently advertised	**80.3%**
The recruitment process is sufficiently transparent	**74.1%**
The recruitment process is sufficiently merit-based	**76.5%**

MORE3 key figures

Satisfaction with working conditions in EU28



International mobility for or during PhD

PhD mobility:
16% of R1 and R2 researchers

>3 months during PhD:
18% of R1 and R2 researchers

International mobility in post-PhD stages

27% of researchers currently working in the EU has been mobile in the last 10 years for more than 3 months

International collaboration

62,9%
collaborate with researchers in their own country

63,2%
collaborate with researchers in EU countries

45,9%
collaborate with researchers in non-EU countries

Interdisciplinary collaboration

60%
in the same institute

57%
in other universities or research institutes

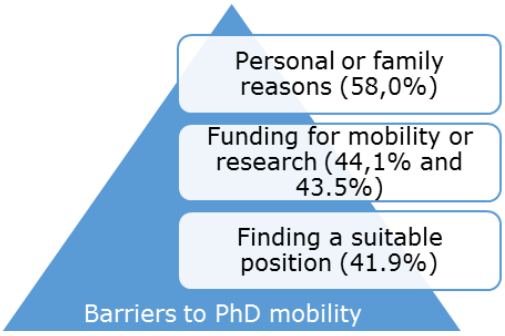
31%
in non-academic sector

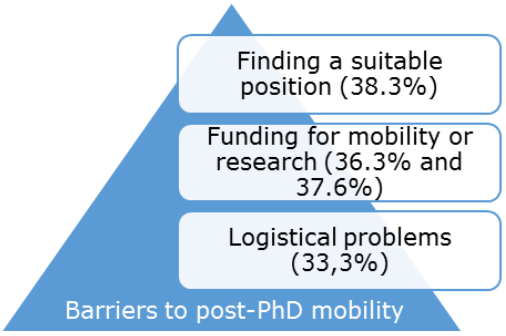
Intersectoral collaboration

35% of researchers collaborate with non-academic sectors

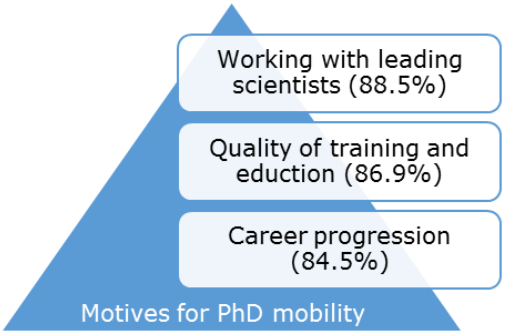
MORE3 key figures

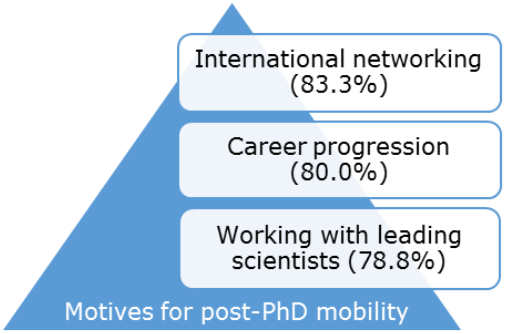
Enablers for international mobility

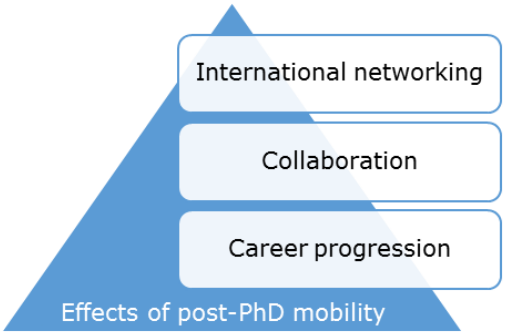




Drivers for international mobility







Strengths and weaknesses of the ERA (direct comparison)

Salaries

Availability of positions

Conditions for knowledge production (funding, career paths, teaching-research balance)

Social security

Quality of life (vs. US)

Education and training

HUMAN RESOURCES: GENDER EQUALITY

Like other literature on the topic, MORE3 finds that there is still a **gender imbalance** for researchers in the HE sector. In most of the EU28 countries female researchers, particularly in leading scientific positions, are still underrepresented and no improvement has been observed between 2012 and 2016. 41% of researchers are women in 2016, but in the R4 career stage this is only 25%. Indications that the glass ceiling continues to exist, are found from Eurostat data, She figures and the MORE3 findings. The fact that the distribution is more equal in younger career stages can either indicate the continuation of the glass ceiling, or point at improvements for future generations when the balance holds also in later career stages.

Other relevant findings show that:

- The share of female researchers with children is lower than the share of male researchers with children, especially in case of researchers with full-time positions. To a certain extent, higher shares of part-time working mothers than part-time working fathers are rooted in unequally distributed time spent on care work.
- Female researchers are less often satisfied with their environment for scientific knowledge production compared to men, particularly in case of the balance between teaching and research and the possibility to collaborate with leading experts. This hints at the need to further improve initiatives to facilitate female researchers focusing on their research, e.g. by teaching-free time periods awarding distinguished performance (also in teaching and assistance activities).
- In the EU28 female researchers are far less satisfied with social and job security than men, feel more often worse paid than their counterparts outside academia and more often report that they felt forced to move because there were no options for a research career in their home country. Country heterogeneity is high.

HUMAN RESOURCES: PHD TRAINING

PhD training remains the main point of entry into research careers, with 92% of academic researchers currently working in the EU holding a PhD or participating in PhD training. As a consequence, the quality and content of PhD training matters i) for attracting researchers into research careers; ii) for attracting talented researchers from abroad, as there is international mobility of talented students looking for the best training; and iii) for outcomes of research activity, such as scientific productivity in the EU, industry research performance and wider societal goals potentially affected by PhD training.

In spite of this universal role of the PhD, training structures and content differ considerably within the EU, as well as between the EU as a whole and non-EU countries such as the US. First, in terms of the **structure of PhD training**, PhD candidates in the EU as a whole describe that they are predominantly supervised by a single researcher (56%). Supervisory committees (29%) or doctoral schools (15%) remain a minority, by contrast with the US. Joint doctorates are much more common among researchers currently working in the EU (23%) than in the non-representative sample of researchers working outside the EU, reflecting the rich diversity of the EU doctoral programmes.

Second, in terms of the **content of PhD training** other than the core academic specialisation in a research field, we see that while 81% of EU researchers think that transferable skills have an important influence on career progression, only 33% of PhD candidates in the EU receive training in transferable skills. It focuses on skills more closely related to core research activities, such as research skills, communication and presentation skills, decision making and problem solving, and critical and autonomous thinking (73-90%). Skills such as engagement with society (46%) and entrepreneurship (38%) are less frequently part of transferable skills training.

This is consistent with **what PhD candidates think is important in their PhD training**: foremost research excellence (88%) and attractive working conditions for research (81%: e.g. research independence, career perspectives). Intersectoral collaboration and industry funding are least valued, at odds with the principles for innovative doctoral training, of which only 9% of R1 and 11% of R2 researchers are aware. PhD candidates' expectations are more likely more focussed on remaining in (academic) research, thus perhaps valuing less those skills more needed elsewhere.

Box 2: Main findings on PhD training

- *PhDs are main port of entry into research careers – their quality and content matters;*
- *Large heterogeneity at EU level in terms of structure and content of PhD studies; joint degrees are more common inside than outside the EU;*
- *Single researcher supervision dominates over more structured forms of training;*
- *Although seen as important for career progression, only a third of PhD graduates received training in transferable skills;*
- *Intersectoral mobility or industry exposure is seen as less important for PhD training than core research skills.*

In terms of policy, the high share of single researcher supervision and country heterogeneity with respect to the transparency and accountability of procedures for admission, supervision, evaluation and career development indicate that there is room for further professionalisation of PhD training in the EU, e.g. through introducing more structured PhD training. Given relatively low levels of structured training in many EU countries, increasing the budget for MSCA co-funding of doctoral programmes could be investigated.

While the Salzburg Principles mention that it is recognised that doctoral training must increasingly meet the needs of an employment market that is wider than academia, both PhD candidates' perception of what is important for PhD training and actual training indicate that training content further away from core research specialisation, such as opportunities for intersectoral mobility or exposure to industry is less valued. While structured training would also make it easier for programmes of industry-science mobility to be drawn up, **more research should illuminate the tension between the demands of academic excellence in basic research, requiring specialisation in research, and acquiring broader skills or more applied industry experience to keep labour market options open**. The role of industry-oriented doctorates as practiced by the European Industrial Doctorates, for example, in mitigating this tension could be further investigated.

Improved doctoral training can also be regarded as a key feature of country efforts to improve the effectiveness of their national research systems (ERA priority 1), to foster open labour markets (priority 3) and industry-science knowledge exchange (priority 5) as well as gender equality (ERA priority 4). Improving the quality of PhD training is likely to lead to inflows of early stage researchers into research careers. But during a further stage it may also lead to an increased outflow of talented young academics when career prospects and the general attractiveness of academic careers do not follow suit, as better trained PhD holders are then in a better position to access the global market for scientists. The next section will accordingly present findings of MORE3 on recruitment, career progression and career paths.

CAREER PATHS

After their PhD training, researchers often face country-specific recruitment and career progression procedures which lead to country-specific career paths and more generally structural differences between national higher education systems. The structure of career paths is a main determinant of the attractiveness of a research system, as it conditions career perspectives and time horizons for research agendas: short fixed-term contracts do not allow for pursuing long-term, risky research strategies. Previous research found that career perspectives, or more precisely career paths which lead to tenure based on merit only are the most important determinant of job choice in academia for early stage researchers.

A relatively high share of researchers agrees that their home institution practices open, merit-based and transparent recruitment, particularly with respect to sufficiently publicly advertised vacancies. However, as in PhD training, there are large country differences. While career paths are seen as relatively transparent on average (71%), in some countries there is a significant share of researchers who disagree on this. The assessment of merit-based career progression or merit-based tenure-contracts is less positive on average in the EU28 (65% and 64%), with more than 1 out of 3 researchers stating that it is not merit-based.

Box 3: Main findings on career paths

- *A majority of researchers in the EU think that recruitment and career progression is transparent and merit-based, however there is large heterogeneity between countries;*
- *Apart from research performance, international mobility and transferable skills are the main factors for recruitment and career progression; intersectoral mobility is less valued on average in the EU, with some heterogeneity;*
- *While a majority of researchers has open-ended contracts, different career systems give rise to different shapes of the "pyramid" – young researchers embarking on a research career in HE face different opportunities according to their national research systems, with problems ranging from "getting in" to "getting up".*

Positive factors for career progression are very similar to those for recruitment. On average in the EU28, researchers perceive international mobility (85%) and transferable skills (81%) as most positive for their career progression, while a mobility experience to the private sector is perceived to have the weakest positive impact (58%) and the highest negative impact (11%). In case of intersectoral and interdisciplinary mobility and alternative forms of research output (like project reports or grant writing) large country variations within the EU are observed. Within transferable skills seen as important for career progression in HEI, skills at the core of an academic research career are most valued, such as decision-making and problem solving, critical and autonomous thinking, communication and presentation, networking and grant and/or proposal writing (95%); entrepreneurship (67%) and dealing with IPR are on average deemed to be less important for career progression in a HEI.

Most of the researchers in the EU28 have a permanent or open-ended contract (72%). The share of researchers with permanent contracts is notably higher among male (76%) than among female (66%) researchers. Early stage researchers (career stages R1 and R2) are younger, more likely to be on a fixed-term contract, and are less satisfied with research autonomy; R3 and R4 are more likely to be on a permanent contract, male (share of female researchers in R1: 50%, in R4: 25%), and are more satisfied with research autonomy but also face higher teaching loads.

The combination of positions in the HE sector with positions in other sectors (e.g. private industry) is rare (3%), both in- and outside the EU, and again with slightly higher shares among researchers in higher career stages. MORE3 findings hence point to a rather slow emergence of new types of (academic) career paths in terms of more dual positions with industry, recognition of alternative research outputs or intersectoral mobility for recruitment and career progression.

Overall, 76% of EU researchers are confident about their future career prospects, with more male (80%) than female (69%) researchers feeling confident. Moreover, country differences are large. The share of researchers who lack confidence is the highest in the group of early-stage researchers, while established researchers show higher levels of optimism about their future.

In the EU28 it takes 17 years, on average, from the early career stage to become a leading scientist (R4). The early career stage itself (R1) takes on average 4.7 years. However, there is substantial variation across countries, particularly with respect to the length of time it takes to finish the first two career stages. The heterogeneity of higher education systems across the EU leads to heterogeneous careers, also affecting the distribution of researchers over the career stages R1-R4. It is natural for this distribution to take the shape of a "pyramid", with more researchers at early career stages than at later career stages as not everyone can become full professor. MORE3 indicates, however, in line with other research that the shape of the pyramid considerably differs between countries, e.g. as a consequence of the organisation of universities' working units as collegiate departments or hierarchical chairs. As a result, talented young researchers face different opportunities to embark on a successful academic career due to different structures of HE systems. In some research systems, the problem is more related to "getting in", while in others it is "getting up". Policy options for career systems will accordingly differ, accentuating different parts of a **tenure track system** which many researchers view as the most attractive career model. Both the probability of getting tenure and the path to the top of the career ladder matter considerably when academics make decisions about employment options. While the situation in Europe is changing, continued policy efforts are certainly necessary to improve career systems in particular for early stage researchers.

At the EU level, this also concerns funding for mobility and career perspectives (ERC, MSCA, etc.) in particular in countries where there is a lack of funding for mobility stints, as international mobility is very important for career progression and recruitment. Support for mutual learning - such as in the form of the policy support facility (PSF) which is specifically working to address the danger of divergence in research and innovation and also works on higher education and science system - continues to be crucial. Mutual Learning Exercises within the PSF could look at the question of attractive career paths for early stage researchers.

WORKING CONDITIONS

Once researchers have entered a research career, the working conditions in their job are crucial for their scientific productivity and for the decision to stay in research or take on another job. MORE3 conceptualises the main relevant working conditions to fall into one of three categories, namely:

- **Working conditions not directly affecting scientific knowledge production,** such as conditions relevant for extrinsic pecuniary motivations to engage in a research career (e.g. salary and pension entitlements), and working conditions affecting social and content-specific motivations of a research career. **Individual satisfaction** at work and with **social environment and recognition** are high (85%-95%), by contrast with remuneration (67%).

- **Working conditions affecting scientific knowledge production**, where satisfaction with the current position differs e.g. between research funding (42%), balance between time for teaching and research (67%), working with leading scientists (83%) and research autonomy (89%).
- **Working conditions relevant for both knowledge production and pecuniary motivations**, such as career and mobility perspectives, where 2 out of 3 researchers in the EU28 are satisfied with their current position (68% and 73%).

Overall, comparing all aspects of working conditions independent of specific career stages, researchers' satisfaction with funding, the balance between teaching and research and career perspectives is lowest. Working conditions which are crucial for deciding between jobs or for sustainably attracting early stage researchers into research careers are mainly those that are relevant for knowledge production, for doing research, and much less so material working conditions or quality of life. While salaries are ceteris paribus important, researchers are "willing to pay" – to give up salary – for working conditions which enable them to implement their research agenda. The attractiveness of research jobs is hence a result of factors influencing how well researchers can do their jobs, including among others the extent of research autonomy, the quality of their peers, their funding, the balance of time between teaching and research as well as long-term career prospects. By comparison with MORE2, there is a clear upward trend in the satisfaction with working conditions, particularly regarding employment aspects. However, there is a conundrum in that MORE3 indicates that a career in research entails very high levels of satisfaction with intellectual challenge and job-specific content at the same time as much lower satisfaction due to uncertain career perspectives, less satisfactory funding of research and the balance between time for teaching and time for research. The same pattern is found in the survey concentrating on researchers currently working outside the EU. This means that attracting more people into research careers – as it is an EU policy goal to tackle the challenges of more knowledge-based competition and the role of knowledge in fighting climate change, among others – is clearly linked to funding and career perspectives.

In terms of policy, MORE3 findings indicate that **research jobs are attractive by their nature** – intrinsically motivated researchers like what they are doing. This means that for research careers to be attractive, it is sufficient to provide good working conditions. Researchers are willing to trade material working conditions such as salary against working conditions for research, including research autonomy and funding, longer time horizons for their research agendas (in the form of long-term career perspectives), etc. Working conditions for research are hence drivers of attractiveness of jobs in research, more so than salaries, quality of life or other non-research related working conditions.

Moreover, as with career paths and recruitment, a picture of **heterogeneity** in satisfaction with working conditions emerges across the EU, although this time the fault lines are less related to different higher education systems, but rather to economic development and public budgets for research and research performance. On the assumption that real differences are at least partly responsible for these perceptions, this heterogeneity may impact on the completion of the single knowledge market in the EU and on the perspectives of achieving symmetric rather than asymmetric mobility of talented researchers in the EU (i.e. brain drain instead of brain circulation). Such heterogeneity can be addressed through general economic policies (e.g., through ESIF), through more research funding at the EU level, changing allocation modes of funding, best practice sharing and regular monitoring of developments in working conditions.

Box 4: Main findings on working conditions

- *Satisfaction with working conditions has improved overall, but there are strong differences: Individual satisfaction at work and with social environment and recognition are high, by contrast with remuneration and some working conditions affecting scientific knowledge production (research funding, balance between teaching and research, career perspectives);*
- *Research jobs are attractive by nature – researchers enjoy what they are doing. Increasing the attractiveness of jobs in research hinges as a result mainly on efforts to improve working conditions for knowledge production, such as research funding*
- *There is large heterogeneity at the EU level, less related to different career systems, but to economic differences which impact on research funding, remuneration and pension plans.*

INTERNATIONAL MOBILITY AND COLLABORATION DURING PHD

International mobility is generally considered a key dimension of international networking and knowledge exchange and circulation. Previous studies have focused on the analysis of the effects of international mobility on global competitiveness and innovation, and on the determinants of mobility of individuals. At system level, international mobility is related to the degree to which countries have a sufficiently large pool of researchers to develop innovative research and ensure the country's competitiveness in the medium and long-term. As such, these works are usually associated with concepts such as 'brain drain', 'brain gain' and, more recently, 'brain circulation"[7]. In this context, the MORE3 study contributes with a series of indicators on the international mobility of early career stage researchers as well as in post-PhD stage.

International mobility during PhD stage is considered an important asset for researchers' future careers. PhD mobility can also entail a positive choice for better suited training programmes. It is therefore also an indicator of attractiveness for PhD candidates. The MORE3 EU HE survey shows that **16%** of EU PhD candidates obtain their PhD in a country other than that of their citizenship (PhD degree mobility) and **18%** experience a move of more than 3 months to another country during their PhD (mobility during PhD). 70% of EU28 R1 and R2 researchers was not mobile for or during their PhD.

The largest shares for **PhD degree mobility** are found among researchers that are citizens from Romania, Greece, Iceland, Ireland, Malta and Cyprus (35% or more). This means, for example, that around 45% of all researchers with Romanian citizenship are mobile to obtain their PhD in another country than Romania. On the contrary, Belgian, Bulgarian and Swedish citizens are the least PhD degree mobile (below 6%), i.e. a large majority of Belgian researchers obtain their PhD in Belgium, etc. When looking at country of destination within the EU, PhD degree mobility is highest (in terms of shares) towards small, open countries (besides Luxembourg, also Malta, Switzerland, the Netherlands, Austria and Belgium).

[7] Thorn, K., & Holm-Nielsen, L. B. (2008). International mobility of researchers and scientists: Policy options for turning a drain into a gain. The international mobility of talent: types, causes, and development impact. In Solimano, A. (ed), The International Mobility of Talent, Oxford: Oxford University Press, p. 145-167.
Fahey, J. and Kenway, J. (2010) 'International academic mobility: Problematic and possible paradigms', Discourse: Studies in the Cultural Politics of Education, 31: 563–75.

For **moves during the PhD**, researchers who will/did obtain their PhD in Spain, Denmark and Italy are considerably more mobile during their PhD to another country than the EU average (between 40% and 60% compared with 18%). This means that the majority of the researchers - of any citizenship – working on a PhD in Spain, have a >3 months mobility experience outside Spain during their PhD.

Both for PhD degree mobility and during PhD mobility, we find a stable ranking of motives over time. Young researchers are driven by scientific knowledge production factors such as working with leading scientists, quality of training and education, career progression and international networking. This corresponds to the general vision that international PhD mobility is expected to have a positive impact on academic life and skills.

The barriers to PhD mobility, as perceived by non-mobile researchers, also are stable over time and comparable to the post-PhD mobility barriers. Emphasis is on personal or family related reasons (58%), the ability to obtain funding for mobility (44%) or for research (43%) and finding a suitable position (42%). This is consistent with the previous literature, which sees motivations related to boosting one's career as crucial for moving somewhere else, while personal or family reasons hold researchers back or lead to return mobility.[8]

Box 5: Main findings on international 'during PhD mobility'

- *PhD degree mobility is not often combined with mobility during PhD;*
- *Two thirds of EU28 R1 and R2 researchers was not mobile for or during PhD;*
- *Stable pattern and convergence in importance of the motives for PhD mobility: working with leading scientists, quality of training and education and career progression are the top 3 motives;*
- *Family status is an important determinant of the motives for mobility at PhD stage, but the importance of, for example, personal reasons, culture and international networking and availability is again reduced when the partner is also a researcher;*
- *Stable pattern of barriers to PhD mobility, with emphasis on personal reasons and finding positions or funding.*

INTERNATIONAL MOBILITY AND COLLABORATION IN POST-PHD STAGES

The MORE3 study also provides important insights into the evolution of international mobility and collaboration after the PhD. **The share of researchers that have engaged in long-term (>3 months) international mobility is relatively stable over time**: in 2012 31% of the researchers had undertaken this type of move compared to **27%** in 2016. As with PhD mobility, family status plays a role: the rate of international mobility is at 26% for researchers with children, versus 38% for researchers without children. International mobility is also less common in Southern and Eastern European countries, and reducing in some of the technologically-advanced Member States. This stability over time is also shown with regards to motives and barriers. Cross-time and cross-survey analysis of the motives and barriers for mobility reveals a very stable picture. In other words, independent of the type of international mobility the

[8] Franzoni, C., Scellato, G., & Stephan, P. (2012). Foreign-born scientists: mobility patterns for 16 countries. Nature Biotechnology, 30(12), 1250-1253.

general **motives** are the same: international networking, career progression and working with leading scientists. With regards to the **barriers** for mobility, it is observed that, even though funding and positions are not important motives for international mobility, the lack thereof does constitute the main barrier for international mobility:

- The EU HE survey indicates the most important barriers for the moves within the EU: finding a suitable position (38%), obtaining funding for research (38%) and obtaining funding for mobility (36%);
- The Global survey shows that EU researchers find the following barriers when trying to return to Europe: finding a suitable job position (74%), obtaining funding for mobility (73%), and obtaining funding for research (72%).

The MORE3 study also points at interesting insights with respect to **forced mobility**; that is, the extent to which researchers feel forced to move to another country. 16% EU researchers have felt forced to move to another EU country. 9% of the mobile researchers indicated that they felt forced to move because there were no options for a research career in their home country. Another 7% felt forced because international mobility is a requirement for career progression in their home country. This is even more acute among earlier career stage researchers (R2: 23%, R3: 15%, R4:16%). Among the researchers working outside Europe, the Global survey indicates 28% of them had experienced this type of forced mobility, but the share reaches 37% of the EU researchers currently working outside the EU - mostly due to lack of career opportunities.

Effects of mobility are in line with the motives for mobility: the main effects are international networking, collaboration and career progression. This pattern is also stable over time and overall positive for all types of effects. For researchers in earlier career stages, effects on skills and job options in academia are more important, while R4 researchers experience stronger effects on their academic output.

Box 6: Main findings on international post-PhD mobility

- *Long-term mobility is less common in southern and eastern European countries and reducing in some of the technologically-advanced Member States;*
- *The long-term mobility of female and male researchers is converging but family composition still matters;*
- *16% of European researchers have felt forced to move to another EU country;*
- *R2 researchers more frequently forced to move;*
- *International networking, career progression and working with leading scientists are the major drivers for mobility within the EU;*
- *One out of three non-European researchers indicates that obtaining a visa was a significant barrier to undertaking a long-term move to the EU;*
- *R2 researchers tend to encounter more barriers to long-term mobility than R3 and R4 researchers ;*
- *Personal and family reasons are the most important motives to decide not to move, to a greater extent than in 2012 (77% in MORE3 compared to 67% in MORE2);*
- *Effects of international mobility are positive and reflect the main motives.*

These findings are in line with the literature – researchers move to improve their career, and stay or come back more for personal reasons, or for lack of funding and position. Improving scientific knowledge production factors will hence create motives or incentives to move to a country in the first place – they are drivers of mobility. Reducing barriers to mobility will enable such mobility, so that increased research funding and the availability

of suitable positions are also enablers of mobility[9]. By thus **fostering voluntary international mobility**, which is the type of mobility driven by and resulting in international collaboration and networks, knowledge circulation is further enhanced in the EU.

INTERDISCIPLINARY MOBILITY AND COLLABORATION

Interdisciplinary mobility and collaboration, understood as working in another discipline and working with researchers from other disciplines respectively, have been said to foster certain skills that are of key importance for researchers today. Entrepreneurial skills[10], an increased ability to effectively communicate beyond the frontiers of one's own field, and a greater capacity of adaptation to ever-changing environments are some of the advantages related to this type of mobility.

- The MORE3 EU HE survey shows that **34% of the researchers working in the EU have switched to another (sub)field of science** in their research career. Furthermore, this survey indicates that researchers in the EU tend to think that this type of mobility is a positive factor for recruitment and career progression (74% respectively).
- With respect to interdisciplinary collaboration, **60% of the researchers in the EU collaborate with other researchers working in other disciplines within the same institute** and 57% in other universities or research institutes, versus 31% in the non-academic sector.

One limitation for the development of policies pursuing interdisciplinary careers is the absence of a clear-cut definition of interdisciplinarity, susceptible of being applied across career stages and fields of science. The findings of this report suggest that further research is needed in this area in order to be able to measure its impact as well as to allow for the design of effective policies.

Box 7: Main findings on interdisciplinary mobility and collaboration

- *More than one third of all researchers have switched to another field or subfield during their academic career, but they are less confident about the effects thereof than their non-interdisciplinary mobile colleagues;*
- *Below average shares* of interdisc*iplinary collaboration are observed in Social Sciences and Humanities (SSH).*

INTERSECTORAL MOBILITY AND COLLABORATION

Mobility between different research sectors, such as between the academic and industrial sector – or others, such as not-for-profit – is crucial for the exchange of ideas, for exploiting knowledge and more generally for innovative capability. Intersectoral mobility is even more important when the business sector becomes more R&D intensive. This dimension of mobility is strongly related to what has been called the "European paradox"; that is, the difficulties faced in Europe "to sufficiently turn research results into

[9] Note that research funding affects of course also scientific knowledge production, it is however not a main motive to become mobile.

[10] The State of the Innovation Union 2011 report: http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2013/state_of_the_innovation_union_report_2013.pdf

globally competitive products"[11]. The fact that there were not enough researchers working in the industry has been pointed out as one of the reasons behind this "European Paradox", and as something that was also hindering European economic development and innovation[12].

The EU lags behind the US and Japan with respect to the number of researchers employed in the private sector[13] and the employment of doctorate holders in the business sector remains low in comparison with these economies[14]. Eurostat data indicate that 42% of EU researchers work in the private sector. **The MORE3 EU HE survey indicates that 25% of R2, R3 and R4 researchers (that currently work in a HEI) moved to another sector during their research career.** This is a decrease from 30% in 2012, mainly due to a decrease of moves to the public sector. 18% moved at least once to the private sector (8% to large firms, 4% to SME or start-up and 6% to not-for-profit).

Networking is still the most important motive for working outside academia, regardless of the destination sector (70% of the cases), but motives differ across sectors of destination. For instance, while having first-hand experience with industry is the most frequent motive among those having had an experience in large companies and SMEs, contributing to society is the main driver for those moving to the private, not–for-profit sector. This indicates that future policy instrument to encourage intersectoral mobility would ideally need to take into account researchers' motivations.

Six out of ten researchers consider that intersectoral mobility is positive for recruitment or for career progression. It thereby lags behind international and interdisciplinary mobility. Having been intersectorally mobile does not imply a more positive view on the effect of this type of mobility on these aspects. A less positive view on the effect of this mobility is found outside Europe: the Global survey shows that only 29% of the researchers see this type of mobility as positive for recruitment and 37% for career progression.

When looking into intersectoral collaboration, the MORE3 EU HE survey indicates that 35% of researchers working in HEI collaborate with researchers in non-academic sectors. It is more common in later career stages (47% in R4), for male researchers (39%) and less common in SSH fields (26% in Humanities and 29% in Social Sciences).

[11] European Commission (2006), Mobility of Researchers between Academia and Industry. 12 Practical Recommendations. http://ec.europa.eu/euraxess/pdf/research_policies/mobility_of_researchers_light.pdf
[12] Vandevelde, K. (2014). Intersectoral Mobility. Report from the 2014 ERAC mutual learning workshop on Human Resources and Mobility.
[13] Vandevelde, K. (2014). Intersectoral mobility. Report from the 2014 ERAC mutual learning workshop on Human Resources and Mobility.
[14] OECD (2010), Careers of Doctorate Holders dataset. www.oecd.org/sti/cdh

Box 8: Main findings on intersectoral mobility and collaboration

- *18% of the post-PhD researchers who currently work in European HEI have at least once moved to the private sector;*
- *Even though intersectoral moves do not appear much appreciated in recruitment or career progression, networking is still the most important motive to engage in an experience in another sector;*
- *35.5% of researchers collaborate with non-academic sectors, 16% see their move as a result of international mobility.*

ATTRACTIVENESS OF THE ERA

When knowledge is the principal factor behind competitive advantage, leading to increasing competition for talented knowledge workers, the attractiveness of research areas is crucial for sustainable and dynamic knowledge economies. Attractiveness of postgraduate research jobs is a result of the structure of recruitment, career paths and the quality of working conditions. The attractiveness of research areas is also determined by the attractiveness of PhD studies. International or intersectoral mobility may be driven by perceptions of varying attractiveness. In turn, mobility indicators, e.g. in terms of which countries researchers choose for their international mobility experience, can also be interpreted as indicators of attractiveness, and mobility perspectives influence working conditions as they enable international collaboration, a driver of scientific productivity. Attractiveness is driven by research job characteristics influencing a researcher's scientific productivity, such as research autonomy, career perspectives and working with high quality peers. "Material" working conditions related to remuneration, pensions and job security and other non-science related conditions influence job choice ceteris paribus, but are not decisive factors for job or mobility decisions.

Career perspectives are cross-cutting working conditions, as they influence both financial conditions and scientific knowledge production and therefore have an impact on setting time horizons for long-term research agendas. Long-term research agendas are more conducive to fundamental breakthroughs than research agendas limited by fixed-term contracts. Career perspectives are particularly important to early stage researchers, for whom a performance-based model ("tenure-track" versus a seniority-based model) can make a significant difference to their careers. **MORE3 presents findings on the attractiveness of the EU based on of survey questions asking EU and non-EU researchers to directly compare the EU with non-EU research systems on a number of such determinants of attractiveness**, more precisely in terms of working conditions for research, material working conditions and cross-cutting working conditions, as well as in terms of a range of additional characteristics such as ease of industry collaboration.

The main insights are that:

- The more advanced the non-EU research system that researchers come from or in which researchers have worked, the less positive the EU is seen as a place to do research;
- The EU's strong points are perceived within **material working conditions**, such as social security, job security, quality of life (vs. the US, but not overall) and pension plan (not for salaries) and within **education and training**; the weak points are perceived particularly with regard to **attractive career paths**, and to a certain extent also with regard to the **availability of suitable positions.**

- Within the group of EU researchers currently abroad, researchers in the US perceive the US to be a much better place to do research, with the exception of social and job security as well as quality of life. Within the group of non-EU researchers currently working in the EU, researchers from associated EU-countries – Iceland, Norway and Switzerland – perceive the EU on balance to be much worse than their countries of citizenship. This is in line with university rankings and research performance indicators, where the US and Switzerland as one of the three EU Associated Countries regularly get top spots.
- Within the EU, there is strong heterogeneity. Researchers who have been mobile outside the EU and who are now working in Eastern and Southern Europe find it relatively more attractive to work outside the EU than inside than researchers from Western and Northern Europe. This indirectly reflects on the attractiveness of their current countries of employment.

In a nutshell, **key career-related job characteristics or characteristics influencing researchers' productivity are perceived to be better on balance in a number of economically advanced countries with strong research systems, than in the EU**. The EU is seen to be better for quality of life and job/social security. The MORE surveys show that career-related aspects are decisive factors for researchers to move away from their home country (e.g. independence, working with leading scientists and attractive career paths), while they move back for personal or family reasons. Barriers to mobility are related to research and mobility funding, the availability of positions and issues such as portability of pensions.

This general finding means that the current advantages of the EU in terms of quality of life and job characteristics related to social and job security work less as drivers of attractiveness than characteristics which influence the scientific productivity of researchers and where the advantages of the EU are less clear cut, again depending on the strength of the research system the EU is compared with. The survey results therefore show a clear opportunity for the EU to strengthen its attractiveness as a place to do research through improving conditions for scientific knowledge production. Many policies at the EU, national and regional level address the factors that are potentially relevant for attractiveness. This has been presented in the first part of the executive summary. In the following we present MORE3 findings on the role of EU funding and on the availability of positions (the EURAXESS jobs portal) for attractiveness.

The two most important barriers to mobility are the availability of a suitable position and availability of research funding. EURAXESS and EU research funding can, as a result, play a potentially very important role as **enablers** of mobility or of attractiveness, of course next to instruments at the national level, as they directly address the availability of positions and research funding. MORE3 findings indicate that EU instruments manage to reach their intended target group. EU funding and EURAXESS can therefore in principle contribute to the foundation of attractiveness in terms of enabling mobility to the EU – or preventing forced outward mobility of talents - if researchers want to come to the EU in the first place. Both in terms of awareness, e.g. for non-EU researchers who were not mobile to the EU, but also in terms of actual usage, there is however room for improvement. There are, for example, high levels of general interest by non-EU researchers in EU research funding, but a frequently indicated barrier to accessing it is the lack of knowledge about specific EU research programmes.

Box 9: Main findings on attractiveness of the ERA, based on a direct comparison of systems

- *The EU's strong points are encompassed within material working conditions, such as social security, job security, quality of life (vs. the US, but not overall) and pension plan (not for salaries) and within education and training; the weak points are related to attractive career paths, and to the availability of suitable positions;*
- *Key characteristics influencing researchers' productivity are perceived to be better on balance in a number of countries with strong research systems, than in the EU;*
- *The current advantages of the EU in terms of quality of life and job characteristics related to social and job security work less as drivers of attractiveness, than characteristics which influence the scientific productivity of researchers and where the advantages of the EU are less clear cut;*
- *Euraxess and EU research funding address the two most important barriers to mobility and can as a result play a potentially very important role as enablers of attractiveness, but there is room for increased use.*

Table of Contents

Part 1 Study, policy context and concepts

1. Introduction

1.1. Objectives of the MORE3 study

The MORE3 study, entitled "support of data collection and analysis concerning mobility patterns and career paths of researchers", is carried out under the framework contract "provision of services in the field of research evaluation and research policy analysis" Lot 2 "Data collection and performance indicators to monitor the European Research Policy". It foresees **to update, improve and further develop the set of indicators** of the MORE2 study in order to meet the need for indicators over time and assess the impact on researchers of policy measures introduced for the development of an open labour market for researchers. The MORE3 study provides new surveys and thus new indicators to meet emerging policy needs and priorities.

The main objective of the MORE3 study is defined as:

"***Carrying out two major surveys and developing indicators to help monitor progress towards an open labour market for researchers"***

For this, four tasks are identified:

V. Carry out a survey of researchers currently working in the EU (and EFTA) in higher education institutions (HEI) regarding their mobility patterns, career paths, employment and working conditions (Task 1);

VI. Carry out a global survey of researchers currently working outside Europe regarding their mobility patterns, career paths and working conditions (Task 2);

VII. Update the set of internationally-comparable indicators on researchers (Task 3);

VIII. Draft a final report that provides a comparative, policy-relevant analysis of the mobility patterns, working conditions and career paths of researchers (Task 4).

This report is the Final Report of the MORE3 study. It presents the final results of Task 4, the comparative analysis of all findings in the MORE3 study, including the EU Higher Education survey (Task 1), the Global survey (Task 2), and the indicator framework based on existing data (Task 3). Further, it provides a policy-relevant analysis by reflecting on existing policy aims and the lessons that can be drawn from the comparative analysis in MORE3 for the policy discussion.

1.1. Acknowledgements

The present report has been prepared by:

- Miriam Van Hoed (IDEA Consult, Belgium)
- Annelies Wastyn (IDEA Consult, Belgium)
- Lidia Nuñez (IDEA Consult, Belgium)
- Jürgen Janger (WIFO, Austria)
- Agnes Kügler (WIFO, Austria)
- Anna Strauss (WIFO, Austria)
- Nikos Maroulis (Technopolis Group, Belgium)
- Viola Peter (Technopolis Group, Belgium)

Comments on a draft version of this report have been received from Vincent Duchêne (IDEA Consult, Belgium, project director), Sybille Hinze (DZHW, Germany), Vitalis Nakrosis (PPMI, Lithuania) and Lena Tsipouri (University of Athens, Greece). We thank them all for their valuable input and recommendations for this report.

The report is based on information collected through two surveys and desk research. This information collection has been the result of coordinated work of:

- The partners within the MORE3 consortium:
  - IDEA Consult (Belgium);
  - WIFO (Austria);
  - Technopolis Group (Belgium).
- Subcontractors and experts:
  - Leopoldo Nascia (sampling strategy expert, Italy);
  - Michael Thelwall (University of Wolverhampton, UK);
  - Interago (CATI and CAWI survey techniques, Italy);
  - Loft33 (website development, Belgium).
- The Quality Assessment Team:
  - Anna Currado (proofreader, UK);
  - Julie Callaert (Incentim, Belgium);
  - Zeynep Esra Tanyildiz (Georgia State University, United States);
  - Sybille Hinze (DZHW, Germany);
  - Stefan Kuhlmann (University of Twente, STePS, The Netherlands);
  - Vitalis Nakrosis (PPMI, Lithuania);
  - Lena Tsipouri (University of Athens, Greece);
  - Bart Van Looy (Incentim, Belgium).

The design of the study and questionnaires have been a result of coordinated work led by IDEA Consult. The EU Higher Education (HE) survey in Task 1 and the Global survey in Task 2 have been carried out by IDEA Consult and WIFO. The collection of Indicators on researchers from existing sources has been carried out by Technopolis Group.

Comments received from Emiliano Carozza (EC, DG RTD) and the steering committee with respect to this report, but also during the whole project, are gratefully acknowledged.

1.2. Guide to the structure of the report

In remainder of Part 1 of the report, we summarise the relevant policy context for the study (section 2) and we resume the general conceptual framework of the MORE3 study according to which the analysis is structured and the results are discussed (section 3).

In the Part 2 of the report, we elaborate on the results of the MORE3 study. The sections are structured according to the conceptual framework of the study:

- Section 4 - Human resources: researchers
- Section 5 - Human resources: PhD training
- Section 6 - Recruitment, career progression and career paths
- Section 7 - Working conditions
- Section 8 - International mobility during PhD stage
- Section 9 - International mobility after PhD stage
- Section 10 - Other forms of international exchange: short-term mobility, collaboration, virtual mobility, conferences
- Section 11 - Interdisciplinary mobility and collaboration
- Section 12 - Intersectoral mobility
- Section 13 - Attractiveness of the European Research Area

Each time, we present in the first subsection the key findings and results of a comparative analysis between the EU HE survey, Global survey and Indicators report on

researchers. Then, in the second subsection, these findings are situated in the policy context and used to discuss policy relevant questions.

Part 3 of the report first summarises the overarching policy implications of the study, including the general state of play, an overview of the policy implications for the two main areas of the study: attractiveness of the ERA and optimal exchange and circulation, as well as for three overarching topics: gender, heterogeneous patterns in the EU and reflections on the current policy instruments.

In the Annexes more details are provided on the conceptual framework (Annex 1) the survey methodology (Annex 2 and 3), the questionnaires (Annex 4) and a number of additional tables and figures (Annex 5).

Before elaborating on the conceptual framework and results of the study, we briefly present a guide on the interpretation of the results, including a discussion on the quality of the different data sources and caveats in the interpretation thereof.

1.3. Guide to the interpretation of the results

The MORE3 project included several sources of evidence. Data from each of them were collected through different approaches. The interpretation of the results should take these factors into consideration.

It is important to note that the MORE3 EU HE survey was designed to offer maximum accuracy at both EU and individual country level. The MORE3 Global survey follows a convenience sampling. As such although this survey is not designed to offer representative data at country level, it offers relevant insights on a number of policy-relevant issues related to European researchers currently working outside Europe.

The following paragraphs present in more detail the main characteristics of the data analysed in the MORE3 project and presented in this report and the caveats for their interpretation.

THE MORE3 EU HIGHER EDUCATION (HE) SURVEY

The MORE3 EU Higher Education (HE) survey is the most important source of information. Most of the findings described in this report refer to this survey. The survey was administered in 31 European countries (the 28 Member States of the European Union and 3 Associated Countries: Iceland, Switzerland and Norway) through CAWI (Computer-assisted web interviewing) and CATI (Computer-assisted telephone interviewing) techniques.

The sampling process was developed to provide estimates on researchers in the EU28+3 HE sector with maximum accuracy at both EU and individual country level[15] (5% max error -p value of 0.05) and including a stratification by fields of science (FOS). The total sample included 10,394 respondents.

[15] If the survey was to be repeated a hundred times, in 95 cases the outcomes at country level would be deviating no more than +/-5% from the outcomes of the MORE3 survey (5% max error -p value of 0.05).

- **Margin of Error:** In most countries the number of validated questionnaires achieved a margin of error of 5.5%; in four countries a margin of error between 5.5% and 6% was achieved and for one country a 6.5% error was achieved. Overall, the response rates are more equally distributed across countries than in MORE2.
- **Comparability with MORE2 estimates**: This was one of the main goals when designing the approach and developing the questionnaire in MORE3. For this reason, the sampling approach and data editing approach is the same as in MORE2 (more information on this is presented in Annex to this report and in the MORE3 EU HE report). The implementation was improved based on the lessons learned in MORE2. This means the methodology is the same, but better results in terms of accuracy are obtained (i.e. closeness of the estimates to the real values). The key questions, and with them the majority of the questionnaire, are the same as those applied in MORE2, but also here improvements were implemented (cf. MORE3 EU HE report for more details).
- **Cross-sectional surveys:** It is important to stress the fact that the two studies do not follow a panel design. This entails that MORE2 and MORE3 are independent from each other in the sense that the two surveys do not by definition follow the same individuals over time. Nevertheless, the possibility that the same researcher has replied to both MORE2 and MORE3 is not excluded.
- **Head Count (HC)-based estimates:** All estimates are expressed in terms of HC only and correspond to the above-mentioned accuracy level.
- **Career stage estimates:** Caution is also needed in the interpretation of the career stage estimates. The information on career stages is based on a survey question (self-selection by the researchers). The distribution over career stages can therefore not be considered without bias. However in annex to the MORE3 EU HE report, post stratification weights by career stage were applied to test the bias related to the fact that the data included lower shares of R1 researchers compared to the data published by Eurostat. In general, the results were minimally affected by this bias.

In general terms it is also important to stress that when results refer to 'country' without further specifications, the results are based on the country included in the panel (i.e. the country used in the sampling strategy and equal to the country of current employment). In other cases it is specifically mentioned that the analysis is based on another point of reference, e.g. country of Phd/graduation, country of citizenship, etc.

THE MORE3 GLOBAL SURVEY

The sampling approach for the Global survey is characterised as 'convenience' sampling (similar to the MORE2 Extra-EU survey[16]). This approach was selected due to the absence of internationally comparable data of the population of researchers worldwide. This entails that, contrary to the MORE3 EU HE survey, no information on the population of researchers was considered in the sample design or the sample validation processes. Instead, a multichannel approach was applied to identify researchers working outside the EU: first, through a web-based contact collection approach; second, through the Euraxess Links (Officers) and, third, through an open communication strategy where a non-personalised link to the online survey was distributed on the MORE3 website, EC websites and via intermediary organisations.

[16] IDEA Consult et al. (2013) Support for continued data collection and analysis concerning mobility patterns and career paths of researchers. EXTRA-EU report.

As indicated, this Global survey does not provide representative data at the level of the countries covered, or their mobility patterns from and to specific countries. This sample does not reflect the proportion of researchers currently working outside the EU within the overall population of researchers currently working outside the EU. Therefore, results need to be interpreted with care and no generalisations/extrapolations can be made in this regard. Its value lies more in contextualising the MORE3 EU HE results and further suggesting trends and hypotheses to be tested with future surveys.

INDICATORS REPORT ON RESEARCHERS

The third source of evidence analysed in this report comes from the MORE3 Indicators report on researchers. This report gathers data from different (existing) sources and elaborates indicators at country level for the main dimensions covered in MORE3 project: human resources; working conditions; career paths; international, intersectoral and interdisciplinary mobility; and the attractiveness of the ERA.

The sources used in the elaboration in these reports are the following:

- MORE2/MORE3 figures;
- Eurostat;
- SHE Figures;
- EURAXESS;
- SCOPUS.

The underlying report integrates the findings from these three tasks in the MORE3 study in a comparative and policy-relevant analysis. The following sections provide a brief introduction to the policy context of the study (section 2), and how this is reflected in the conceptual framework of the study (section 3), before going into detail on the findings (sections 4-13).

2. Policy context

In this section two policy actions are briefly highlighted that are particularly relevant to the design and interpretation of the MORE3 survey results. First, Open Innovation, Open Science and Open to the World are discussed as basis of the European Commission's current research and innovation policy. Second, the European Research Area (ERA) process is mentioned as an overarching policy aim that determines the context of the MORE3 results.

2.1. The three Os: Open Innovation, Open Science and Open to the World.

Commissioner for Research, Science and Innovation, Carlos Moedas, has set out the three O's as a next chapter in the ERA and Innovation Union policy[17]: Open Innovation, Open Science and Open to the World. Each of these are regarded as strategic priorities to foster research and innovation in Europe for the years to come[18].

2.1.1. Open innovation

Chesbrough (2006) stated that "[a]*t its root, open innovation assumes that useful knowledge is widely distributed and that even the most capable R&D organisations must identify, connect to, and leverage external knowledge sources as core process in innovation*"[19]. Innovation is no longer regarded as the result of the efforts of a single organisation, but rather as 'the outcome of a complex co-creation process involving knowledge flows across the entire economic and social environment'[20]. The Commission, in line with the academic research to date on open innovation, states that innovation needs to be 'user-centric': "*an invention becomes an innovation only if users become a part of the value creation process*"[21]. User-centric innovation seems to increase social welfare and is one of the aims of the Responsible Research and Innovation[22] programme in Horizon2020 - to foster public engagement in innovation.

The MORE3 EU HE survey covers a number of issues related to the Open Innovation axis, focusing on the interrelation between academic researchers on the one hand and research in private sectors, collaboration with and working in other disciplines and other actors in society, etc. As such, it sheds light on a crucial aspect of Open Innovation; that is, the openness of organisations to attract knowledge and skills from different sectors. In this respect, it also analyses the impact of a series of factors related to Open Innovation on researchers' career paths, such as the role of transferable skills and access to research funding.

---

17 Speech of 22 June 2015. http://europa.eu/rapid/press-release_SPEECH-15-5243_en.htm
18 Open Innovation, Open Science, Open to the World - a vision for Europe. Directorate-General for Research and Innovation. May 2016.
19 Chesbrough, H., Vanhaverbeke, W., & West, J. (Eds.). (2006). Open innovation: Researching a new paradigm. OUP Oxfoapprox.
20 Open Innovation, Open Science, Open to the World - a vision for Europe. Directorate-General for Research and Innovation. May 2016
21 Ibid.
22 http://ec.europa.eu/research/innovation-union/pdf/b1_studies-b5_web-publication_mainreport-kt_oi.pdf#view=fit&pagemode=none

2.1.2. Open science

The generalisation of Big Data and digital technologies is profoundly altering the way research is being done. The European Commission funded project 'FOSTER' (e-learning platform to Facilitate Open Science Training for European Research) defined Open Science as: *"the practice of science in such a way that others can collaborate and contribute, where research data, lab notes and other research processes are freely available, under terms that enable reuse, redistribution and reproduction of the research and its underlying data and methods"*[23]. In other words, Open Science involves Open Access, Open Data, Open Source and Open Reproducible Data and shares with these concepts the principles of transparency, universal accessibility and reusability of the scientific information disseminated via online tools[24]. Open Science also goes beyond results and methods - it affects each step of the scientific process. The aim is therefore to use technological improvements and cultural changes as a basis to foster collaboration and openness in research[25].

Regarding the dimensions analysed in the MORE3 surveys, there is one aspect of Open Science that directly concerns researchers' careers: how activities under Open Science (e.g. data curation) can be recognised and considered in recruitment and career progression, without being an additional stress factor for (young) scientists. Transparency and merit-based research careers remain important in this sense. Also (transferable and alternative) skills training and new ways of collaborating are addressed in the MORE3 survey. Virtual mobility, interdisciplinary mobility and collaboration with non-researchers directly relate to these aspects.

2.1.3. Open to the world

The EC sees international cooperation and the commitments that derive from it as a valuable source of knowledge and, hence, of innovating solutions to tackle current and future world-wide challenges. Science and researchers are no exception to this objective. In this context, the EC has introduced a global dimension into its researcher-oriented actions. In order to foster international cooperation among researchers, the EC aims at lowering the barriers to mobility in several dimensions: lowering administrative barriers ensuring reciprocal access to programmes and the development of efficient and fair intellectual property rights systems. To this end, the focus has been put on developing a Global Research Area which follows the example of the ERA in articulating a system of collaboration across borders and disciplines at a world-wide level.

Several sections of the MORE3 project are directly related to the Open to the World dimension of the EC's priorities, in particular the international dimension of mobility and collaboration but also the indicators on the attractiveness of the EU as a research environment. Next to the survey in Higher Education in Europe, the Global survey of researchers currently working outside Europe (Task 2 of the MORE3 study) regarding their mobility patterns, career paths and working conditions' sheds light on the perceptions of three important groups: European researchers working outside Europe, non-Europeans who have never worked in Europe and non-Europeans who have worked in Europe before. Finally, the set of internationally-comparable indicators on researchers (Task 3 of the MORE3 study) contributes to monitor the evolution of the policies that have been carried out or introduced since MORE2 in what concerns the position of Europe in the world and its openness to third countries and organisations.

---

[23] https://www.fosteropenscience.eu/foster-taxonomy/open-science-definition
[24] *Pontika, N., P. Knoth, M. Cancellieri, S. Pearce (2015) Fostering Open Science to Research using a Taxonomy and eLearning Portal.*
[25] Open Science. https://ec.europa.eu/digital-single-market/en/open-science

2.2. The European Research Area

The **European Research Area** concept was introduced in the 2000 Communication 'Towards a European Research Area'[26] and endorsed by the Lisbon European Council. The primary objective was to create a "*unified area, open to the world, based on the internal market in which researchers, scientific knowledge and technology circulate freely and through which the Union and its Member States strengthen their scientific and technological bases, their competitiveness and their capacity to collectively address grand challenges*".[27] The underlying motivation of this concept was that in order to remain competitive at the global level, Europe needed to increase the number of researchers and foster the quality of research outputs.

One of the major requisites to create a critical mass of researchers that could impact Europe's role in global competition was and is the need to create an 'internal market' of researchers. By lowering the barriers to free movement, and by promoting the coordination of programmes, research activities and policies at the EU level, the creation of this internal market will lead to an increase of knowledge and technology circulation across Europe. This internal market encompasses measures to promote transnational mobility, fostering interdisciplinary collaboration and encouraging collaboration and movement between the public and private sectors. In this sense, removing the barriers to free movement does not only include those administrative or financial obstacles that hinder researchers' mobility both within and across countries, but also involves improving the working conditions for men and women. From the side of research institutions and private sector, the ERA encourages the use of fair, open and transparent recruitment at Higher Education Institutions (HEI).

The ERA and the aims associated with it are pursued and reinforced up to the present day. The ERA was **further anchored in the EU2020 strategy**[28], as a cornerstone of the **Flagship Initiative "Innovation Union"**, and reaffirmed later on in the 2012 Commission Communication 'A Reinforced European Research Area Partnership for Excellence and Growth'.[29] In this communication, measures for a more efficient and effective public research system were defined in view of the completion of the ERA by 2014. The measures envisage increased cooperation to reduce duplication of research efforts and increased competition to ensure that the best researchers and teams receive funding and can compete in the global research landscape. Six key priorities were put forward:

1. More effective national research systems;
2. Optimal transnational cooperation and competition;
3. An open labour market for researchers (facilitating mobility, supporting training and ensuring attractive careers);
4. Gender equality and gender mainstreaming in research;
5. Optimal circulation and transfer of scientific knowledge;
6. International cooperation.

The progress towards completing the ERA is monitored regularly in the ERA Progress Reports. The latest ERA Progress Report dates from 2016[30] and concluded that progress had been made on all five key priorities, but that still more efforts were needed to

[26] COM(2000) 6
[27] http://ec.europa.eu/research/era/pdf/era-communication/era_what-why-when.pdf
[28] COM(2010) 2020
[29] COM(2012) 392 final
[30] COM(2014) 575 final
http://ec.europa.eu/research/era/pdf/era_progress_report2014/era_progress-report_150521.pdf

address specific issues and disparities between countries. National research systems had become more aligned to the ERA priorities; scientific international cooperation and coordination in addressing the grand challenges were increasing; and there were improvements in terms of open, transparent and merit-based recruitment in view of creating an open labour market for researchers. Many initiatives have been launched to address gender issues and this increases the expectations over their outcome in the coming years. At the same time the EC acknowledges that digitalisation and development of global networks constitute important challenges for the future development of the ERA.

3. Conceptual framework

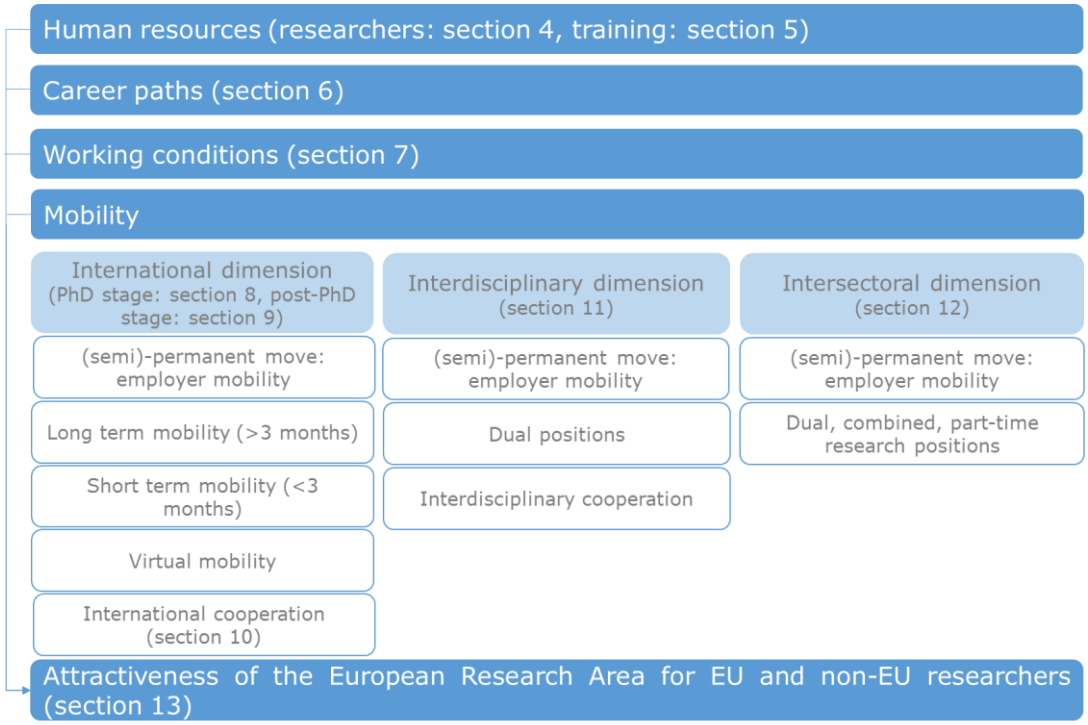
Within the context of these policy developments, the conceptual framework defines and structures a set of overarching concepts that were applied consistently in the four different tasks of the MORE3 study. It is as such a tool that structures the concepts and guides the analysis and synthesis of the findings in each of the tasks in this final report. The conceptual framework is also strongly based on the framework in the MORE2 study (2012) for reasons of consistency and comparability.[31]

In our conceptual framework, human resources are the starting point, as the stock of human resources is basically our population of interest. Career paths of researchers can be seen as an important element of working conditions of jobs in research; taken together both are important factors which influence the various forms of mobility, e.g. taking the next career step may necessarily involve international mobility to gain access to international networks, or bad working conditions may drive researchers away to other countries within the same sector or to other sectors within the same country. Perspectives for international mobility may also be seen as part of the working conditions of a job, as they influence potential international collaborations which are associated with scientific productivity. The quality of doctoral training, working conditions and career paths determine to a large extent the attractiveness of the European Research Area for EU and non-EU researchers, whereas different forms of mobility can inter alia be seen as indicators for issues of attractiveness.

Generally, the MORE framework brings together the variables and indicators at three different levels: human resources and working conditions relate to the system and organisation level, career paths and mobility fit in the individual researcher perspective and the attractiveness of the ERA corresponds to the system level.

[31] IDEA Consult et al. (2013) Support for continued data collection and analysis concerning mobility patterns and career paths of researchers. FINAL REPORT (deliverable 8).

Figure 1: Conceptual framework for the MORE3 study



Source: MORE3 based on MORE1, MORE2 and literature review

Annex 1 further defines all concepts and indicates the evolution in the framework compared to the MORE2 study. In the following paragraphs, the conceptual framework is framed within the policy context and the policy instruments which support the different concepts. This contextualisation of the framework allows identification of the policy-relevant analyses needed to provide relevant and evidence-based input into the policy discussion on each of these points.

As described in section 2 on the policy context, the ERA roadmap is a crucial contributor to the overarching goals of open science, open innovation and open to the world (cf. ERA Progress Report 2016: *"A successful ERA will lead to Open Innovation, Open Science and Open to the World"*). In view of the grand challenges ahead, the EU has identified a number of policy lines in which the research area plays an important role. The 6 priorities of the ERA roadmap are put forward to develop an area where researchers move, collaborate and exchange without barriers and where the full research potential of the European Union is deployed. This is presented in the top part of the figure below as strategic and operational policy goals.

The realisation of ERA is the main operational policy goal. The policy lines under this operational EU policy goal can be divided into two broad – and interrelated - categories (yellow boxes in the figure below):

- The first category is the attractiveness of career paths of researchers, aiming to reach the full potential of the research base in Europe in terms of number of researchers, gender balance, attracting young researchers to the profession, etc.
- The second category is the optimal exchange and circulation of knowledge, aiming to valorise collaboration and mobility and optimise knowledge exchange without borders. Indicators of mobility, such as barriers to or motives of mobility, provide important insights into what makes for an attractive place to do research and can also be used for monitoring progress in attractiveness.

The third ERA priority, open labour market for researchers, is the one that the MORE3 study relates most closely to. Even though ERA priority 3 is the main inspiration for the MORE3 study and its conceptual framework, several concepts link directly to specific aspects of the other ERA priorities:

- Priority 1: More effective national research systems
- Priority 4: Gender equality and gender mainstreaming in research (from a HEI sector perspective)
- Priority 5: Optimal circulation, access to and transfer to scientific knowledge (from the perspective of intersectoral experiences in early career stages)
- Priority 6: International cooperation (from the perspectives of non-EU recruitment to the EU and effects of global exchanges)

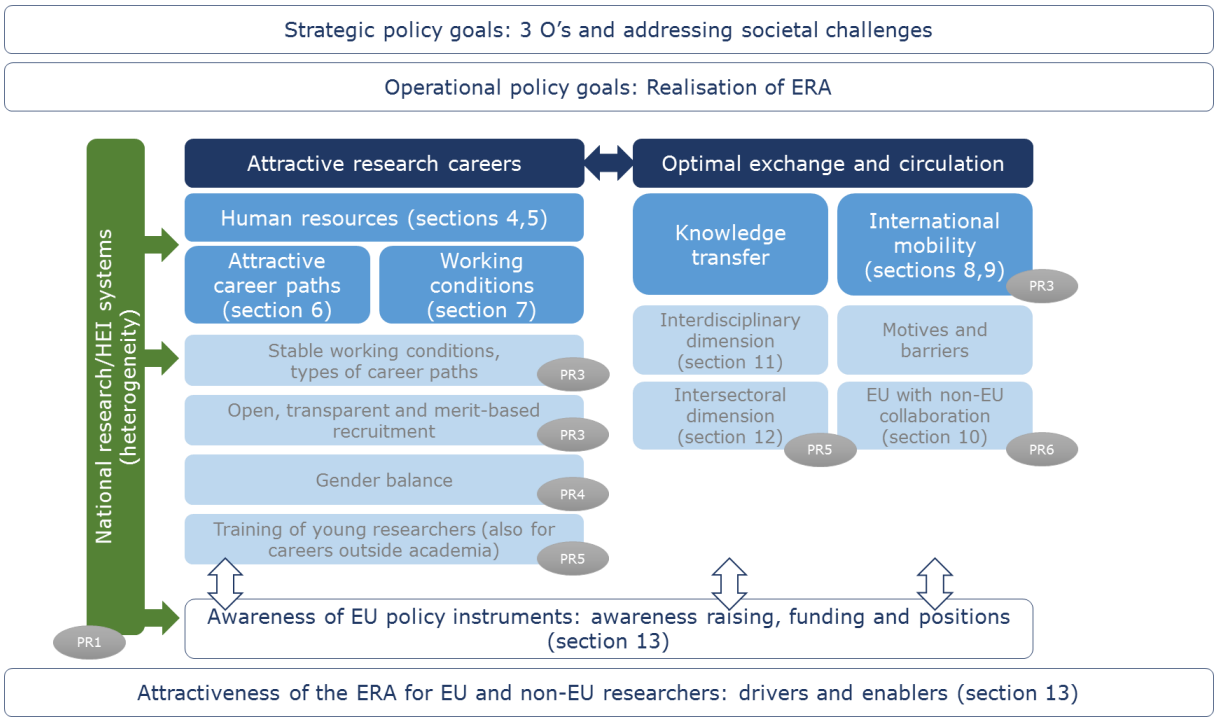
The figure below integrates the policy context with the conceptual framework of the MORE3 study (blue boxes). The links with the ERA priorities are indicated by the grey fields. The MORE3 study thus delivers a broad spectrum of indicators on researchers' working conditions, careers and mobility to support the monitoring of these important policy priorities and contribute to policy debate with new insights into the process behind mobility decisions and the overall attractiveness of the European Research Area. It is important to take into account the diversity of national research and HEI systems in Europe (green box). Many of the MORE3 results confirmed the heterogeneity of systems across Europe, thus identifying the need for a flexible and diversified approach in policy.

The analysis part of the report (Part 2) is structured according to the conceptual framework of the MORE3 study. Sections 4 to 7 discuss all topics related to doctoral training, attractive career paths for researchers and working conditions; sections 8 to 12 analyse those related to optimal exchange and circulation; and section 13 finally focuses on the attractiveness of the ERA for EU and non-EU researchers and the policy instruments supporting this.

Within each section, the corresponding concepts are introduced through a summary of key figures and findings from the comparative analysis. These findings are then situated in the policy context and used to discuss policy relevant questions.

Part 3 of the report then summarises the overarching policy implications and provides recommendations for further research.

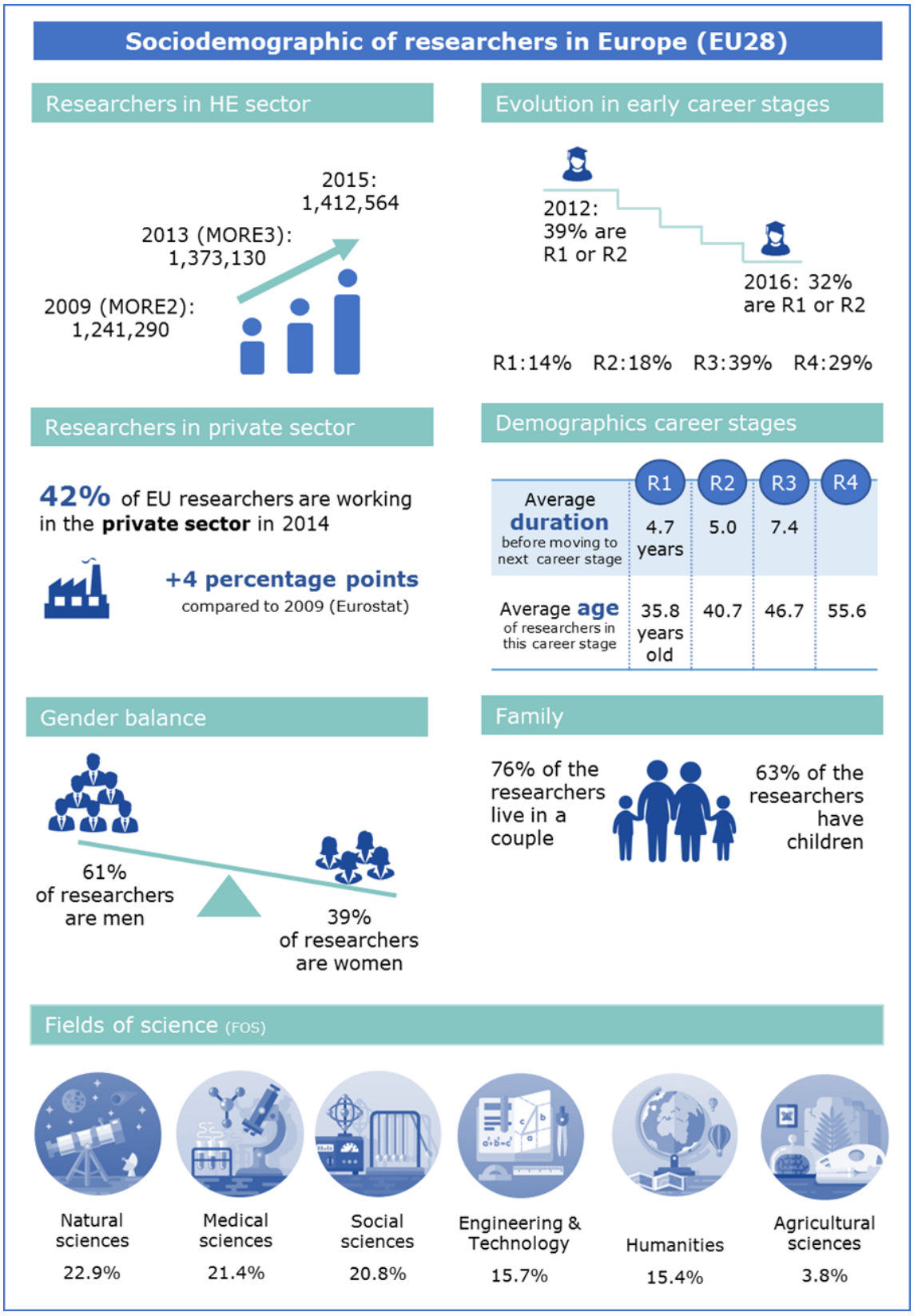
Figure 2: Conceptual framework in the policy context



Source: MORE3

Part 2 Comparative and policy-relevant analysis

4. Human resources: researchers



Source: Based on MORE3 EU HE report, of which the population data are based on Eurostat data (section 5.1)

4.1. Key findings

Analysis of the population of the EU HE survey (presented in the above infographic) gives insights into the demographics of researchers currently working in higher education institutions in Europe. In the MORE3 Indicator report on researchers, a number of indicators on human resources were also developed based on Eurostat data, which further complement the picture on researchers in Europe. Particularly relevant are those on the total number of researchers, young researchers (PhD graduates), researchers working in private industry and gender differences. A brief overview:

On the number of researchers in general:

- There is slow progress towards a more knowledge-intensive Europe: the number of researchers increases, as well as the relative number of **researchers per thousand employees**[32] (annual average increase for the EU of 3.2% in the past decade). This share was on average 8 researchers in full-time equivalent per 1,000 employees for the EU28 in 2013-2014. It ranges from 2.2 researchers in Romania to 16 in Finland. Europe shows a rather clear divide in this indicator: the Nordic countries Denmark, Sweden, and Finland have shares of 14-16 researchers per 1000 employees. Most of the central Western European countries have shares of 9-10 such as Austria, Belgium, France, Germany, Ireland, Luxembourg, the Netherlands, Portugal and the UK. Slovenia is the only country from the Eastern European countries with an equally high share of 9.6. With 5.5, Italy has the lowest shares among the Southern countries, while Spain (7) and Greece (8.6) have higher shares. Among the remaining new Member States, the share of researchers per 1,000 labour force ranges from 2.2 in Romania (followed closely by Cyprus with 2.4) to 7.4 in the Czech Republic.
- Noteworthy is the finding that researchers' jobs were less affected than the average employee during and following the crisis year 2009. The number of researchers remained unaffected in two thirds of the Member States in 2009 and only in four can a decrease be observed for 2010, followed by a recovery and continuing increasing numbers. Exceptions are Spain and Finland – in both countries the total labour force figures dropped between 2009 and 2013 and the decrease in the number of researchers continued to decrease until 2014 (latest available year).[33]

On researchers by sector of R&D performance:

- From the Eurostat information on R&D personnel by sectors of performance[34], we found in the MORE3 Indicator report on researchers that about 40% of the EU researchers are working in the private sector. The figure is relatively stable at 42% in 2014 compared to 38% in 2009, but large variation is found between Member States.

[32] Based on Eurostat, Total R&D personnel (researchers) by sectors of performance, occupation and sex (rd_p_persocc, occupation 'researchers' and unit 'FTE') and Employment and activity by sex and age, total employed from 15 to 64 years in thousand persons (lfsi_emp_a). Cf. indicator 1.1 in the MORE3 Indicator report on researchers.

[33] Cf. footnote **Error! Bookmark not defined.**.

[34] Based on Eurostat, Total R&D personnel (researchers) by sectors of performance, occupation and sex (rd_p_persocc, occupation 'researchers', unit 'FTE', sector 'business enterprise sector'). Cf. indicator 1.6 in the MORE3 Indicator report on researchers.

- In 2014, the range of the share of private sector researchers peaked with 67% in Sweden while it was the lowest in Croatia with 15%. Obviously, these shares depend on industry structures (low tech versus medium and high-tech industries, size of companies, etc.) and their changes but also on established research and innovation infrastructures, opportunities and incentives. Industry structures dominated by small firms and established research systems are among the reasons for the relatively low shares of private sector researchers in many Eastern Member States - but also Portugal and Greece experience low shares of researchers in the private sector over long periods.
- By comparing the shares of researchers in the private sector in 2009 and 2014 as well as the annual average growth rates, one can observe large increases in several Eastern Member States such as Latvia (from 9% to 21%), Lithuania (from 13% to 23%), Bulgaria (from 14% to 27%), or Poland (from 16% to 32%), achieving two-digit growth rates. These are typically the countries starting with very low shares of researchers in this private sector. This suggests that if the private sector is developing towards more research-intensive processes, it also creates opportunities for skilled personnel. A reason for these shifts could, however, also be fewer opportunities in the public sector. Countries which have high shares in the private sector such as Sweden, Austria, Denmark, France, Malta, the Netherlands and Ireland – all above 60% in 2014 – already had these high shares in 2009. An exception are perhaps the Netherlands which grew by 17%.

On the number of young researchers:

- Another indicator pointing to the knowledge base of a country concerns PhD graduates. Taking the share of **young PhD graduates**[35] (aged 25 to 29 years old) per 1,000 population in this age group, the EU-average remains rather stable with one young PhD graduate per 1,000 young inhabitants. While there is a generally stable increase in Europe, the shares dropped slightly in 2013 and 2014 compared to previous years. The highest shares of young PhDs among the young population in 2014 can be found in Slovakia (2.6), Ireland (2.1) and the UK (2.2). More than one PhD graduate per 1,000 young inhabitants is also seen in Austria, Belgium, Denmark, France, Germany, the Netherlands, Portugal, Slovenia and Sweden, while all others have less than one. Bulgaria, Croatia, Cyprus, Finland, Greece, Latvia, Luxembourg, Malta and Poland have even less than 0.5 young PhD graduate per thousand population in 2014.
- In terms of the total **number of PhD graduates**[36] in Europe, one can observe in general a positive trend with an average annual growth rate of 6.7% between 2010 and 2014. Two-digit growth rates can typically be found in countries with small absolute numbers such as Cyprus, Malta, or Luxembourg. Two-digit growth rates can also be observed for Bulgaria, Denmark and Portugal. A few countries have reverse trends: Greece, Italy, Hungary, Austria, Romania and Slovakia – in all of these countries, the numbers dropped during the four years period 2010-2014. In Austria and Slovakia, the 2014 figures is still above EU average despite the decrease.
- A combination of low shares of **researchers**, low shares of PhD graduates and low shares of new PhD graduates per young population characterise to a different extent Malta, Bulgaria, Croatia, Cyprus and Greece.

[35] Based on Eurostat, Total R&D personnel (researchers) by sectors of performance, occupation and sex (rd_p_persocc, occupation 'researchers', unit 'FTE', sector 'business enterprise sector'). Cf. indicator 1.6 in the MORE3 Indicator report on researchers.

[36] Based on Eurostat, Graduates (educ_uoe_grad from 2013, educ_grad until 2012) and Population on 1 January by age and sex (demo_pjan). Cf. indicator 1.2 in the MORE3 Indicator report on researchers.

On gender equality:

- When it comes to the **relative number of female researchers per thousand female employees**[37], the EU-average[38] is at 5.5 FTEs per 1,000 female employees, thus considerably lower than the total of 8 FTE per 1,000 employees. Denmark has the highest share with 10.5 female researchers per 1,000 employees while the lowest can be found in Cyprus (2) and Romania (2.4). Rather high shares can be found in Greece (7.9), Portugal (8.3), Slovenia (7.5), and Sweden (8.3). The increase of the shares is rather slow: ten years ago, the EU-average was 3.9 females (2004). The annual average growth of the share was 3.8%.
- If we look at the share of **female young PhD graduates**[39] among the young population (25-29), a similar pattern emerges as for the total. The EU average increases in recent years, but with a slight drop from 1.05 to 0.99 from 2013 to 2014, compared to 1.01 in total. Also the patterns across countries is similar to that of the total: the shares of female PhD graduates are above two in the UK (2.0 – 2.2 in total), Slovakia (2.9- 2.6 in total) and Germany (2.2 – 1.9 in total). Lowest shares can be found in Malta (0.1 – 0.2 in total), Bulgaria (0.3 - 0.3 in total), Croatia (0.3 – 0.3 in total), Latvia (0.3 – 0.3 in total), Poland (0.36 – 0.3 in total), Finland (0.4 – 0.5 in total) and Luxembourg (0.4 – 0.5 in total). Comparing the share of female young PhD graduates to the total share of female researchers thus indicates that in the early career stages female researchers are better represented.

- If we want to analyse career progression by women, one can use the **glass ceiling index** (GCI)[40]. On average for 2012, the index was 1.75 in the EU. A value higher than 1 indicates a relative under-representation of women in grade A positions (equivalent to Full Professors in most countries). A decade ago, the EU average was 1.90. Thus overall, the GCI decreased over the last decade, implying an improved representation of women in grade A positions. This decrease is observed in all Member States. Nevertheless, under-representation of women in grade A positions (i.e. GCI values above 1) is still observed in several countries.
- In 2013, we can find a share of 22% of all **grade A positions occupied by women**[41]. A decade earlier, the EU average share was about 7 percentage points (pp) lower (14.6%). Highest proportions are observed in Bulgaria, Croatia, Finland and Romania (26% or more). Lowest proportions are found in Belgium, Cyprus, Czech Republic and the Netherlands (16% or less).
- **Female representation on boards**[42] is another indication of whether women are included in decision-making processes, such as in scientific or R&D commissions, councils, etc. In 2014, on EU-average[43], the proportion of women on boards was 28%. In four countries (Sweden, Luxembourg, Finland and the Netherlands), 50% of the board positions are occupied by women. Countries below EU average include Cyprus, Germany, Hungary, Portugal, Slovakia, Poland, Belgium, Estonia and Greece. In the latter, only 12% of the board positions are occupied by females. The higher share of women in boards compared to grade A positions can point at the selection procedures for board positions take into account gender issues to a greater extent than the selection procedures for grade A positions.

---

37 Based on Eurostat, Total R&D personnel (researchers) by sectors of performance, occupation and sex (rd_p_persocc) and Employment and activity by sex and age, total employed from 15 to 64 years in thousand persons (lfsi_emp_a). Cf. indicator 1.1 in the MORE3 Indicator report on researchers.

38 Without Finland and the U.K. Both countries do not provide breakdowns by gender.

39 Based on Eurostat, Graduates (educ_uoe_grad from 2013, educ_grad until 2012). Cf. indicator 1.2 in the MORE3 Indicator report on researchers.

40 SHE figures (WIS database). Cf. indicator 2.3 in the MORE3 Indicator report of researchers.

41 SHE figures (WIS database). Cf. indicator 3.5 in the MORE3 Indicator report of researchers.

42 SHE figures (WIS database). Cf. indicator 3.6 in the MORE3 Indicator report of researchers.

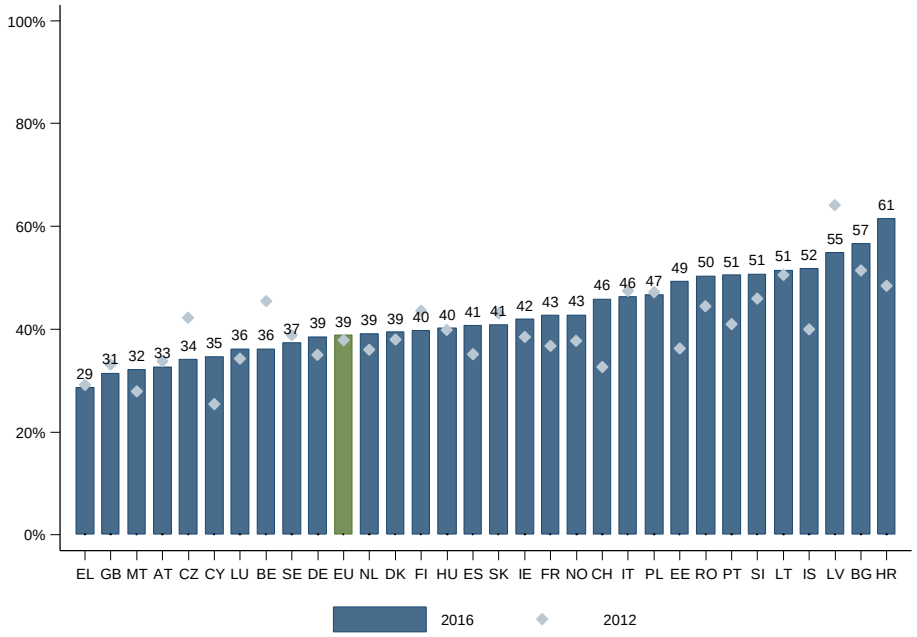
43 EU-22 due to absence of data for Croatia, the Czech Republic, France, Ireland, Malta, and the UK.

- The position of female researchers in terms of career progression is relatively weak in Malta – which equally has very low shares of female Ph.D. graduates. Croatia is rather gender-friendly, in particular in terms of career progression.

The main observations from these statistical findings based on Eurostat information, are confirmed in the analysis of the MORE3 EU HE survey. The analysis of the socio-demographic characteristics in the EU HE survey confirms GCI data, in that there is a persistent pattern of gender imbalance in research, with a larger imbalance in later career stages: while 50% of R1 and 48% of R2 researchers in EU28 countries are women, the percentage drops to 41% for R3 and even to 25% among R4 researchers. There are large differences across countries, as Figure 3 shows, however the share of female researchers has increased in most countries

Also across disciplines, the EU HE survey still shows significant differences with large imbalances in Engineering and Technology (22% are women) and in Natural Sciences (33%), but almost a perfect balance in Medical Sciences, Social Sciences and Humanities (respectively 48%, 45% and 44% are women). Again, there are important differences across career stages. 85% of leading researchers in career stage R4 in Engineering and 79% in Natural Sciences are male. Moreover, the share of male researchers in R4 is also remarkably high in Medical Sciences (73%), while the vast majority of early stage R2 researchers in Medical Sciences is female (72%).

Figure 3: Female representation across countries



Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Figure 6 in MORE3 EU HE report

Notes:

- Based on question 2: "What is your gender?"
- (n=9,412)

4.2. EU policy aims and implications of MORE3 findings

In previous decades, policy lines were set out to make Europe the most dynamic and competitive knowledge economy in the world, including the development of the European Research Area and commitment to the 3% objective for R&D expenditure. The Communication on the ERA emphasised the need for more abundant and more mobile human resources[44]. In the years following this Communication, the European Council repeatedly endorsed the ERA and emphasised the possible shortage of human resources in R&D. This lack was also identified and warned against in the context of the 3% objective: the Communication on "More Research for Europe – towards 3% of GDP" [45] warned against the risk that a lack of sufficient human resources in R&D would constitute a bottleneck to the attainment of the 3% objective. The increased attention for human resources in R&D since 2000 is also linked to the parallel policy lines on labour market and working conditions in general, emphasising the development of human capital and lifelong learning amongst others.

In the same policy context of full deployment of research capacity in Europe, the inclusion of women in the research profession at all stages and in all sectors and disciplines is high on the agenda. It is an ERA objective to "foster scientific excellence by fully utilising gender diversity and equality and avoiding an indefensible waste of talent".

These goals have set a context in which an increasing number of researchers is needed in Europe, together with the full exploitation of the full human capital potential independent of sector, geographical location or gender. The main policy goals related to the topics of this section are thus:

- **Quantity of researchers**: Ensure a sufficient number of researchers in all career stages, fields and sectors so as to exploit the full potential of the human capital in Europe to the benefit of the European knowledge economy.
- **Gender equality among researchers**: Ensure a balanced representation of women in research, in all career stages, fields and sectors, so as to exploit the full potential of the human capital in Europe to the benefit of the European knowledge economy.

However, perceptions of difficult working conditions or career paths may lead people interested in a research career to other fields or sectors. It therefore requires continuous efforts to improve the attractiveness of working conditions and career paths for researchers in Europe in order to develop the profession's full potential. In the following paragraphs this is discussed from the point of view of the number of researchers. Topics that are more related to the effects of training, working conditions and career paths are discussed in detail in the next three chapters.

WHICH LESSONS CAN BE DRAWN FROM THE MORE3 KEY FINDINGS ON THE NUMBER OF RESEARCHERS AND GENDER BALANCE FOR THESE POLICY AIMS?

The analysis indeed shows an increase in the number of researchers in the higher education sector from 1.2 to 1.4 million researchers between 2009 and 2014 (based on Eurostat total and consistently applied in the MORE3 study). It is however equally important that researchers find their way to career paths outside academia. Important indicators for this are evolutions in the number of PhD graduates (overall stock of

[44] COM(2000)6 final of 18.01.2000
[45] COM(2002)499 final of 11.09.2002

researchers for all sectors) and in the number of researchers already working in private industry.

The analysis of the Eurostat data showed that the total **number of PhD graduates**[46] in Europe shows a general positive trend. This implies that the number of researchers in Europe can potentially grow at a relatively fast pace compared with overall employment growth, increasing the number of researchers relative to workforce. This depends however on attractive training and careers in both academic and industry research settings (cf. section 4 on PhD training and section 6 on research careers).

In terms of **researchers working in the private sector**[47] between 2009 and 2014, Eurostat data also indicate a growth of 4pp, which is considerable given the overall growth rates of researcher stock. Yet, this type of indicator is not expected to fluctuate or evolve strongly and will need to be monitored in the longer run to see the effect of policy actions since 2000-2010. It is important to note that there are large country differences that relate to the economic structure and research intensity of the different Member States. Policy initiatives for attractive career paths in industry research settings will thus need to take this diversity in the national contexts into account and allow for sufficiently flexible approaches. The issue of intersectoral mobility and exchange is further discussed at length in section **Error! Reference source not found.**.

Regarding **gender balance**, the MORE3 EU HE survey data show a persistent patter of gender imbalance, in particular in later career stages with 25% of women among R4 researchers, corresponding to the 23.5% of Grade A positions in HEI occupied by women. The glass ceiling still impedes women from reaching higher positions and heterogeneity is large among countries. The fact that there is a more equal balance among early career stages, can be both an indication of improvements for the future or further evidence of the glass ceiling where female researchers drop out before they reach R3 or R4 career stages. Yet progress is observed in almost all Member States and further improvements are expected, though at a slow pace given the nature of the research systems and index. This positive development is already seen from the Eurostat indicators and ERA Progress Report 2016[48]. As mentioned above, gender equality is a cross-cutting issue which will return in several other sections of this report.

EU-LEVEL AND NATIONAL POLICY INSTRUMENTS

As mentioned before, policy instruments that address attractiveness of training, working conditions and career paths of researchers in Europe will have an impact on the number of researchers choosing for and staying in a research career in Europe. These instruments are discussed in the relevant chapters below on PhD training, working conditions and career paths. Research careers in industry settings and intersectoral collaboration are discussed in section 12. In what follows, we therefore focus only on the extent to which policy supports the **gender equality** and which needs are identified in this respect.

[46] Based on Eurostat, Graduates (educ_uoe_grad from 2013, educ_grad until 2012). Cf. indicator 1.3 in the MORE3 Indicator report on researchers.
[47] Based on Eurostat, Total R&D personnel (researchers) by sectors of performance, occupation and sex (rd_p_persocc). Cf. indicator 1.6 in the MORE3 Indicator report on researchers.
[48] http://ec.europa.eu/research/era/pdf/era_progress_report2016/era_progress_report_2016_com.pdf

At EU level, gender equality is strongly integrated in all types of policies and programmes for researchers. Already in 1999, with the Communication "Women and Science"[49], specific measures concerning the gender dimension in European research policy were presented and consequently implemented through the "Science and Society action plan"[50]. The Helsinki Group on Gender in Research and Innovation was established also in 1999 by the European Commission to provide guidance in addressing 'disadvantage of women' in research and science (support, dissemination and adoption of best practices, monitoring). The group continued to exist but was transformed in 2017 to the Standing Working Group on Gender in Research and Innovation of the European Research Area and Innovation Committee (ERAC). Since 2003, statistics on gender equality in science and research have been published in the SHE Figures reports.

In 2005, the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers were adopted by the European Commission. The Charter and Code recommend that "employers and/or funders should aim for a representative gender balance at all levels of staff, including at supervisory and managerial level."

Efforts continued in every step of the ERA process and since 2012 gender equality has been one of the priorities. The 2015 ERA Roadmap further envisages an improved integration of the gender dimension into R&D policies, programmes and projects. All large European programmes explicitly promote gender equality:

- The **Horizon2020** programme explicitly implements this through its "Vademecum on Gender Equality in Horizon2020", agreed by the Helsinki Group delegates, which set the lines on gender equality, gender balance in research teams at all levels, and integrates gender dimension in the content of research and innovation[51].
- The **Marie Skłodowska-Curie actions** (MSCA) have from the outset emphasised gender equality. In line with the Charter and Code, and more recently the Horizon2020 commitments, they promote gender equality through transparent recruitment practices and good working conditions for researchers that amongst others integrate work-(family) life balance. The MSCA also promotes gender equality through the decision-making process (evaluation of proposals, human resources in project execution and supervision; decision making in the MSCA Advisory Group); and in the content of the research itself. The interim evaluation of the MSCA[52] it was found that the programme performs well in terms of gender equality. This evaluation, together with a recent study on research careers in Europe[53], recommend that the Career Re-start Panel be enhanced to further stimulate this aspect, for example by allowing for longer extensions and tailoring training support to the corresponding needs in order to enable restarters to fully re-

[49] COM(1999)76 final of 17.02.1999; see also the "Women and Science initiative": ETAN working group report "Science policies in the European Union: promoting excellence through mainstreaming gender equality", 1999; Resolution of the European Parliament on Women and Science of 03.02.2000 (EP 284.656); Commission working document "Women and science: the gender dimension as a leverage for reforming science" SEC(2001)771 of 15.05.2001; Council Resolution on science and society and on women in science of 26.06.2001; OJ C 199, p.1 of 14.07.2001; Report by the Helsinki Group on Women and Science "National policies on women and science in Europe" – March 2002.

[50] COM(2001)714 final of 04.12.2001.

[51] See http://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/ gender_en.htm.

[52] FP7 ex post and H2020 interim evaluation of Marie Skłodowska-Curie actions (2017). Directorate-General for Education, Youth, Sport and Culture
See https://publications.europa.eu/en/publication-detail/-/publication/27e546f6-c847-11e7-9b01-01aa75ed71a1

[53] Research careers in Europe, Final Report (2016). Prepared by: PPMI Group (Lithuania) in cooperation with CARSA (Spain) and INOVA+ (Portugal) for the European Commission, Directorate-General for Education and Culture.

establish themselves and compete with other researchers; or by supporting part-time fellowships in a more systemic way. This recommendation was addressed in the MSCA work programme 2018-2020.

- The **European Research council** (ERC) has set up a dedicated working group to monitor gender balance in ERC calls. This Working Group on Gender Balance drafted consequent ERC Gender Equality Plans (2007-2013 and 2014-2020) with the objective to raise awareness among (potential) applicants, improving gender balance among ERC candidates and within ERC-funded research teams, identifying and removing any potential gender bias in the ERC evaluation procedures, embedding gender awareness within all levels of the ERC processes - while keeping focus on excellence, striving for gender balance among the ERC peer reviewers and other relevant ERC bodies[54].

It may be interesting to note that the HRS4R accreditation has not led to marked effects in terms of career progression for women into Grade A positions yet. For example in the UK, the country with the highest number of accredited institutions, there is almost no change in its rather constantly low share of Grade A female researchers. Countries which had higher shares of female Grade A researchers a decade ago are also among the leading ones now – with or without the accredited institutions. This may suggest that national gender policies influence changes much more than schemes addressed at individual organisations.

In this respect, national level policies are important to achieve gender equality across Europe. The ERA Progress Report 2016 expresses new expectations of significant progress in the coming years as the National Action Plans announce several new actions for implementation of gender equality and monitoring thereof across a wide range of Member States. Without aiming to be exhaustive, and without information on the effectiveness of the measure, we list a number of examples below.

With respect to improving gender balance in general, several types of actions can be distinguished:

- Actions for improvement of work-(family) life balance in e.g. Italy, Finland, and Germany.
- Comprehensive action plans and monitoring. The Czech Republic announces the Action Plan for Human Resources Development and Gender Equality in R&D, as well as the continuation of the National Contact Centre for Gender and Science that monitors the areas of gender equality and gender mainstreaming in R&D and innovation. Also in Slovenia, a comprehensive action plan is designed to ensure the enforcement of the gender equality principle at public research institutes. In Austria, emphasis is put on increasing tenure track positions and professorships, and on monitoring of gender equality in higher education and research.
- Advisory committees.
- Development of quota in e.g. Germany and Greece.
- Actions to address the typical 'male' versus 'female' areas in e.g. Malta and Finland.
- Member States also refer more generally to the framework set out in European legislation and Horizon2020 programme and indicate they (will) align policy and actions on this (e.g. Belgium, Germany, Malta, Netherlands).

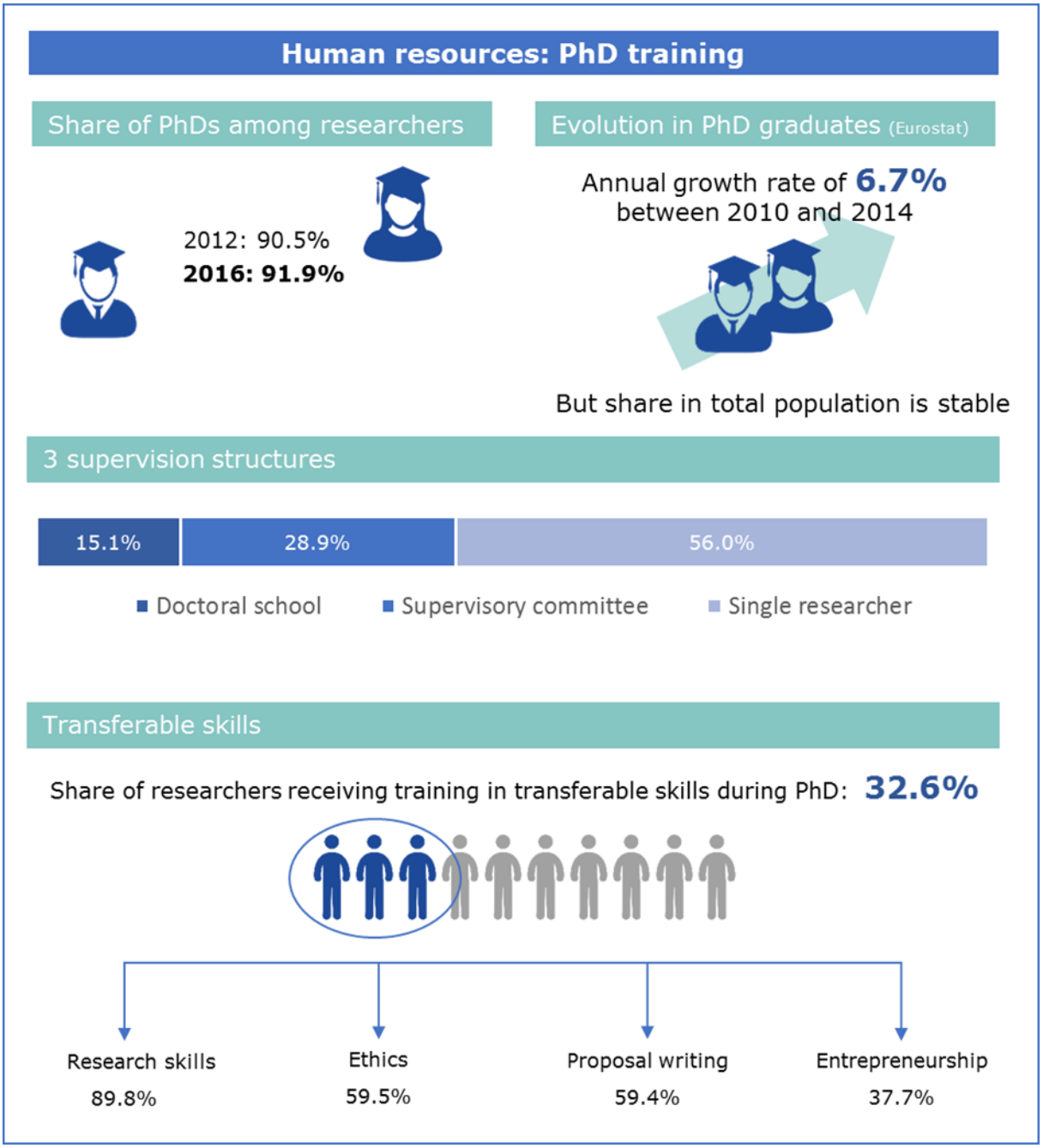
[54] See https://erc.europa.eu/thematic-working-groups/working-group-gender-balance.

There are also specific actions addressing gender balance in later career stages or higher research positions:

- Italy, for example, has announced incentives for RPOs providing employment and career advancement opportunities to the under-represented gender.
- France will promote equality in selection criteria for management teams.
- In Denmark and Norway, a better monitoring of the gender distribution in boards and management of universities is announced.
- In Germany, several actions are announced aimed to improve the gender balance in leadership positions. The ongoing (2008-2012 and 2012-2017) Women Professors Programme is intended to be a highly effective measure to increase the number of female professors and establish conditions that guarantee gender equality at the universities and grants for newly appointed female professors will be linked to proof of a convincing equal opportunities policy.
- Several Member States refer to the importance of role models for raising awareness among young, female researchers. They (will) work on e.g. mentoring programmes in different research institutes to prepare highly qualified women for senior positions (Germany), awarding prizes to successful careers of women (Germany, Czech Republic, Slovenia) and using role models in marketing (Malta).

Even though gender equality has received continuous attention in EU and Member States policy, continuation and intensification of further efforts seems to be necessary in order to increase the pace of improvements and reach equality. Existing evaluations and monitoring, e.g. also of the MSCA, point at the need to further increase the work-life balance and support other paces and forms of career paths, e.g. with part time positions or the possibility of career breaks. Gender monitoring is also in place in the large majority of ERA countries and/or further developed according to the list of actions in the National Action Plans. Gender monitoring at all levels will make it easier to evaluate the initiatives and draw more lessons on what works to increase gender equality.

5. Human resources: PhD training



Source: Based on MORE3 EU HE report (section 5.2)

This section reports key findings on PhD training at the EU and global level, specifically on PhD graduation rates, organisation and structure of PhD training, content of PhD training mainly in terms of transferable skills as well as PhD candidates' views on innovative principles of doctoral training.

5.1. Key findings

Share of researchers currently enrolled in a PhD program or already holding a PhD *Of all researchers*							
	EU total	**Per career stage**		**Per FOS**		**Per gender**	
2012 (n=9,016)	90.5%	R1:	89.7%	MED:	87.4%	F:	89.1%
		R2:	90.4%	NAT:	91.9%	M:	91.3%
		R3.	92.0%	SOC:	91.0%		
		R4:	91.1%				
2016 (n=9,412)	91.9%	R1:	72.5%	MED:	92.9%	F:	90.9%
		R2:	94.3%	NAT:	92.6%	M:	92.6%
		R3.	95.6%	SOC:	90.6%		
		R4:	95.2%				

Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012)
Note:
- Based on question 25: "Are you currently working on a PhD or are you enrolled in a doctoral program?" and question 9: "Please indicate below all higher education (=post-secondary) diplomas/degrees you have obtained so far and their details."

In 2014, almost 131,000 students participated in doctoral training in the EU28. As shown in the MORE3 Indicator report on researchers based on Eurostat data, the number of PhD graduates (ISCED8) per thousand population[55] has been on the rise in the EU28 from 0.20 in 2010 to 0.24 in 2014 (cf. also section 4 for a more detailed elaboration).

PhD training globally remains the main point of entry into research careers, with 92% of academic researchers currently working in the EU (cf. table above) and 94% of the Global survey sample of researchers currently working outside the EU holding a PhD or participating in PhD training.[56] As a consequence, the quality and content of PhD training matters i) for attracting researchers into research careers when they face a decision between pursuing research or other labour market options; ii) for attracting talented researchers from abroad, as there is international mobility of talented students looking for the best training section 8 on PhD mobility); and iii) for outcomes of research activity, such as scientific productivity in the EU, industry research performance and wider societal goals potentially affected by PhD training. In spite of this universal role of the PhD, training structures and content differ considerably within the EU, as well as between the EU as a whole and non-EU regions or countries such as the US.

First, in terms of **structure of PhD training** (Figure 4), PhD candidates in the EU as a whole state that they are predominantly supervised by a single researcher (56%). Supervisory committees (29%) or doctoral schools (15%) remain a minority. Based on our sample of researchers in the Global survey, 61% of PhD graduates in the US were embedded in a doctoral school, with only 10% supervised by a single researcher (Figure 5). Within the EU, structures also vary a lot, with single researcher supervision very commonplace in the Czech Republic (approx. 80% of the respondents obtained their PhD in this setting) and much less so in Cyprus (approx. 20%). Doctoral schools are most

[55] Based on Eurostat, Graduates (educ_uoe_grad from 2013, educ_grad until 2012)) and Population on 1 January by age and sex (demo_pjan). Cf. indicator 1.3 in the MORE3 Indicator report on researchers.

[56] See on this point also Ates, G., Brechelmacher, A., „Academic career paths". In Work Situation, Views and Activities of the Academic Professions: Findings of a Survey in Twelve European Countries, Teichler, U., E.A. Höhle, eds., 13–35, 2012. In some countries, such as with Germany's "Habilitation", further qualifications after the PhD are required to successfully enter an academic career.

frequent in Finland and Denmark at about 31% but non-existent in our sample in Malta and Greece.

Transparent and accountable procedures for admission, supervision, evaluation and career development are more common in the Anglo-Saxon and Nordic system (besides Malta) than in the Southern (besides Greece) and Continental system. The lowest shares of PhD candidates perceiving procedures as transparent and accountable can be found in Austria (22%), France (24%), Portugal (26%), Romania (28%), and Hungary (29%). The highest shares can be found in Malta (84%), Norway (66%), Greece (62%), Sweden (62%) and Iceland (61%). Joint doctorates are much more common among researchers currently working in the EU (23%) than in the non-representative sample of researchers working outside the EU, reflecting the rich diversity of EU doctoral programmes.

Second, in terms of **content of PhD training** (Figure 6) other than the core academic specialisation in a research field, we see that while 81% of EU researchers think that transferable skills have an important influence on career progression, only 33% of PhD candidates in the EU receive training in transferable skills such as research skills, people and project management. It varies widely among EU countries, with again the Anglo-Saxon and Nordic countries faring better at around 50% of PhD candidates receiving training, possibly linked to more structured PhD training, while other countries such as Austria (9%), Germany and France (below 27%) achieve much lower shares. Figure 6 also illustrates the share of PhD candidates stating that they have received training in transferable skills by the country of employment. Comparing the shares by country of PhD and by country of employment, the figure shows that some countries benefit from other countries by importing transferable skills via mobile researchers. For instance, while only 9% of Austrian PhD candidates (based on the country of PhD) state that they have received training in transferable skills, 13% of R1 & R2 researchers working in Austria (based on the country of employment) do so. Among the benefitting countries are Belgium, Denmark, Ireland (showing the largest positive difference between the compared shares), Latvia, Malta and Norway. On the other hand, some countries are net exporters of structured training. Among these countries are Cyprus, Luxembourg, Greece and the United Kingdom.

Training in transferable skills focuses on skills more closely related to core research activities, such as research skills, communication and presentation skills, decision making and problem solving, and critical and autonomous thinking (73-90%). Skills such as engagement with society (46%) and entrepreneurship (38%) are less frequently part of transferable skills training. Among the Global survey sample of researchers, while on average researchers who graduated in a non-EU country have received more training in transferable skills, the same pattern of skills taught prevails. Researchers who graduated from a US institution are more likely to have received training in transferable skills, however entrepreneurship and IPR rights is even slightly lower than in the EU. This may be explained by US PhD programmes focusing on excellence in basic research[57].

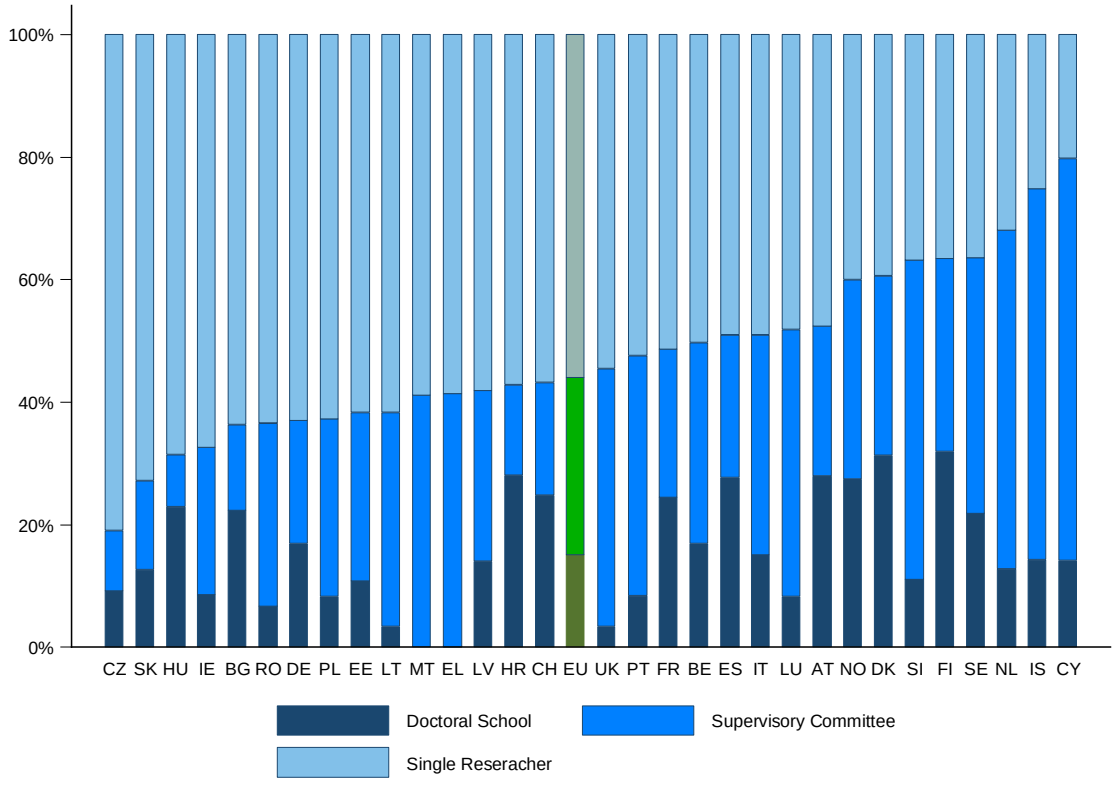
A more detailed analysis of how PhD training looks in individual EU countries is given in the MORE3 EU HE survey. For example, there is large country heterogeneity with respect to international networking as a part of PhD training, with 78% of PhD candidates in

[57] The US-American higher education system is overall very heterogeneous, with low-quality institutions operating alongside top institutions. Our results seem to reflect respondents working at high-quality institutions, as international mobility to low-quality institutions is probably low. However, in terms of attractiveness and of asymmetric mobility of EU researchers towards US research universities, it is precisely these high-quality US institutions which are interesting as a benchmark for the EU's ambitions.

Malta who declare that they have developed international networks and only 19% of PhD candidates in Poland.

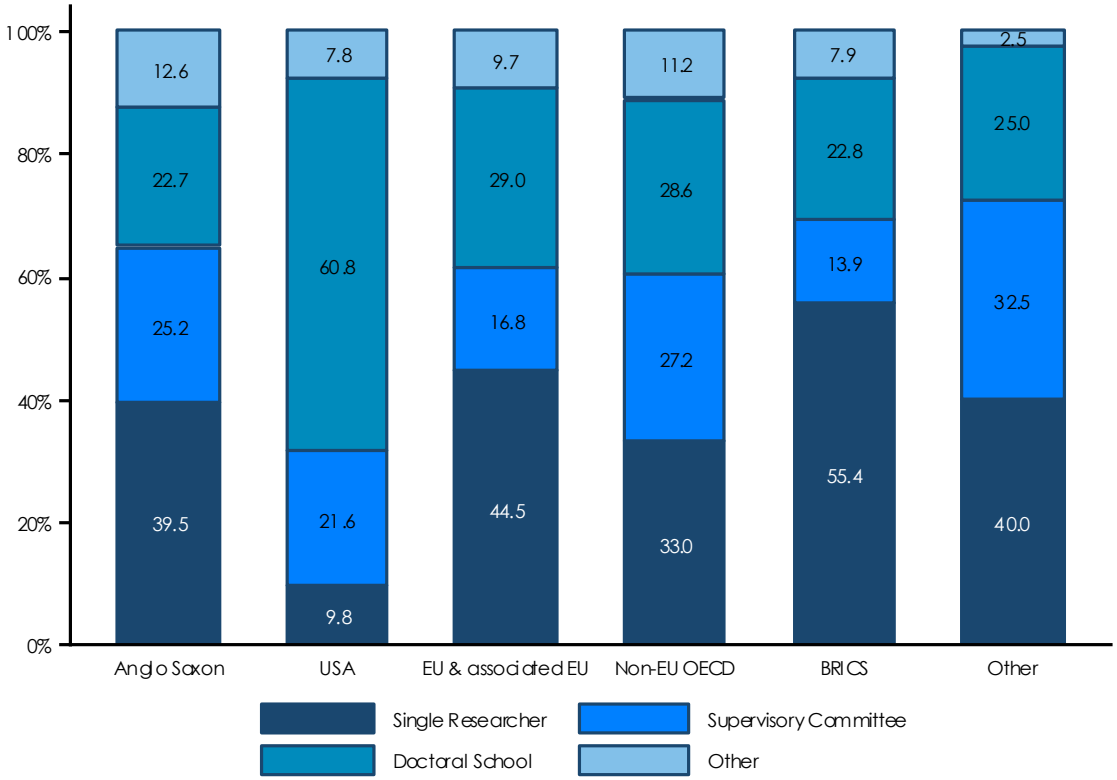
Third, this is in line with **what PhD candidates think is important in their PhD training**: foremost research excellence (88%) and attractive working conditions for research (81%: e.g. research independence, career perspectives). Intersectoral collaboration and industry funding are least valued, at odds with the principles for innovative doctoral training. PhD candidates' expectations are more likely focussed on remaining in (academic) research, thus perhaps they place less value on the skills more needed outside of the academic sector. Researchers in natural and health sciences are by about 5-10 percentage points more positive about collaboration and industry funding than researchers in social sciences. EU heterogeneity is on average less pronounced than in the structure and content of PhD studies - the actual PhD training with the difference between the maximum and the minimum amounting to around 47 percentage points. This points towards a more unified perception of early stage researchers and what matters with respect to PhD training, contrasting with large real heterogeneity in actual PhD training. Only 9% of R1 and 11% of R2 researchers are aware of the principles for innovative doctoral training.

Figure 4: PhD supervision structures per country, researchers working inside the EU



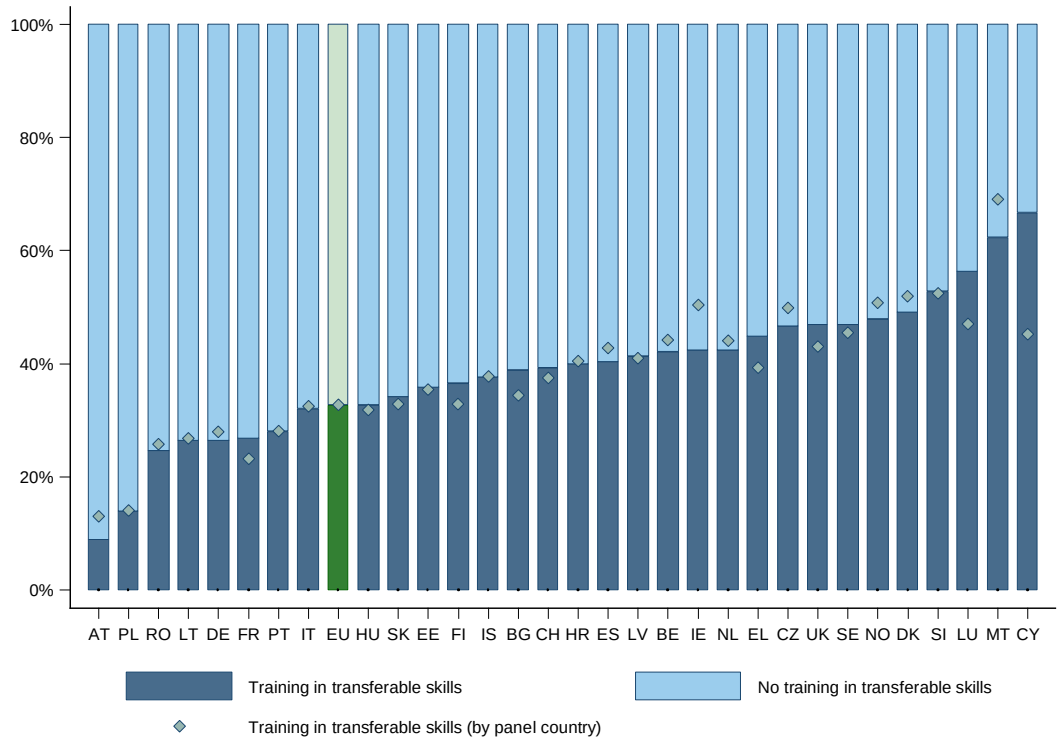
Source: MORE3 EU HE Survey (2016) – Figure 14 in MORE3 EU HE report
Notes:
- Only R1 PhD candidates and R2 PhD holders.
- The answer could be either that PhD supervision was undertaken by just one senior, by a supervisory committee, embedded in a doctoral school or took another form.
- Based on question 49: "How would you describe your PhD in terms of supervision structure?"
- (n=2,786)

Figure 5: PhD supervision structures by country of graduation, researchers working outside the EU



Source: MORE3 Global survey (2017) – Figure 19 in Global survey
Notes:
- Only R1 PhD candidates and R2 PhD holders.
- Based on question 14: "How would you describe your PhD in terms of supervision structure?" and on question 13: "What is/will be the country of graduation (of your PhD degree)?"
- (n=564)

Figure 6: Share of researchers receiving training in transferable skills during PhD per country of graduation and panel country



Source: MORE3 EU HE Survey (2016) –Figure 16 in MORE3 EU HE report
Notes:
- Only R1 PhD candidates and R2 PhD holders.
- Share of researchers receiving training in transferable skills per country of PhD graduation (bars) and panel country (dots).
- Country of PhD graduation refers to the country where one obtained a PhD or is currently enrolled in a PhD program; panel country refers to the country where the researcher is currently working according to the ex-ante data collection in the sample. When the dot is above the bar, the country "imports" PhDs from other countries and vice versa (the country "exports" PhDs).
- Based on question 51: "Which of the following statements are applicable to your PhD training?" … I received training in transferable skills.
- (n= 2,786-2,989)

5.2. EU policy aims and implications of MORE3 findings

The policy context for PhD training in the EU is characterised by a variety of policy aims emanating e.g. from Council Conclusions on young researchers, the EU innovative doctoral training principles and the five ERA priorities:

- **Quantity of researchers trained at PhD level**: industry needs more researchers not only because international competition is increasingly R&D- and innovation-based but also because it is getting harder to find new ideas, leading to declining R&D productivity[58]. PhD studies need to be attractive to draw in growing numbers of talented students.

[58] According to a recent study, R&D productivity is falling in several industries, as it is "getting harder to find ideas". E.g., it now takes 18 times as many researchers to double the computing power of microtransistors

- **Quality of PhD studies**: worldwide competition for the most talented researchers[59] implies that PhD training programmes in the EU must be attractive enough for the best, ensuring brain circulation rather than brain drain. High quality PhD training is a pillar for later research excellence, which is linked to both economic competitiveness and meeting societal challenges.
- **Content of PhD training**: Higher PhD demands by industry and the pyramidal nature of career options in academia call for keeping options broad for PhD candidates. PhD studies need to ensure that general and transferable skills are part of the curriculum to equip students for changing expectations in terms of career paths outside academia.
- **Composition of the student body**: without gender equality in PhD training, it is unlikely that gender equality among researchers will ever be met. This holds equally true for students from disadvantaged social backgrounds. Both gender equality and greater inclusiveness feed back into the goal of quantity of researchers.

In terms of policies to reach these aims, there are EU-level funding instruments such as the MSCA co-funding of structured PhD training, but also a variety of guidelines and principles of doctoral training (Salzburg Principles and Innovative Doctoral Training Principles, see Box 1) which universities or Member States can draw on to improve doctoral training.

Box 10: Seven Principles for Innovative Doctoral Training

In 2005, the European University Association (EUA) conducted the Doctoral Programme project[60], which has led to the Salzburg conference and the ten "**Salzburg Principles**"[61] (reproduced in the Bergen declaration) as the basis for the reforms of doctoral education in Europe. These principles reflected the key role of doctoral programmes and research training in the Bologna process. They were further developed into to the Salzburg Recommendations II (2010)[62]. The European Commission consequently used this basis, together with good practices in the Member States and the Marie Curie experience to develop its seven '**Innovative Doctoral Training Principles**'[63] in the framework of the ERA:

1. Research Excellence
Striving for excellent research is fundamental to all doctoral education and from this all other elements flow. Academic standards set via peer review procedures and research environments representing a critical mass are required. The new academic generation should be trained to become creative, critical and autonomous intellectual risk takers, pushing the boundaries of frontier research.

2. Attractive Institutional Environment
Doctoral candidates should find good working conditions to empower them to become independent researchers taking responsibility at an early stage for the scope, direction and progress of their

every two years as it did in 1970 (Moore's Law). See Bloom, N., Charles I. Jones, John Van Reenen, and Michael Webb. 'Are Ideas Getting Harder to Find?' Working Paper N. 23782. National Bureau of Economic Research, September 2017.

59 Hunter, Rosalind S., Andrew J. Oswald, and Bruce G. Charlton. 'The Elite Brain Drain*'. *The Economic Journal* 119, no. 538 (2009): F231–F251.

60 http://www.eua.be/eua-work-and-policy-area/research-and-innovation/doctoral-education/doctoral-programmes-project/

61 http://www.eua.be/eua/jsp/en/upload/Salzburg_Conclusions.1108990538850.pdf

62 http://www.eua.be/Libraries/Publications_homepage_list/Salzburg_II_Recommendations. sflb.ashx

63 Based on the "Report of Mapping Exercise on Doctoral Training in Europe: Towards a common approach" of 27 June 2011(final), adopted by the ERA Steering Group on Human Resources and Mobility. The seven principles were defined with the help of experts from university associations; industry and funding organisations.

project. These should include career development opportunities, in line with the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers.

3. Interdisciplinary Research Options
Doctoral training must be embedded in an open research environment and culture to ensure that any appropriate opportunities for cross-fertilisation between disciplines can foster the necessary breadth and interdisciplinary approach.

4. Exposure to industry and other relevant employment sectors
The term 'industry' is used in the widest sense, including all fields of future workplaces and public engagement, from industry to business, government, NGO's, charities and cultural institutions (e.g. musea). This can include placements during research training; shared funding; involvement of non-academics from relevant industry in informing/delivering teaching and supervision; promoting financial contribution of the relevant industry to doctoral programmes; fostering alumni networks that can support the candidate (for example mentoring schemes) and the programme, and a wide array of people/technology/knowledge transfer activities.

5. International networking
Doctoral training should provide opportunities for international networking, i.e. through collaborative research, co-tutelle, dual and joint degrees. Mobility should be encouraged, be it through conferences, short research visits and secondments or longer stays abroad.

6. Transferable skills training
"Transferable skills are skills learned in one context (for example research) that are useful in another (for example future employment whether that is in research, business etc.). They enable subject- and research-related skills to be applied and developed effectively. Transferable skills may be acquired through training or through work experience". It is essential to ensure that enough researchers have the skills demanded by the knowledge based economy. Examples include communication, teamwork, entrepreneurship, project management, IPR, ethics, standardisation etc.
Business should also be more involved in curricula development and doctoral training so that skills better match industry needs, building on the work of the University Business Forum and the outcomes of the EUA DOC-CAREERS project. There are good examples of interdisciplinary approaches in universities bringing together skills ranging from research to financial and business skills and from creativity and design to intercultural skills.

7. Quality Assurance
The accountability procedures must be established on the research base of doctoral education and for that reason, they should be developed separately from the quality assurance in the first and second cycle. The goal of quality assurance in doctoral education should be to enhance the quality of the research environment as well as promoting transparent and accountable procedures for topics such as admission, supervision, awarding the doctorate degree and career development. It is important to stress that this is not about the quality assurance of the PhD itself rather the process or life cycle, from recruitment to graduation.

The "Principles for Innovative Doctoral Training" have been endorsed by the EU Council of Ministers in their conclusions on the modernisation of higher education on 28/29 November 2011 and by the ERA Standing Group on Human Resources and Mobility[64].

Source: Report of Mapping Exercise on Doctoral Training in Europe: Towards a common approach (2011) and IDEA Consult and Cheps (2011) Exploration of the implementation of the Principles for Innovative Doctoral Training in Europe, Final report.

[64] Report of the ERA Steering Group Human Resources and Mobility (ERA SGHRM): Using the Principles for Innovative Doctoral Training as a Tool for Guiding Reforms of Doctoral Education in Europe.

The 2011 study to explore the acceptance and implementation of the IDTP in European institutions[65] concluded that there is an important interplay between these seven principles; and this was recognised in the adoption paper of the SGHRM[66]. European stakeholders of doctoral education consider "research excellence" based on internal "quality assurance" and the "attractiveness of the institutional environment" as core elements that should form the basis for every doctoral training offered. Exposure to industry and other relevant employment sectors, interdisciplinary research options, international networking and transferable skills are seen as complementary but nonetheless important principles influencing the success of doctoral training and of the future career of doctoral candidates. These principles are linked among other things to disciplinary demands, considerations of the specific research topic of the candidate or special features of the doctoral programme. The interplay between the principles is further influenced by the economic conditions and structure of the Member States the regulatory stability and legal framework on doctoral education, the academic culture (national traditions, disciplinary cultures etc.) and by the sustainability of funding provided to the universities.

WHICH LESSONS CAN BE DRAWN FROM THE MORE3 KEY FINDINGS ON PHD TRAINING FOR THESE POLICY AIMS?

While the known strength of the diversity of EU doctoral programmes is also reflected in our survey data on joint degrees and PhD studies are seen to focus on the advancement of knowledge through original research in line with the core mission of PhD studies[67], the comparison with Innovative Doctoral Training Principles (IDTP) point to several areas of potential improvement.[68] The high share of single researcher supervision and country heterogeneity with respect to the transparency and accountability of procedures for admission, supervision, evaluation and career development indicate that there is room for further professionalisation of PhD training in the EU, e.g. through introducing more structured PhD training. While other sources document significant progress in reforming doctoral education in Europe, MORE3 survey data point towards ongoing reform needs.[69]

As such doctoral schools or programmes need critical mass in terms of research activity, introducing more structured training may also imply wider reforms for universities, e.g. in terms of profile building or allocation of funding. In a more structured programme bringing together a higher number of PhD candidates, there is also more competition between students allowing for earlier selection, so that students can see early on whether a career in research is likely, or whether alternative career paths are more appropriate.

Furthermore, more structured training would also facilitate introducing more interdisciplinary training and the development of transferable skills through taught courses, as well as allowing for more international collaboration. The increase in administrative capacity which should go along with more structured training also makes it easier to conclude international exchange programmes, as in short-term PhD mobility. Structured training programmes or doctoral schools also allow for the introduction of

65 IDEA Consult and Cheps (2011) Exploration of the implementation of the Principles for Innovative Doctoral Training in Europe, Final report.
66 Report of the ERA Standing Group on Human Resources and Mobility (ERA SGHRM), https://cdn5.euraxess.org/sites/default/files/principles_for_innovative_doctoral_training.pdf
67 Training in creative, critical and autonomous thinking seems to be relatively high, as called upon by the Council Conclusions on measures to support early stage researchers.
68 Only approximately 10% of PhD candidates are aware of the Innovative Doctoral Training Principles.
69 Report of the ERA Standing Group on Human Resources and Mobility (ERA SGHRM), https://cdn5.euraxess.org/sites/default/files/principles_for_innovative_doctoral_training.pdf

transparent recruitment policies, which can take into account criteria such as international recruitment, gender equality, and social background, as pointed out by the follow-up to the Salzburg Recommendations (Salzburg II Recommendations).

Intersectoral mobility also has an important role to play with respect to early career researchers. The notion that doctoral programmes need to be adapted to the needs of an employment market that goes beyond academia is increasingly shared among stakeholders and policy makers. In this sense, the Salzburg II Recommendations and the Principles for Innovative Doctoral Training are paradigmatic: according to these, "*Doctoral programmes should seek to offer geographical as well as interdisciplinary and intersectoral mobility and international collaboration within an integrated framework of cooperation between universities and other partners*". In a similar vein, the Council conclusions on 'Measures to support early stage researchers, raise the attractiveness of scientific careers and foster investment in human potential in research and development' also explicitly stresses the need to support early stage researchers in their careers by promoting intersectoral mobility, dual-career opportunities and PhD in collaboration with industry, among others.[70]

While the Salzburg Principles mention that it is recognised that doctoral training must increasingly meet the needs of an employment market that is wider than academia, and the IDTP call for exposure to industry in various ways, both PhD candidates' perception of what is important for PhD training and actual training indicate that training content further away from core research specialisation, such as opportunities for intersectoral mobility or exposure to industry, is less valued[71]. While structured training would also make it easier for programmes of industry-science mobility to be drawn up, more research should illuminate the tension between the demands of academic excellence in basic research, requiring specialisation in research, and acquiring broader skills or more applied industry experience to keep labour market options open. Studies point to the disincentives of the perspective of achieving tenure for engaging in applied research prior to tenure, as early stage researchers are assessed on the excellence of their publication output which is usually harder to achieve by engaging in applied problem-solving: problems are less general and hence less publishable in the top basic research journals[72]. Of course, there are exceptions to this, when industry is very close to basic research, as e.g. in pharmaceuticals.

Potential avenues to ease this tension may consist of increasing the provision of different types of PhD programmes, ones preparing for academic basic research and others oriented towards working in industry, as practiced e.g. in Denmark[73] or by the European Industrial Doctorates (EID) in the framework of MSCA Innovative Training Networks (ITN). This does not mean that basic research oriented PhD programmes will no longer offer taught courses to prepare PhD candidates for engagement with society, or for entrepreneurship, as there are instances when basic research leads to discoveries that can (only) be commercialised by the researchers behind the discovery.[74] Career development opportunities can also be part of basic research-oriented PhD programmes.

---

70 http://data.consilium.europa.eu/doc/document/ST-14301-2016-INIT/en/pdf.

71 It is also interesting to note that researchers working in the EU with a US PhD value above all research excellence and working conditions for research as guiding principles of doctoral training, while entrepreneurship and IPR issues are valued even less than on average in the EU.

72 Thursby, Marie, Jerry Thursby, and Swasti Gupta-Mukherjee. 'Are There Real Effects of Licensing on Academic Research? A Life Cycle View'. *Journal of Economic Behavior & Organization*, Academic Science and Entrepreneurship: Dual engines of growth, 63, no. 4 (August 2007): 577–98.

73 See e.g., the Danish programme on industrial PhDs, https://innovationsfonden.dk/en/application/erhvervsphd.

74 Zucker star scientists in commercialisation of academic research.

However, intersectoral mobility during PhD training and working on applied problems is easier in industry PhD programmes, followed by quick labour market transitions from PhD training to industry research. Industry-oriented PhD programmes could also involve business in curricula development, as suggested by the IDTP to reduce skill mismatch. Furthermore, the design and execution of industry-oriented PhD could benefit from the key characteristics of MBA programmes, including exposure to specific industries or regions, interaction with business leaders or use of the case method or hands-on training. However, offering different types of PhDs clearly needs more research and evaluation of existing programmes such as in Denmark. The evaluation of the EIDs has shown that they are almost exclusively set up in engineering and information sciences, which are closer to industry than e.g. some basic natural sciences. Moreover, EID fellows were usually already interested in industry before they started the PhD. While their career prospects have usually improved due to the high quality of the EID and their networks, the overall effect on the aim of increasing exposure to industry or interest in careers in industrial research remains open.

Another, complementary option to foster the transfer and commercialisation of basic research ideas is to provide appropriate incentives for applied research or for commercialising basic research through licensing after tenure has been achieved, where research points to less conflict between engaging in solving applied problems and research output.[75]

EU-LEVEL AND NATIONAL POLICY INSTRUMENTS

Given the findings of MORE3, EU co-funding of graduate schools or doctoral programmes as done e.g. through the MSCA co-funding initiative or through ESIF is certainly addressing important issues in the ERA. Co-funding allows for coping with the fixed cost of establishing structured PhD training and for requiring conditions, such as transparent recruitment policies in line with EU policy objectives, among others research excellence and gender equality. Given relatively low levels of structured training in many EU countries, increasing the budget for MSCA co-funding of doctoral programmes could be investigated.

As concerns industry doctorates, or initiatives to broaden skills acquired through doctoral training, low success rates of applications for EIDs would speak in favour of increasing the budget of this action[76]. More industry-oriented PhD programmes may also make it easier for applications from universities which are not at the frontier of basic research and are more likely to be in economically poorer EU countries to be successful. This could boost equity in the ERA and contribute to convergence, rather than divergence in research excellence among EU countries, as opening up labour markets for researchers always runs the risk of triggering concentration processes of the most talented researchers moving to the most attractive places to do research. Setting up industry PhD programmes with firms in catching-up countries could also help these firms assessing the potential value added of qualified workers with advanced research skills, potentially increasing innovation activities.[77]

---

[75] See Thursby et al., 2007.

[76] European Commission, DG Education, Youth and Culture, European Industrial Doctorates – towards increased employability and innovation. Final report, Prepared by ICF and Technopolis.

[77] In countries far from the technological frontier, firms are much less likely to adopt innovation strategies as elements of their competitive strategy, due to a number of barriers to innovation, such as lack of qualified workers, but also failure to perceive benefits from innovation (see Hölzl, W., and Janger, J.. 'Distance to the Frontier and the Perception of Innovation Barriers across European Countries'. *Research Policy* 43, no. 4 (Mai 2014): 707–25.

Plans also exist to expand the EIT regional innovation scheme (EIT-RIS) model and the EIT label to more universities and regions to strengthen development of entrepreneurship and innovation skills and better prepare doctoral candidates and graduates for working in innovative businesses. Also, in 2018, the Commission will develop a Digital Education Action Plan with specific measures on blended learning, training on digital skills or increasing the level of participation of researchers from all Member States in the MSCA.

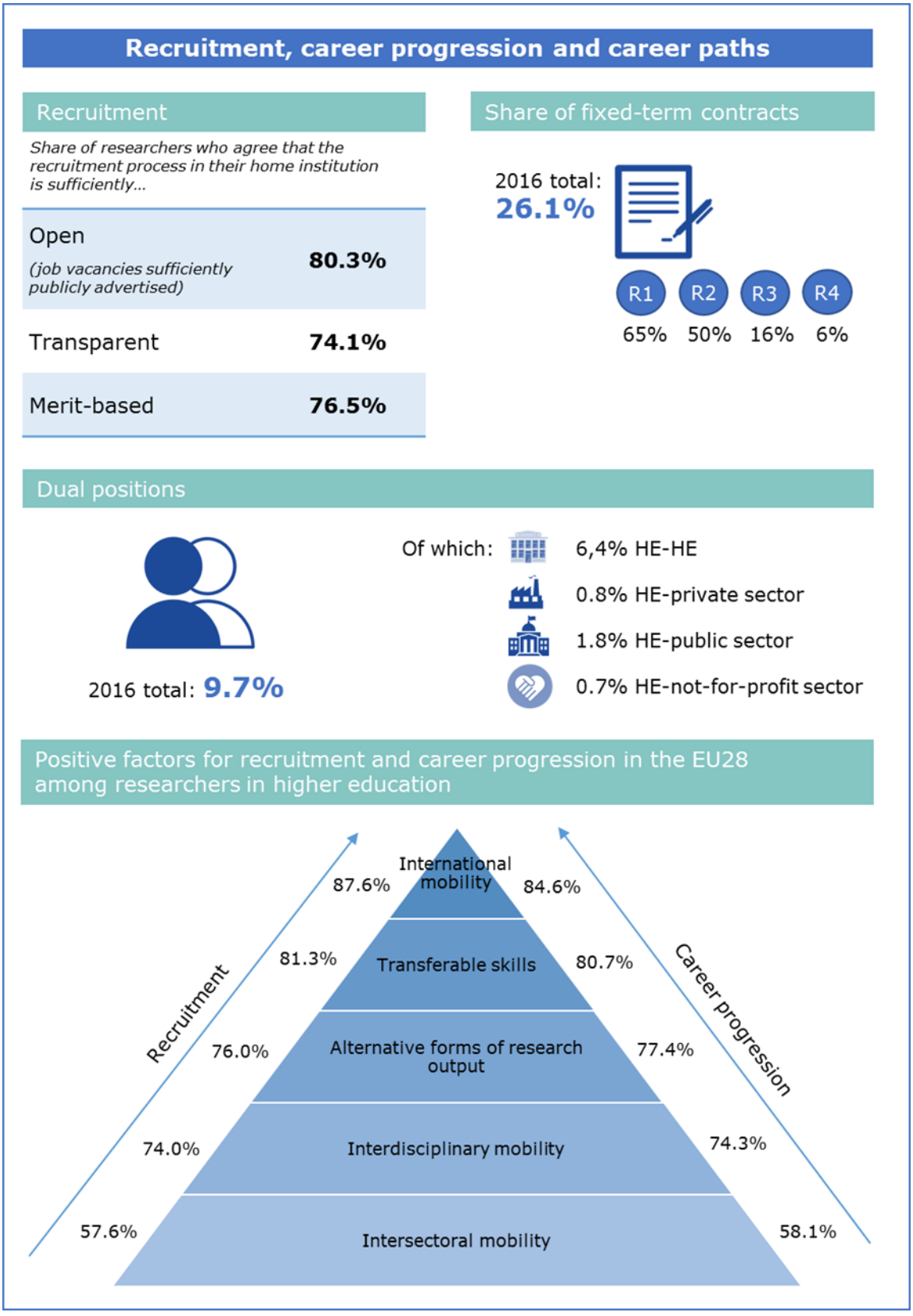
Returning to reforming PhD training more generally, not just with respect to industry doctorates, further reforms at the national level are a necessary complement to EU level efforts. Improved doctoral training can be regarded as a key feature of country efforts to improve the effectiveness of their national research systems (ERA priority 1), to foster open labour markets (priority 3) and industry-science knowledge exchange (priority 5) as well as gender equality (ERA priority 4). Improving the quality of PhD training is likely to lead to inflows of early stage researchers into research careers. But in a further stage, it may also lead to an increased outflow of talented young academics when career prospects and, more generally, the attractiveness of academic careers do not follow suit as better trained PhD holders are then in a more advantageous position to access the global market for scientists. The next section will accordingly present findings of MORE3 on recruitment, career progression and career paths.

At the national level, Member States' National Action Plans (NAPs) announce a number of measures and initiatives. Screening through these announced initiatives shows that policy at national level is also directed to the above-mentioned points. Without aiming to be exhaustive, and without any further information on the effectiveness of the measure, we list a number of examples that show a variety of measures to improve doctoral training, although there is less activity than regarding careers and working conditions (cf. sections 6 and 7):

- The funding programme of the German Research Foundation DFG for research training groups provides for a closer linking of the support for doctoral candidates with the opening up of new research prospects. The DFG is also working towards the across-the-board application of the possibility created in 2009 that doctoral candidates in all subjects will be paid on the basis of employment positions rather than grants. There are also plans for the expansion of programme elements which look at post-doc career paths for young academic talent. Furthermore, measures for the internationalisation of support for young scientists have already been a priority for the DFG for a long time. This is demonstrated, among other things, by the high proportion of international research training groups. It is intended that further internationalisation measures should also support this trend in all the other (national) research training groups. The Max Planck Society will continue its successful programme for structured doctoral training at its International Max Planck Research Schools (IMPRS). Max Planck institutes are cooperating with German as well as foreign universities in the more than 60 IMPRS. The International Leibniz Graduate Schools, which are being continued as well, also offer structured doctoral programmes in an excellent international research environment. In the Helmholtz Association, common guidelines provide the basis for structured doctoral training. Helmholtz Graduate Schools and Helmholtz Research Schools are designed to improve the structuring of the doctoral phase and give doctoral candidates stable supervision conditions and an individually agreed qualification programme consisting of subject-specific and general elements. As of 2014, the German Academic Exchange Service's "IPID4all" programme for the internationalisation of doctoral studies in Germany, which is funded by the BMBF, provides support to universities in Germany which want to establish an internationally attractive environment for their doctoral candidates. The aim is to fund a wide range of measures to create internationally competitive conditions for doctoral candidates which are attractive to young scientists around the world (Germany).

- Introduction of a programme to improve the professional insertion of PhDs (France).
- In Bulgaria, to address the shortcomings a partnership is sought with and between BAS, AA and the universities to ensure that doctoral programmes become more international, incentivise the mobility of PhD candidates, establish better connections to market needs, and ensure higher quality in different disciplines. The so-called European Principles of Innovative Doctoral Training could be applied by all institutions performing research in Bulgaria. The partnership also implies initiatives to work towards more competitive salary levels and structures, with room to differentiate, fix and adjust researchers' remuneration levels based on individual performance. This should go hand in hand with a dedicated augmentation of the public funding base. The partnership between BAS and the universities should be based on medium-term HR planning (rolling 3-5 years) concerning pensioning versus new positions for younger generations of researchers, including working on a better gender balance in Bulgaria's public research base. (Bulgaria)
- In the Netherlands a recently submitted bill on higher education and research internationalisation contains provisions for further expansion of the right to confer doctorates. This will enable university Doctorate Boards to appoint academic staff members, who do not hold professorships but do have the qualities to serve as PhD candidate supervisors. The bill also establishes a new hierarchy in which the degree of Dr is equivalent to that of PhD. This will serve to create a level playing field and ensure fair international competition.

6. Recruitment, career progression and career paths



Source: Based on MORE3 EU HE report (sections 5.3 and 5.4)

After their PhD training, researchers often face country-specific recruitment and career progression procedures which lead to country-specific career paths and more generally structural differences between national higher education systems. This section presents key findings from MORE3 on these issues, beginning with recruitment and career progression, and discusses their policy implications given EU policy objectives.

6.1. Key findings

PERCEPTION OF RECRUITMENT AND CAREER PROGRESSION

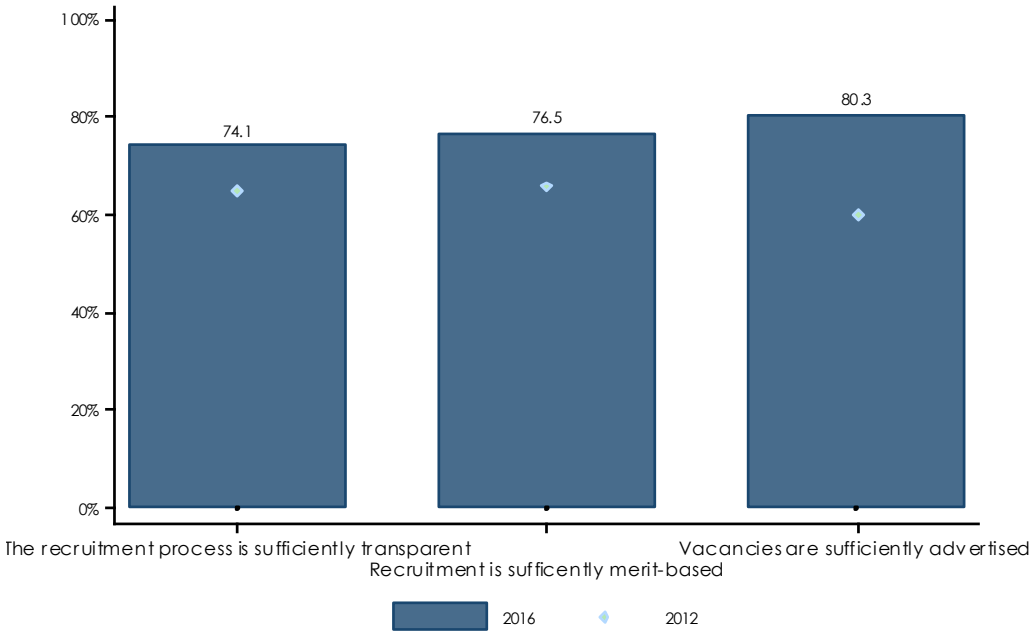
The design of recruitment and career progression are crucial for the attractiveness of research systems as they determine whether those with better training and future potential get the jobs or are promoted. Compared to MORE2, a higher share of researchers agrees that their home institution practices open, merit-based and transparent recruitment (Figure 7), particularly with respect to sufficiently publicly advertised vacancies[78]. However, there are country differences regarding recruitment procedures. For instance, researchers in some Southern (e.g. Italy 60%, Portugal 61%) and Eastern European countries (e.g. Hungary 55%) think that merit-based recruitment is less standard than on average in the EU28. Outside Europe, in the US the shares of researchers agreeing that recruitment is transparent, publicly advertised and merit-based are as high as in the EU28 (US: 72%-81%), all other non-EU country groups report lower shares (cf. MORE3 Global survey report; note that as noted in section 1.3, the Global survey is not representative). Moreover, external advertising of positions does not necessarily imply opening up a position for more intense competition, as additional criteria for the position may make it difficult for researchers to successfully apply for it. As an example, if foreign researchers need to teach in the language of the country where the position is offered, this may substantially reduce the number of candidates for a position.

Researchers' perceptions of how transparent and how merit-based career progression in their home institutions takes place cannot be compared to MORE2 results (Table 1 shows country detail). However, similarly to recruitment, while career paths are seen as relatively transparent on average (71%), in some countries there is a significant share of researchers who disagree on this (e.g., Hungary: 52%). The assessment of merit-based career progression or merit-based tenure-contracts is less positive on average in the EU28 (65% and 64%), with more than 1 out of 3 researchers stating that it is not merit-based. In particular researchers from Southern European countries (Spain, Portugal, France, Italy are between 52-56%), while researchers from some - in contrast with recruitment - Eastern and Northern European countries are more positive (70-80%).

The perception of researchers currently working inside the EU of how transparent and merit-based careers progress is similar to that of researchers currently working outside the EU, but EU researchers perceive higher levels of transparency and merit. Again, the US is an exception as the shares of researchers in agreement are of similar size to the EU28 averages (cf. MORE3 Global survey report).

[78] Comparison with 2012 needs to be made with caution, as the wording of the questionnaire changed slightly.

Figure 7: Researchers' perception of recruitment in their home institutions (EU28)



Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Figure 20 in MORE3 EU HE report

Notes:

- Shares of researchers agreeing with the statement of the question.
- Based on question 40: "What is your opinion on the following issues with respect to recruitment in your home institution: 1) Research job vacancies are sufficiently externally and publicly advertised and made known by the institution. 2) The recruitment process is sufficiently transparent. 3) Recruitment is sufficiently merit-based.", with answer categories "I agree", "I don't agree" and "N/A".
- The difference with 2012 data needs to be interpreted with caution since the respective question in MORE2 was stated slightly differently, in particular the item on external advertising. In MORE2: "What is your opinion on the following issues: 1) Are you satisfied with the extent to which job vacancies are publicly advertised and made known by your institution? 2) Do you think that the recruitment process at your home institution is sufficiently transparent? 3) Do you think that recruitment at your home institution is sufficiently merit-based?", with answer categories "yes", "no" and "N/A / no opinion".
- The size of the sample for each of the items is: for the question on transparency, n=9,558; for the question on merit, n=9,224; and for the question on advertisement, n=9,570

Table 1: Perception of career progression by country, 2016

Country	Merit-based	Transparent	Tenured
Austria	67.7%	75.3%	60.1%
Belgium	72.4%	72.5%	71.3%
Bulgaria	63.0%	69.6%	62.5%
Croatia	56.4%	63.9%	56.1%
Cyprus	68.3%	72.5%	67.4%
Czech Republic	83.2%	82.1%	74.4%
Denmark	75.7%	63.5%	69.1%
Estonia	74.0%	68.9%	68.0%
Finland	74.2%	67.5%	68.4%
France	51.9%	67.8%	61.2%
Germany	65.5%	72.8%	64.9%
Greece	69.1%	77.7%	61.8%
Hungary	52.9%	51.6%	53.5%
Ireland	54.6%	58.5%	62.5%
Iceland	84.3%	79.1%	76.9%
Italy	56.2%	62.6%	46.5%
Latvia	81.8%	78.8%	77.4%
Lithuania	65.7%	67.1%	66.2%
Luxembourg	63.9%	56.7%	54.4%
Malta	72.8%	75.9%	70.4%
The Netherlands	72.5%	60.6%	67.6%
Norway	75.5%	68.9%	63.0%
Poland	83.5%	82.2%	75.8%
Portugal	51.9%	53.9%	49.3%
Romania	80.0%	83.8%	72.2%
Slovakia	64.2%	67.2%	56.3%
Slovenia	66.5%	72.8%	59.3%
Spain	51.5%	62.7%	45.3%
Sweden	78.7%	71.2%	73.6%
Switzerland	69.7%	66.8%	64.8%
United Kingdom	68.2%	74.9%	73.3%
EU	**65.1%**	**70.6%**	**64.2%**

Source: MORE3 EU HE survey (2016)
Notes:
- Shares of researchers agreeing with the statement of the question.
- Based on question 41: "What is your opinion on the following issues with respect to career progression in your home institution: 1) The different types of career paths are clear and transparent at your home institution (I agree/I don't agree); 2) Career progression is sufficiently merit-based (I agree/I don't agree); 3) Obtaining a tenured contract based on merit only is common practice at your home institution (I agree/I don't agree).
- The size of the sample for each of the items is: for the question on transparency, n=9,626; for the question on merit, n=9,373; for the question on tenure, n=8,800.

FACTORS FOR RECRUITMENT AND CAREER PROGRESSION

MORE3 asked researchers how a range of different factors (various forms of mobility, alternative forms of research output and transferable skills) impacts on recruitment and career progression. Standard research output or publication performance was not part of these factors as it was assumed to be central for any researcher.

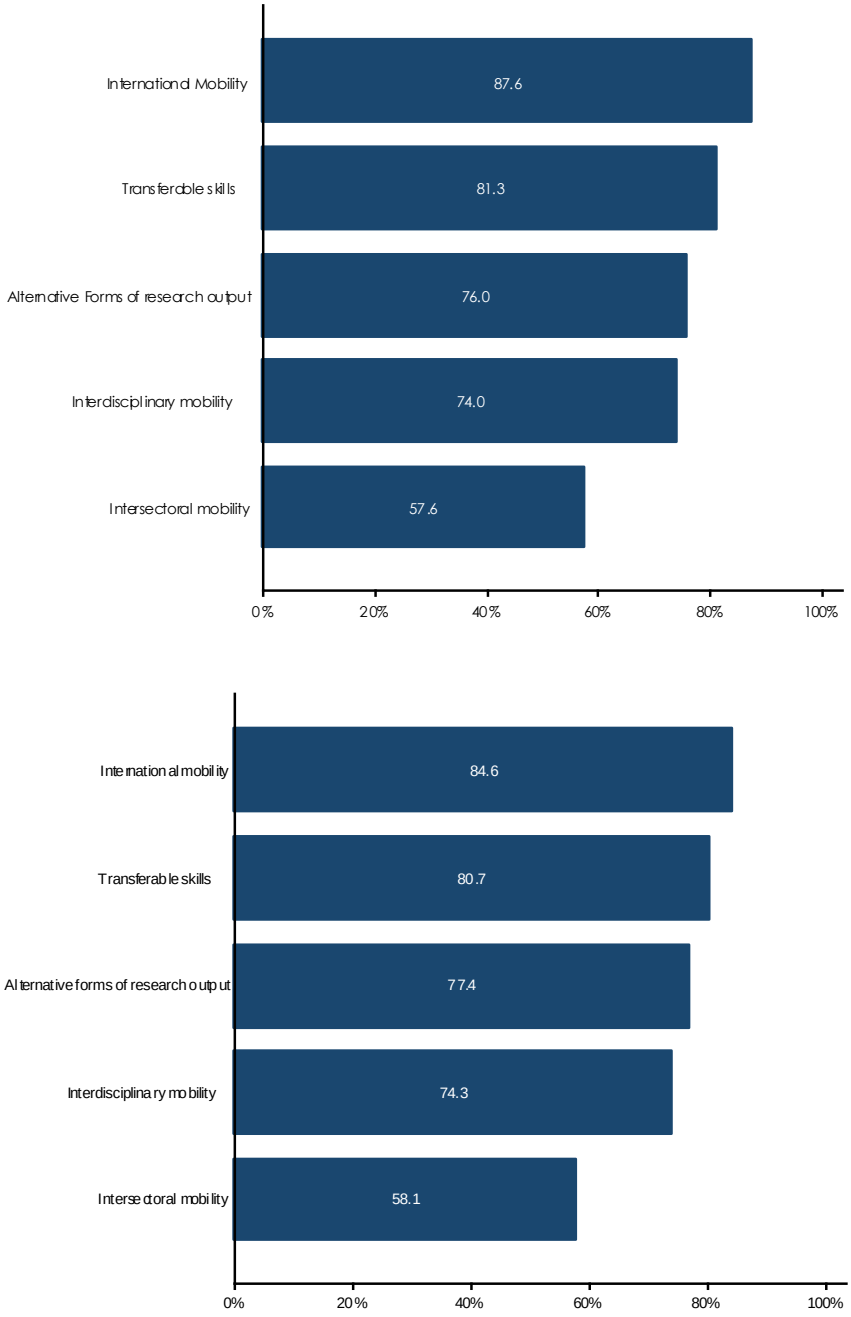
Positive factors for career progression (lower panel of Figure 8) are very similar to those for recruitment (upper panel Figure 8. On average in the EU28, researchers perceive international mobility (85%) and transferable skills (81%) as most positive for their career progression, while a mobility experience to the private sector is perceived to have the weakest positive impact (58%) and the highest negative impact (11%). 7% of researchers in the EU28 think that interdisciplinary mobility has a negative impact on their career progression. In case of intersectoral and interdisciplinary mobility and alternative forms of research output (like project reports or grant writing) large country variations within the EU are observed.

Particularly Southern European countries such as Spain, Italy or France perceive intersectoral mobility (around 48%) and alternative research output (63%) less frequently as positive than on average in the EU. By contrast, researchers in some Eastern European countries are more positive towards intersectoral mobility (e.g., 81% of researchers in Latvia).

The relatively low importance of international mobility as a factor for recruitment or career progression in the US (57%) compared to other non-EU country groups (>70%) or the EU28 (88%) is presumably a consequence of the high quality of the US research system in comparison to other national research systems, so that international mobility may be less beneficial for US-based researchers. Intersectoral mobility in the US is valued even less than in the EU at 35%. As outlined in section 5, this may reflect pressure to excel academically through publishing in top journals. Otherwise, similar results are found in the MORE3 Global survey – a universally positive role of international mobility for recruitment and career progression and a less positive role of intersectoral mobility.

Within transferable skills seen as important for career progression in HEI, skills at the core of an academic research career are most valued, such as regarding decision-making and problem solving, critical and autonomous thinking, communication and presentation, networking and grant and/or proposal writing (95%); entrepreneurship (67%) and dealing with IPR are on average deemed to be less important for career progression in a HEI, but there are differences between disciplines, with e.g. researchers in Medical Sciences and Agricultural Sciences stating that IPR skills (77% and 83%) are important.

Figure 8: Positive factors for recruitment (upper panel) and career progression (lower panel) in the EU28



Source: MORE3 EU HE survey (2016) – Figure 22 and Figure 30 in MORE3 EU HE report
Note:

- Based on question 42: "In your experience, would you say the following factors are regarded as positive or negative factors for recruitment in your home institution?"
- (n=8.483-9.013)
- Share of researchers agreeing that these factors are positive for career progression (EU28 average).
- Based on question 43: "In your experience, would you say the following factors are regarded as positive or negative factors for career progression in your home institution?"
- (n=8,810-8,986)

CHARACTERISTICS OF CAREER PATHS

Different recruitment and career progression procedures give rise to country-specific career paths and systems. The structure of career paths is a main determinant of the attractiveness of a research system, as it conditions career perspectives and time horizons for research agendas: short fixed-term contracts do not allow for pursuing long-term, risky research strategies.[79] Moreover, in quasi-experimental analysis using MORE2 data, it was found that career perspectives, or more precisely career paths which lead to tenure based on merit only are the most important determinant of job choice in academia.[80] This section outlines how long it takes to reach later career stages in the EU, the distribution of researchers over the various career stages (the shape of the "pyramid"), as well as the contractual situation of researchers and the prevalence of dual positions.

In the EU28 it takes 17 years, on average, from the early career stage to become a leading scientist (R4). However, there is substantial variation across countries, particularly with respect to the length of time it takes to finish the first two career stages.[81] Average time in the EU28 to reach R3 is 10 years, ranging from 7-8 (France, Luxembourg, Romania) to 12 (Greece and Italy) and 15 (Poland) years. The heterogeneity of higher education systems across the EU leads to heterogeneous careers, also affecting the distribution of researchers over the career stages R1-R4 (Figure 9). While it is natural for this distribution to take the shape of a "pyramid", with more researchers at early career stages than at later career stages – not everyone can become full professor. MORE3 indicates, in line with other research[82], that the shape of the pyramid considerably differs between countries. Countries with hierarchical chair-based systems and few tenured positions such as in Germany tend to have a smaller share of R4 and R3 researchers (40%), while Southern European systems such as Spain, Greece and Italy tend to feature higher shares of tenured R3 and R4 researchers (69-89%). Compared to 2012, such structural differences seem to be rather persistent.

Most of the researchers in the EU28 have a permanent or open-ended contract (72%). This share has increased considerably over the last years (2012: 63%), implying that fewer researchers are now on fixed-term contracts (EU28 2012: 34%, 2016: 26%). However, at the same time, the gender gap has slightly increased as well.

The share of researchers with permanent contracts is notably higher among male (76%) than among female (66%) researchers. Researcher characteristics across career stages keep their established patterns from previous analyses (MORE2). Early stage researchers (career stages R1 and R2) are younger (below 44 - R1: 78%, R2: 66%), more likely to be on a fixed-term contract (share of permanent contract: R1: 28%, R2: 49%) and have less research autonomy; R3 and R4 are more likely to be on a permanent contract (R3: 83%, in R4 93%), male (share of female researchers in R1: 50%, in R4: 25%), and have more research autonomy but also higher teaching loads.

---

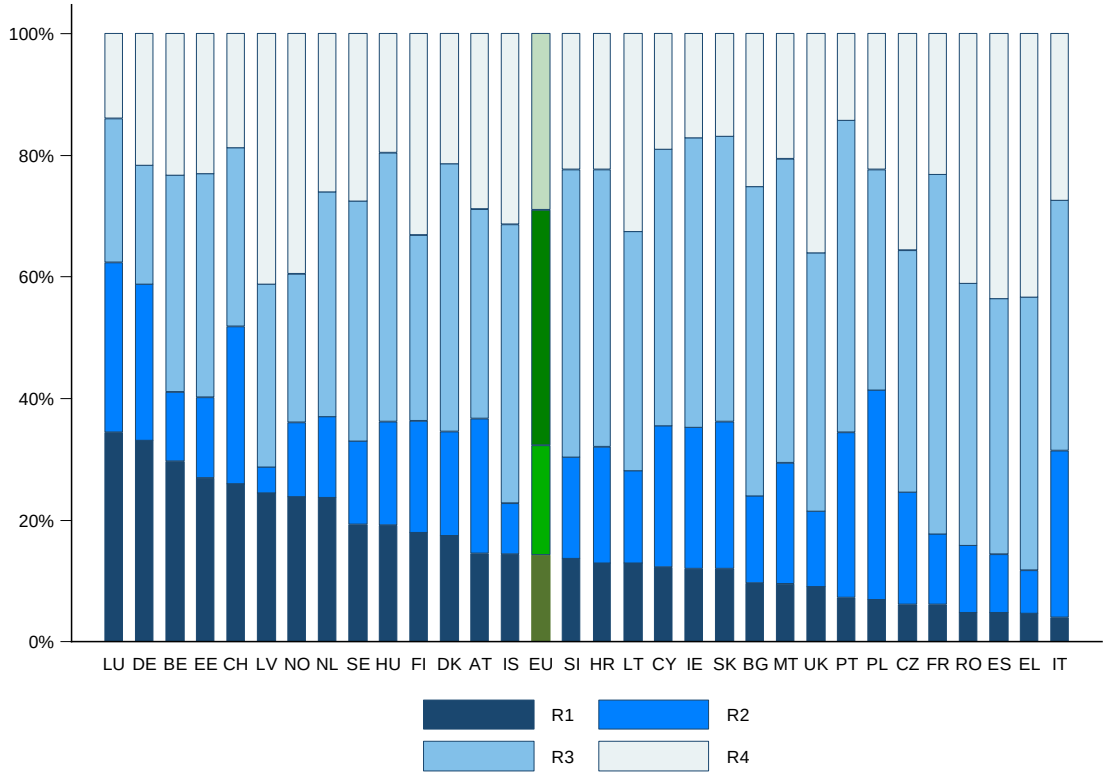
[79] Short-term contracts may also reduce the incentives for a young scientist to invest in human and social capital accumulation; it leads them to favour quantity over quality and may even be detrimental to open science, an EU policy priority (for a thorough discussion of this, see Petersen et al., 2012).

[80] Janger, J., & Nowotny, K. (2016). Job choice in academia. *Research Policy*, *45*(8), 1672-1683.

[81] Ates, G., Brechelmacher, A., „Academic career paths". In Work Situation, Views and Activities of the Academic Professions: Findings of a Survey in Twelve European Countries, Teichler, U., E.A. Höhle, eds., 13–35, 2012, find for selected EU countries an average time span of 7-8 years from PhD graduation to first full-time employment, also with large country variation.

[82] See e.g., Kreckel, R. "University Career Models and International Staff Mobility. Germany, France, Great Britain, USA and Russia Compared." (2017).

Figure 9: Distribution of researchers across career stages R1 to R4, by country



Source: MORE3 EU HE Survey (2016) – Figure 23 in MORE3 EU HE report
Notes:
- Based on question 42: "In which career stage would you currently situate yourself?"
- (n= 10,394)

The country variation in terms of permanent contracts is substantial ranging between 97% in Romania and 27% in Lithuania, again mirroring heterogeneity in career structures: In general, the shares of permanent or open-ended contracts in both Anglo-Saxon/Nordic countries and Southern European countries are higher than in Continental countries. This is in line with the literature, since the Anglo-Saxon/Nordic systems are characterised by an intermediate share and the Southern European system by high shares of tenured researchers[83], while the continental higher education system normally shows higher shares of fixed-term researchers. Looking outside Europe shows that the EU average is higher than the non-EU average, but the US might be an exception: 56% of researchers employed in the US have permanent contracts, while all other non-EU country groups report higher shares (62%-64%). However, in MORE3 EU researchers - working in the US were more likely to be early stage researchers, so that this should be interpreted with caution.

Dual positions are still rare on average not only in the EU, but also outside: in total only 10% of researchers in the EU in the career stages R2-R4 are employed by several institutions, either inside or outside the higher education sector, while 12% of all the respondents to the Global survey report to have a dual position, with higher shares in

[83] The Southern European system refers to systems also called "protective pyramid", with an early access to a permanent position following a strict competition and promotions depending on job availability. E.g. Janger, J., Strauss, A., Campbell, D., „Academic careers: a cross-country perspective". WWWforEurope Working Paper Series 37 (2013).

BRICS countries (16%) than in the US (6%). The shares of researchers with dual position vary only little across career stages, with lowest shares among R2 researchers (9%) and highest shares among leading R4 researchers (11%). Within Europe, dual positions are generally much more common in Eastern and South-Eastern Europe than in other European countries. The combination of positions in the HE sector with positions in other sectors (e.g. private industry) is rare (3%), both in- and outside the EU, and again with slightly higher shares among researchers in higher career stages (R2: 3%, R4: 4%).

CONFIDENCE IN FUTURE CAREER

Overall, 76% of EU researchers are confident about their future career prospects, with more male (80%) than female (69%) researchers feeling confident. In comparison to MORE2 this share is rather stable (2012: 78%) but the observed gender gap has increased (2012: 77% female and 81% male). Moreover, country differences are large and particularly in Northern European the group of optimistic researchers clearly dominates (Iceland: 93%), while the lowest shares of researchers feeling confident are located in Southern European countries (Portugal: 54%). Overall, the share of confident researchers outside Europe is of similar size (79%), and in line with the EU survey the share of researchers who lack confidence is the highest in the group of early-stage researchers, while leading or established researchers show higher levels of optimism about their future (cf. MORE3 Global survey).

6.2. EU policy aims and implications of MORE3 findings

The policy context for researcher careers in the EU is characterised by a variety of policy aims emanating e.g. from Council Conclusions on young researchers, the communication on creating ERA, and the (renewed) agenda for higher education in the EU. Similar to findings regarding PhD training, a number of general performance goals follow from these polices:

- **Quantity of researchers**: As with PhD training, research careers, both with respect to recruitment and career progression procedures need to be attractive (e.g. open, transparent and merit-based), to ensure that a sufficient number of PhD graduates embark upon a career in research. Diversity of career path options is also important with regard to the quantity of researchers.
- **International competitiveness of research careers offered**: worldwide competition for the most talented researchers implies that career paths in the EU must be attractive enough for the best, ensuring brain circulation rather than brain drain.
- **Reducing intra-EU variation in research performance**: reducing both brain drain, notably from weaker regions, as well as the wide regional variation in research and innovation performance, is a key aim of ERA.
- **Diversity of career paths**: Higher demands by industry and the pyramidal nature of career options in academia call for keeping options broad for researchers. Career paths should include all forms of mobility, including intersectoral mobility to the private sector or dual positions.
- **Gender equality among researchers**: Lower shares of female than male researchers, particularly at the later career stages and in natural sciences, point to the need to tackle the under-representation of women in general, but especially in leading research positions, scientific and technical professions as well as in fields where skills shortages exist.

Making progress towards all of these aims would be beneficial both in terms of quantity of researchers and quality of research as measured e.g. through bibliometric indicators, as recruiting the most talented for a career in research would become easier. Apart from

many initiatives at the national level, the EU level addresses these goals from different angles:

- Recommendations and guidelines for Member States, as in the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers, stressing the need for career development opportunities, mobility perspectives or transparent and merit-based recruitment;
- Completion of a unified ERA, where knowledge and researchers circulate freely, using a variety of instruments such as EU-wide (and even global) advertisement of job openings on EURAXESS and providing information on careers in Europe, or working towards portability of pension plans, even creating an EU vehicle (Retirement Savings Vehicle for European Research Institutions or RESAVER);
- Providing funding for individual researchers, e.g. through ERC and MSCA schemes, which provide career development opportunities and mobility perspectives;
- Gender – the EU is encouraging Member States to implement policies boosting gender equality, in particular in decision-making positions, inter alia through providing monitoring of gender balance in research (eg. The SHE figures; see section 4 for more information).
- Encourage young people to embark on scientific careers and encouraging science education.

WHICH LESSONS CAN BE DRAWN FROM THE MORE3 KEY FINDINGS ON RESEARCH CAREERS FOR THESE POLICY AIMS?

Overall, there have been several positive developments with respect to recruitment[84], career progression and other features of academic careers in the EU. By comparison with MORE2, more positions are externally advertised, and more researchers agree that their institution recruits researchers in a **transparent and merit-based** way. Several countries have addressed recruitment and external advertising through reforms and although MORE3 cannot establish causal links between reforms and MORE3 survey results, MORE3 findings are encouraging in this regard. Moreover, there are positive trends with respect to MORE2, with fewer researchers confronted with insecure working conditions in terms of fixed-term contracts, particularly in later career stages, marking a development contrary to the US when judging by the recent literature[85]. However, fixed-term contracts often come with third party research funding, e.g. by science funds, so that a lower number of fixed-term contracts may also be a result of less research funding rather than of purposeful reforms of career structures. In terms of policy, this result needs to be investigated further, as generally MORE3 findings also show that structural heterogeneity between national career and higher education systems in the EU persists, as structural features are naturally slow to evolve.

Recruitment, career progression and paths are characterised by many **national and institutional-level specificities.** Researchers are sometimes employed as civil servants (e.g. particularly France and Greece) or as private sector employees, PhDs and post-docs may depend on third-party funding rather than university funds; the organisation of universities' working units as collegiate departments or hierarchical chairs affects the shape of the "pyramid", i.e. the potential for early stage researchers to make it to later career stages. Practices of recruitment are sometimes centralised as in Italy or

[84] However, there is no information on how HEI have changed their recruitment policies as a result of the awareness-building measures promoted by the EU. While there are encouraging signs, there needs to be further evidence to conclude on whether or not openness of the EU labour market for researchers has improved.

[85] Stephan, Paula E. *How economics shapes science*. Vol. 1. Cambridge, MA: Harvard University Press, 2012.

decentralised as in many other countries[86]. This wide variety of structural differences between EU countries gives rise to different policy priorities. This diversity need not always be negative: heterogeneity may also be a rich and positive source of learning and experimentation. However, MORE3 points to persisting features which impact on the attractiveness of careers in research, not just within the EU, but also by comparison with leading non-EU countries such as the US. Talented young researchers face different opportunities to embark on a successful academic career due to different structures of HE systems.

As an example, in some Southern European systems, the problem for early stage researchers is rather related to "getting into a protective pyramid". There is a low availability of positions and while entry positions frequently are tenured, the journey further up the career ladder is not always merit-based[87]. Some Continental European systems follow hierarchical chair-based organisation models of universities, making it difficult for young researchers to move up to permanent positions. While there are many fixed-term positions and getting in is easy, a comparatively long entry phase due to the "habilitation" which comes with reduced research autonomy and unclear long-term career perspectives makes it difficult to "get up". This system is clearly unattractive by comparison with a "tenure track"-model in US research universities which are organised according to the collegiate department model[88].

Policy options for both career systems – Southern European and Continental – will accordingly differ. The former is more in need of a higher number of entry positions, also linked to reforms of funding, not just career structures (cf. also section 7 on working conditions) and more merit-based promotion with a clear-cut path to the top. The latter need more positions at later career stages allowing for the introduction of a tenure track model which provides clear-cut career perspectives to a higher number of researchers than in a hierarchical chair-based system. Both systems would hence accentuate different parts of a US-style **tenure track system** which many researchers view as the most attractive career model[89].

Both the probability of getting tenure and the path to the top of the career ladder matter considerably to academics making decisions about their employment options. The tenure track-model is very attractive in that it combines a very clear career perspective already from the position of a fixed-term researcher with clear merit-based criteria for promotion to a tenured position. The "up or out" characteristics of this model make it fairer to

---

86 See, e.g., also Teichler, U., Höhle, E.A.H., Eds., The Work Situation of the Academic Profession in Europe: Findings of a Survey in Twelve Countries. Springer London, Limited, 2013; Janger, J., Strauss, A., Campbell, D., „Academic careers: a cross-country perspective". WWWforEurope Working Paper Series 37 (2013).

87 Enders, J., Musselin, C., "Back to the future? The academic professions in the 21st century", High. Educ. 2030, 2008, Vol.1 Demography, pp. 125–150; Lissoni, F., Mairesse, J., Montobbio, F., Pezzoni, M., "Scientific productivity and academic promotion: a study on French and Italian physicists", Ind. Corp. Change, 2011, 20(1), pp. 253 –294; Pezzoni, M., Sterzi, V., Lissoni, F., "Career progress in centralized academic systems: Social capital and institutions in France and Italy", Res. Policy, 2012, 41(4), pp. 704–719.

88 To illustrate this using MORE3 findings, the question on satisfaction with working conditions includes career perspectives (cf. section 7). Southern European countries are at the bottom of satisfaction levels, with e.g. Portugal at 35%, Italy at 47% and Spain at 55%. This is certainly also linked to a lack of positions due to the economic difficulties in these countries; economically strong countries such as Germany (66%) are just at the EU average of 68%, possibly owing to the peculiar career paths there.

89 See, e.g. Brechelmacher, A., Park, E., Ates, G., & Campbell, D. F. (2015). The rocky road to tenure–Career paths in academia. In *Academic work and careers in Europe: Trends, challenges, perspectives* (pp. 13-40). Springer International Publishing, page 23:"Interviewees in the countries which recently implemented the tenure-track model expressed hopes that the tenure-track will provide perspectives to academics and give more clarity and predictability to the academic career path. Generally, the introduction and underlying idea behind the tenure-track is regarded overwhelmingly positively by junior and senior academics alike."

young academics because they know at an early stage whether a career in academia is possible or not. Particularly for women, the earlier option to stay at a university may be beneficial in terms of work life balance on the condition that the "tenure clock" takes account of maternity leave. The compulsory change of university follows in the US after the PhD studies; academics on a tenure track position can then stay at the university, rather than having to switch to another university e.g. in the German "habilitations system".

In studies on the determinants of job choice in academia, clear-cut career perspectives as in a US-style tenure track model are the most important determinant for deciding between job offers. Early stage researchers reveal a substantial willingness to pay for clear-cut career perspectives, i.e. researchers are willing to accept lower salaries in return for a career path which leads them to a tenured position based on their performance only.[90] More attractive career paths are hence a major lever for increasing the attractiveness of research careers vs. outside options, and also vs. competing systems such as the US where we still see asymmetric mobility and a brain drain of the most talented towards US elite universities. While the situation in Europe is changing and several institutions e.g. in Germany now introduce specific tenure track models and the US tenure track is becoming less commonplace at research universities there, continued policy efforts are certainly necessary, in particular in terms of making this model the standard career path rather than the special career path reserved for only a few.

From a system wide perspective aiming at improving overall research quality of universities, there are potential problems arising out of large shares of tenured academics, in that incentives for continuous scientific productivity over the life cycle might be diminished.[91] This may create negative feedback effects for the ability to attract highly talented scientists via the role of the quality of peers: while it may be possible to recruit many talented scientists in a first round, as they age and do not face incentives to uphold research productivity, it is possible that their research productivity diminishes, so that their role as attractor for other, early stage scientists will be reduced. To make high shares of tenured academics compatible with incentives for continuous scientific productivity, there are several options practiced in higher education systems, which have advantages and drawbacks, e.g. adjusting teaching responsibilities and providing more research funding for tenured researchers on a competitive project funding basis.[92] Providing more incentives for good research (and teaching) through funding systems is also part of the renewed agenda for EU higher education, as well as part of ERA priority 1 (improving the effectiveness of national public research systems).

As regards **gender equality**, in most of the EU28 countries female researchers are still underrepresented, particularly in later career stages, and since 2012 the share has stagnated (Figure 3). The Glass ceiling index[93] has slightly improved over the last decade, however, women in grade A positions as well as women on boards are still

[90] Janger, J., & Nowotny, K. (2016). Job choice in academia. *Research Policy*, *45*(8), 1672-1683.

[91] Thursby, Marie, Jerry Thursby, and Swasti Gupta-Mukherjee. 'Are There Real Effects of Licensing on Academic Research? A Life Cycle View'. *Journal of Economic Behavior & Organization*, Academic Science and Entrepreneurship: Dual engines of growth, 63, no. 4 (August 2007): 577–98. Levin, S. G., Stephan, P. E., "Research productivity over the life cycle: Evidence for academic scientists", Am. Econ. Rev., 1991, 81(1), pp. 114–132.

[92] Janger, J., Strauss, A., Campbell, D., „Academic careers: a cross-country perspective". WWWforEurope Working Paper Series 37 (2013).

[93] The GCI measures the relative chance for women, as compared with men, of reaching a top position. The GCI compares the proportion of women in grade A positions (equivalent to Full Professors in most countries) to the proportion of women in academia (grade A, B, and C), indicating the opportunity, or lack of it, for women to move up the hierarchical ladder in their profession.

underrepresented in most of the EU countries (cf. also section 4 on gender as aspect of the demographics of researchers in Europe and the MORE3 Indicator report on researchers). The MORE3 results corroborate the persistence of a glass ceiling effect in EU28 countries, however, the fact that there is a more equal balance among early career stages, can be both an indication of improvements for the future or evidence of the glass ceiling where female researchers drop out before they reach R3 or R4 career stages (cf. section 4).

Similar to PhD training, neither EU nor non-EU researchers view **intersectoral mobility** as very positive **for recruitment and career progression**, and entrepreneurship and IPR skills are deemed to be much less important for the future career than transferable skills closer to core research activities[94]. Moreover dual careers involving a position in a private firm and a HEI or a public research organisation are also rare. The pressure to excel academically in terms of publications may reduce incentives to engage with sectors outside academia. This merits further research, as in principle a more diverse set of career paths, including positions more oriented towards teaching or research on more applied problems may make it easier for researchers to keep a foot in academia at a time when rising numbers of researchers increase the competition for available positions. MORE3 findings hence point to a rather slow emergence of new types of (academic) career paths in terms of more dual positions with industry, recognition of alternative research outputs or intersectoral mobility for recruitment and career progression; academic researchers seem to value more traditional research careers.

EU-LEVEL AND NATIONAL POLICY INSTRUMENTS

First, current efforts in terms of recruitment, career progression and career paths should clearly be continued and intensified. This concerns funding for mobility and career perspectives (ERC, MSCA, etc.) in particular in countries where there is a lack of funding for mobility stints, as international mobility is very important for career progression and recruitment. Support for mutual learning, such as in the form of the policy support facility (PSF) which is specifically working to address the danger of divergence in research and innovation and also works on higher education and science system, continues to be crucial. Mutual Learning Exercises within the PSF could look at the question of attractive career paths for early stage researchers. Further opening up ERA and making it easier for talented researchers to move to another country within the EU can lead to the concentration of the most talented researchers in the most attractive research institutions.

In terms of **recruitment and career progression**, there are 264 HRS4R (The Human Resources Strategy for Researchers) acknowledged institutions[95] in EU28 (cf. MORE3 T3 indicator report). About half of EU Member States possesses no or only a few HRS4R institutions which suggests a slow and an uneven uptake of HRS4R. Member States are encouraged to further promote the 'Open, Transparent and Merit based Recruitment toolkit' among HE institutions (cf. Council Conclusions on Young Researchers, 2016). Under the ERA Steering Group on Human Resources and Mobility a working group has

[94] This average perception does of course not exclude that there are researchers who view intersectoral mobility as positive, or that for some HEI positions intersectoral mobility may be a requirement.

[95] These institutions have signed the Code of Conduct and provided the Commission with a gap analysis and a solid action plan on how to concretely implement the elements of the Code of Conduct. This indicates the strong commitment of these institutions.

been established that provides 'a step-by-step guide to improve (if, when and where needed) the organisation's OTM-R practices' (SGHRM[96], 2015, p.10).

By November 2017, the Charter & Code principles had been endorsed by more than 910 research organisations (about half of public research organisations) located in 35 ERA countries (ERA Progress report 2016).[97] Since 2010, the "HR Excellence in Research" award gives public recognition to research institutions that have made progress in aligning their human resource policies with the principles set out in the "Charter & Code". Institutions that have been awarded are committed to implement fair and transparent recruitment and appraisal procedures for researchers. Countries with the largest number of these institutions per inhabitant (at least 1 per million inhabitants) are Belgium, Croatia, Cyprus, Finland, Ireland, Luxembourg, Slovenia and the UK. In absolute numbers, the UK lead with 87, followed by Spain (38), Croatia (16), and Belgium (12) in 2015. It is of course up to each organisation to review its current procedures and submit a roadmap to adhere to the Charter and Code principles. In the UK, a public support programme helped universities to apply for the label – a reason why relatively many UK universities are among the label holders.

While EURAXESS is a major initiative providing information on jobs and career perspectives, it is still not known by the majority of researchers. There is also country heterogeneity w.r.t the awareness and usage of EURAXESS portal, in some countries, for instance in Austria, public and international advertisement of new positions on Euraxess is compulsory.

Finally, bilateral and multilateral agreements for the collaboration with non-EU countries, notably with the BRICs, have been implemented and are further developed. However, Western European countries seem to lead the way in implementing international agreements and a gap between those and other EU countries emerged (ERA Progress report 2016).

Second, in terms of **gender**, a continuation and intensification of further efforts seems to be necessary as well. Section 4 outlined how gender equality in research is addressed in all relevant EU policy initiatives and national action plans. The need was identified to learn from evaluations and monitoring on what works to increase gender equality, e.g. work-life balance and alternative paces and paths in research careers. It is found that gender monitoring is already in place in the large majority of ERA countries, making it easier indeed to evaluate various initiatives aimed at increasing gender equality and in particular at increasing the share of female researchers in decision-making positions[98]. More evidence on what really works could then feed into mutual learning exercises. For more detail, see section 4.

Third, in terms of fostering **dual careers, or intersectoral mobility** during careers, more research seems to be necessary. For example, a new survey report, 'Intersectoral Mobility Schemes in Science Europe Member Organisations (MO),' investigates efforts made by public research organisations in Europe to develop and implement intersectoral mobility schemes.[99] 25 MOs have introduced specific support schemes for intersectoral

[96] SGHRM. (2015). Report of the working group of the steering group of human resources management under the European Research Area, on open, transparent and merit-based recruitment of researchers. European Union.
[97] https://euraxess.ec.europa.eu/jobs/charter.
[98] A screening of the ERA National Action Plans shows that gender is addressed through many measures, cf. section 4 for an overview.
[99] https://www.scienceeurope.org/wp-content/uploads/2017/01/SE_Intersec-Mobility_Survey_Report.pdf

mobility.[100] The report advances several recommendations, such as involving the non-academic sector early on in support schemes, developing transparent IP rules, preparation of researchers through adequate training, recognition of intersectoral mobility as positive for career progression as well as monitoring gender equality.
In the framework of the Retirement Savings Vehicle for European Research Institutions (RESAVER) a working group has been formed to address 'intersectoral mobility, asymmetric mobility and skills'. Efforts in this area will also depend on PhD studies (cf. section 5). A higher diversity of positions and careers in research, dedicated to the engagement with business and society (similar to the case of specific PhD programmes), could be investigated. Examples are the position of a senior lecturer who has industry experience (or still works in industry), a higher teaching responsibility and less pressure to publish in top journals; or so-called "professors of practice", who would also be important in terms of making students aware of outside opportunities.

At the national level, Member States' National Action Plans (NAP) announce a number of measures and initiatives. Screening through these announced initiatives shows that also policy at national level is directed to the above mentioned points. Without aiming to be exhaustive, and without any further information on the effectiveness of the measure, we list a number of examples that show a variety of measures to improve recruitment and career paths:

- Incentives for research careers at all stages and to retain and attract young talent from Bulgaria and abroad. (Bulgaria)
- To train scientists and other researchers, employees of institutions of research and higher education, experts and employees of expert and coordination institutions, employees of institutions tasked with policy making and implementation in order to develop their skills related to the commercialisation of R&D results and transfer of technologies. (Lithuania)
- The improvement of recruitment practices to ensure more openness and transparency and merit based appointment to research positions will be encouraged in the public and private sector. Efforts will be made to encourage increased awareness and compliance with the Charter and Code of Conduct; Innovative Doctoral Training principles. (Malta)
- Implementation of career models at non-university research institutions (in particular IST-Austria and Austrian Academy of Sciences); Implementation of the new legal basis for facilitating a "tenure track"; Increasing the number of tenure track positions at universities. (Austria)
- Romania focuses its efforts on improving the transparency and openness of its recruitment and career-development system. This can be achieved, inter alia, by bringing the latter in line with internationally accepted hiring and promotion standards. To this end, the Ministry of Education and Research/the National Authority for Scientific Research and Innovation will endeavor to promote the European Charter and the Code of Conduct among research-performing organisations and individual researchers alike. (Romania)

[100] Among them (p. 5): "direct support to intersectoral mobility with dedicated funding (that is, a physical stay in the other sector); joint positions in higher education institutions (HEI) and industry; chairs and professorships at a HEI or research organisation funded by industry or non-academic body; joint doctorates with industry or non-academic partner; collaborative research projects between academia and industry or non-academia; intersectoral mobility included in the general grant mechanism; internships in other sectors."

- Introduction of a programme which aims to integrate young, post-doctoral scientists in the Cypriot R&I System, to carry out high level research projects, seeking to involve the young scientists in novel research activities, to stimulate a critical mass of researchers in cutting-edge scientific areas and to create sustainable, top level specialised job positions for young scientists. The Program also aims to address the problem of brain drain which has increased in recent years due to the weak financial situation of the country. The Program refers to the implementation of a research project by a Young Researcher, holder of a doctoral degree, in the context of his/hers employment by a Cypriot Research Organisation, Enterprise or Other Organisation. The Young Researcher, who may also be the coordinator of the proposed project, shall be employed by the Host Organisation, for the implementation of the project as the main object of the employment, while being able at the same time to participate in other research or teaching activities. (Cyprus)
- Encourage the higher education institutions, research institutes and other research organisations to actively implement a comprehensive career policy, including the Charter and Code and the Human Resources Strategy for Researchers, and particularly work to enhance a welcoming culture. (Norway)
- To ensure Ireland remains an open and attractive prospect for foreign researchers and to encourage Irish researchers to gain overseas experience, ongoing support will be provided for the EURAXESS Ireland Office and the promotion of its activities to relevant stakeholders. (Ireland)
- Introduction of a scheme for increasing the number and share of researchers collaborating with industry. (Slovenia)

7. Working conditions

Working conditions

Satisfaction with different types of working conditions

	Academic aspects	Employment aspects	Personal aspects	Career related aspects
2012 (n=9,016)	89.3%	59.6%	83.6%	63.0%
2016 (n=9,303)	91.2%	77.5%	86.6%	70.1%

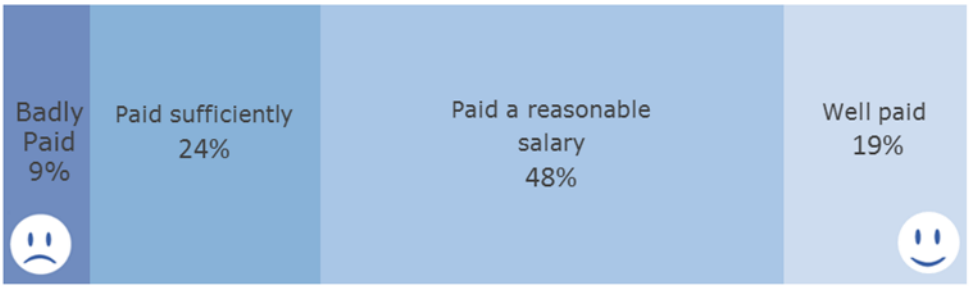
Working conditions with lowest satisfaction

- Satisfaction with research funding (42%)
- Satisfaction with the balance between teaching and research (67%)
- Satisfaction with career perspectives (68%)

Working conditions with highest satisfaction

- Satisfaction with intellectual challenge (95%)
- Satisfaction with level of responsibility (92%)
- Satisfaction with contribution to society (89%)

Perception of remuneration (2016)



Source: Based on MORE3 EU HE report (section 6)

Once researchers have begun a research career, the working conditions in their job are crucial for their scientific productivity and for the decision to stay in research or take on another job. Researchers, particularly academic researchers, experience a highly competitive working environment. The "up-or-out" nature of research results in a high proportion of researchers dropping out of research careers. While the specific "winner-takes-it-all" aspect of (academic) research might lead to undesired drop outs of highly talented researchers, competition among researchers can enhance scientific productivity and lead to new pioneering insights. However, this holds only true if the selection criteria are largely merit-based and leaving the academic labour market is not due to poor working conditions[101].

Research careers are terminated not only because of low levels of productivity. Evidence[102] shows that despite high labour demand, for example, the number of young American physician-scientists was stagnating at the time investigated due to more attractive working conditions and secure career paths outside academia. The availability of funding and research grants, as a measure to ensure continuation of career paths and reduce insecurity, is found to be not only productivity enhancing[103] but also to reduce chances of researchers leaving the profession[104]. Aside from financial support, there are a number of other factors (e.g. collaboration possibilities, teaching and social recognition) influencing both research quality, scientific productivity and the transition and diffusion of knowledge as well as the well-being and satisfaction of researchers with their job.

7.1. Key findings

The infographic above shows the evolution of the perception of satisfaction with working conditions between 2012 and 2016 based on the systematisation of MORE2. It is clustered into aspects related to academic life (intellectual challenge, reputation of employer, research autonomy and level of responsibility), employment conditions (job location/quality of life, job security, pension plan, remuneration package), personal aspects (contribution to society, social status, dynamic work environment) and career aspects (career and mobility perspectives). By comparison with MORE2, there is a clear upward trend, particularly regarding employment aspects.

This myriad of working conditions potentially relevant for working as a researcher makes it difficult to single out the main ones. MORE2 used a stated choice approach to identify the most relevant working conditions[105]. Based on this analysis, MORE3 conceptualises the main relevant working conditions to fall into one of three categories, namely:

- **Working conditions not directly affecting scientific knowledge production**, such as conditions relevant for extrinsic pecuniary motivations to engage in a research career (e.g. salary and pension entitlements), and working conditions affecting social and content-specific motivations of a research career (dark blue bars in Figure 10).

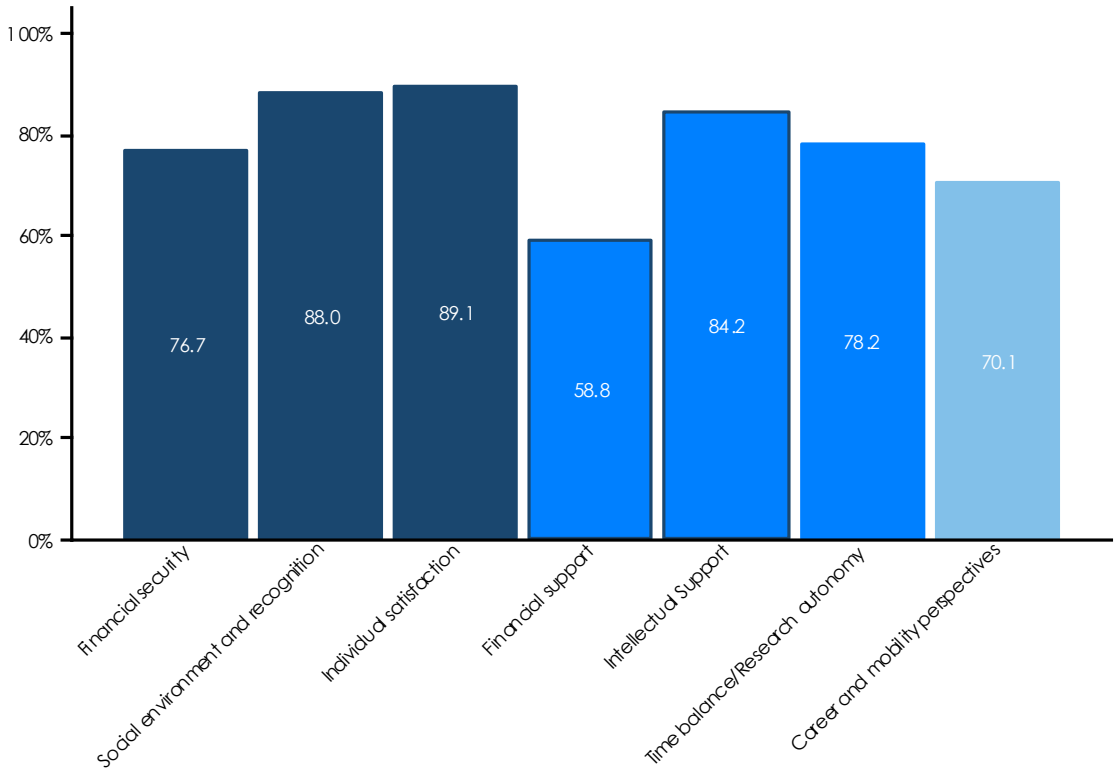
[101] Geuna, A., Shibayama, S., (2015) "Moving Out Of Academic Research: Why Scientists Stop Doing Research?", in Geuna, A. (Ed.), Glob. Mobil. Res. Sci. Econ. Who Goes Why, Elsevier, pp. 271–303.
[102] Donowitz, M., Germino, G., Cominelli, F., Anderson, J. M., (2007) "The attrition of young physician-scientists: problems and potential solutions", Gastroenterology, 132(2), pp. 477–480.
[103] Partha, D., & David, P. A. (1994). Toward a new economics of science. *Research policy*, *23*(5), 487-521.
[104] Geuna, A., Shibayama, S., (2015) "Moving Out Of Academic Research: Why Scientists Stop Doing Research?", in Geuna, A. (Ed.), Glob. Mobil. Res. Sci. Econ. Who Goes Why, Elsevier, pp. 271–303.
[105] IDEA Consult et al, 2013. MORE2 - Support for continued data collection and analysis concerning mobility patterns and career paths of researchers, Final Report. European Commission, DG Research and Innovation, Janger, J., Nowotny, K., (2016) "Job choice in academia", Research Policy, 45(8), pp. 1672–1683.

- **Working conditions affecting scientific knowledge production**, such as research funding, working with stimulating peers or career-path determined time horizon available for implementing one's research agenda (medium blue coloured bars in Figure 10).
- **Working conditions relevant for both knowledge production and pecuniary motivations**, such as career and mobility perspectives (light blue coloured bar in Figure 10).

Working conditions which are crucial for deciding between jobs or for sustainably attracting early stage researchers into research careers are mainly those that are relevant for knowledge production, for doing research, and much less so material working conditions or quality of life. While salaries are ceteris paribus important, researchers are "willing to pay" – to give up salary – for working conditions which enable them to implement their research agenda. The attractiveness of research jobs is hence a result of factors influencing how well researchers can do their jobs, including among others the extent of research autonomy, the quality of their peers, their funding, the balance of time between teaching and research as well as long-term career perspectives.

Figure 10 illustrates the conundrum of embarking on a career in research – a very high level of satisfaction with intellectual challenge and job-specific content runs up against uncertain career perspectives and less satisfactory funding of research. The same pattern is found in the survey concentrating on researchers currently working outside the EU (cf. MORE3 Global survey report). This means that attracting more people into research careers – as is an EU policy goal to tackle the challenges of more knowledge-based competition and the role of knowledge in fighting climate change, among others – is clearly linked to funding and career perspectives. The job of a researcher is attractive as such – researchers find high satisfaction in the content and intellectual challenges of their work, but the conditions have to foster the actual activity of research.

Figure 10: Satisfaction with working conditions (EU28)



Source: MORE3 EU HE survey (2016)
Notes:

- Based on question 36: "Please indicate your satisfaction with each factor as it relates to your current position:" and question 37: How do you feel about your remuneration package (if you do not take into account a second income or, if applicable, the income of your partner)?
  - The figure represents working conditions not directly affecting scientific knowledge production (dark blue), working conditions for scientific knowledge production (medium blue) and career and mobility aspects (light blue).
- Financial security includes remuneration, job and social security; social environment and recognition includes contribution to society, social status and reputation of the current employer; individual satisfaction includes intellectual challenge, dynamic work environment, level of responsibility and quality of life;
- Financial support includes availability of research funding, research facilities and equipment; intellectual support includes working with leading scientists, training and education;
- (n= 10,394)

WORKING CONDITIONS NOT DIRECTLY AFFECTING SCIENTIFIC KNOWLEDGE PRODUCTION

Regarding **financial security**, high shares of the researchers currently working in the EU are content with social security (80%), while rather low shares perceive remuneration as satisfying (67%). Part-time researchers working more than 50% of full-time are on similar levels as full-time researchers in terms of satisfaction with remuneration (around 70%), however, there is a clear gap in terms of satisfaction with job security (82 % vs. 63%). By comparison with outside academia, on average close to 60% of researchers in

the EU feel less well paid than their counterparts outside academia, with female and later stage researchers more likely to report this than early stage researchers[106].

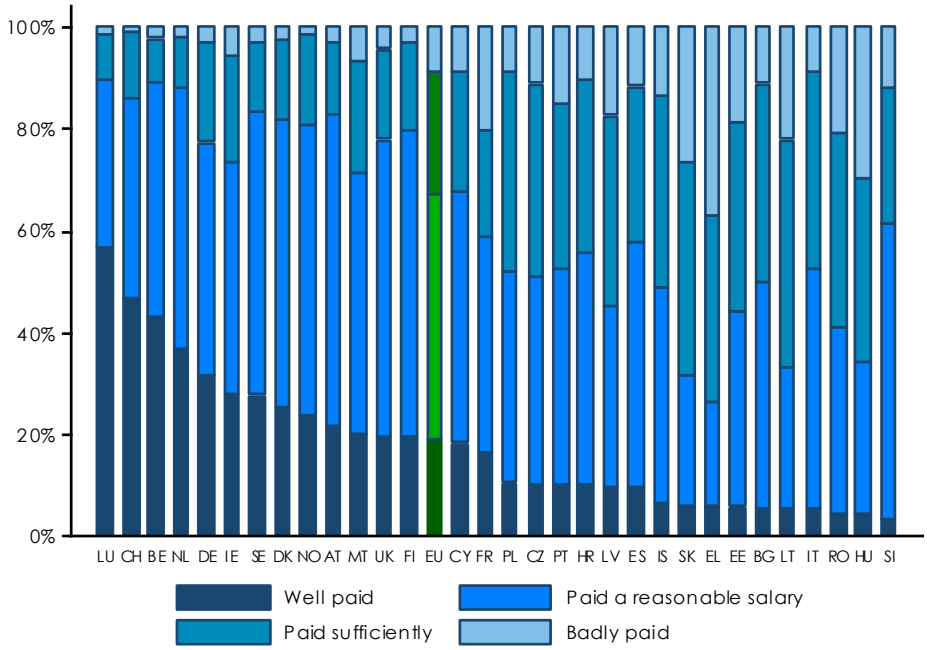
Within the EU and its Associated Countries, significant country differences along lines of economic development can be found, particularly in the case of financial security. While Luxembourg or Switzerland report high shares of researchers perceiving salaries to be reasonable (90%), some Eastern and South European countries are at the bottom (25%) (Figure 11). Similarly, in all Western and in particular in the Nordic EU Member States at least 3 out of 4 researchers are satisfied with their pension plan, while Southern and Eastern countries report shares around 50% (Greece only 25%). In terms of financial security the gap between part-time and full-time workers is particularly high in Southern European countries (pension plans: 20% vs. 54%), while there is much less of a difference between part- and full-timers in Northern European countries. However, not only economic conditions but also HE system structures are reflected in some working conditions: researchers in Germany (71%) are on par with Greek researchers in terms of levels of satisfaction with job security[107]. Particularly in the Baltic countries (e.g. Estonia, Lithuania), as well as in Eastern European countries (e.g. Romania, Slovenia) the shares of female researchers considering themselves as well or reasonably well paid are remarkably lower than the respective shares of male researchers.

A higher share of researchers currently working outside the EU in non-EU OECD countries feel well or reasonably well paid (77%), while the share of researchers satisfied with social security is lower (73%) than in the EU. Similarly, 57% of researchers outside the EU feel less well paid than their counterparts outside academia, however, researchers feel less often worse paid in later career stages, a result in contrast to the MORE3 EU HE survey (cf. MORE3 Global survey). Dissatisfaction with salary can affect researchers' mobility decisions, however, the literature and our results suggest that key motivators are a good research environment and promising career perspectives (cf. discussion in section 9); salary ranks very low as a motive to move.

Within the EU the shares of satisfied researchers with **individual satisfaction** at work and with **social environment and recognition** are high in terms of every individual aspect included (85%-95%). These shares are all slightly higher than the respective shares of researchers currently working outside Europe (74%-91%), however, the pattern stays the same: the approval rates are the highest for intellectual challenge and level of responsibility at researchers' working positions, and are a little lower in terms of quality of life and dynamic work environment (cf. MORE3 Global survey). High levels of satisfaction with social security and content-specific aspects of jobs (intellectual challenge etc.) may compensate dissatisfaction with pay when compared with outside academia, making research careers attractive.

[106] This is based on the perceptions of mostly academic researchers.
[107] Germany features a high share of fixed-term researchers due to their chair-based organisation in universities.

Figure 11: Perception of remuneration by country



Source: MORE3 EU HE Survey (2016) – Figure 42 in MORE3 EU HE report
Notes:
- Share of researchers considering themselves well paid, paid a reasonably salary, paid sufficiently to only make ends meet or badly paid and struggling to make ends meet.
- Based on question 37: Based on question 37: "How do you feel about your remuneration package (if you do not take into account a second income or, if applicable, the income of your partner)?
- (n=10, 394)

WORKING CONDITIONS FOR SCIENTIFIC KNOWLEDGE PRODUCTION

National capabilities to contribute to the scientific frontier are driven by the capabilities of individual researchers. Working conditions which influence scientific productivity of individual researchers are crucial to attract excellent foreign researchers, increase performance of the existing scientific staff and help to build up promising junior scientists, i.e. drawing more people into research careers. Among them are financial support (research funding and access to research infrastructure) and intellectual support provided to researchers (quality of peers) as well as the degree of time balance between teaching and research and research autonomy. Finally, career path elements also influence scientific knowledge production as career-determined time horizons for research agendas change the content of research[108].

The majority of researchers in the EU28, particularly in later career stages, is satisfied with the **intellectual support** (opportunities to work with leading scientists: 83%; quality of education and training: 86%). Within **financial support**, the share of researchers satisfied with their access to research facilities and equipment (76%) is over 30 percentage points higher than the share of researchers who are satisfied with the availability of research funding (42%), which is higher in later career stages compared to

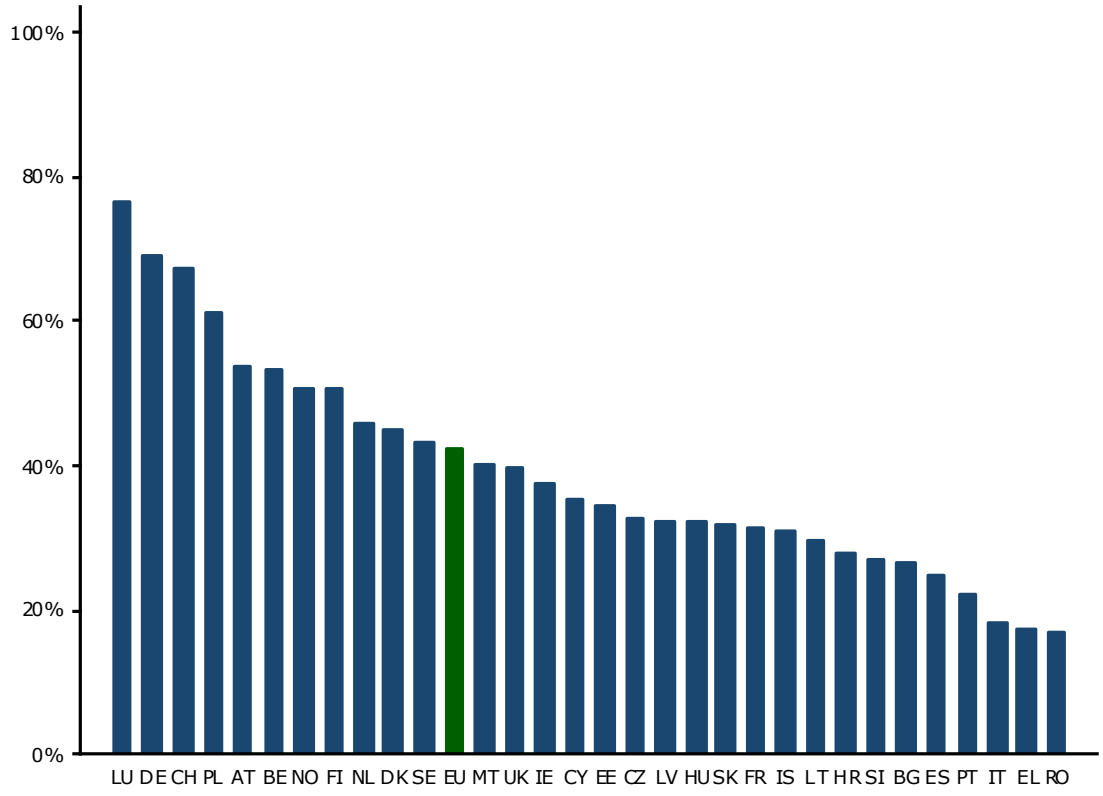
[108] Petersen, A. M., Riccaboni, M., Stanley, H. E., Pammolli, F., (2012) "Persistence and uncertainty in the academic career", Proc. Natl. Acad. Sci., 109(14), pp. 5213–5218.

early career stages. A high share of researchers is satisfied with **research autonomy** (89%, 2012: 87%), with somewhat fewer early stage researchers than leading R4 researchers. In contrast, the share satisfied with their balance **between teaching and research time** is considerably lower (67%), with more satisfied researchers among early stage R1 than among leading R4 researchers. Overall, the teaching load has gone up slightly by comparison with MORE2 (based on a question in the EU HE survey on teaching activities). With respect to every aspect related to the environment for scientific knowledge production the shares of satisfied male researchers are higher than the shares of satisfied female researchers, particularly in terms of balance between research and teaching.

Although the average share of researchers satisfied with research funding is of equal size to outside the EU (39%), the share of satisfied researchers working in the US is considerably higher (50%) than the EU average. With the exception of the US, outside Europe the shares satisfied with their balance between teaching and research time (54%), and the quality of training and education (67%) are in general lower (cf. MORE3 Global survey report).

Within the EU a geographic pattern is observed in terms of satisfaction with research funding, with poorer Eastern European countries (with the exception of Poland) and in particular Southern European countries hit by the crisis and fiscal consolidation are at the lower end of the spectrum (Figure 12). A similar pattern appears in terms of access to research facilities and equipment (Switzerland: 90%, Croatia: 42%) as well as in terms of balance between teaching and research activities (Luxembourg: 91%, Croatia: 46%), with higher shares of satisfied early stage researchers especially in Northern and Western European countries (Table 2). Satisfaction with opportunities to work with leading scientists ranges between 61%-94% and corresponds roughly to the performance of countries in research excellence. Researchers working in Anglo-Saxon and Nordic higher education systems, like Denmark, the Netherlands or the U.K., are on average more satisfied with their opportunities to work with leading scientists (87%) than researchers working in Continental (approximately 82%) or Southern European (80%) higher education systems.

Figure 12: Individual satisfaction with research funding, by country



Source: MORE3 EU HE Survey (2016) – Figure 55 in MORE3 EU HE report
Notes:
- Share of researchers satisfied with the availability of research funding.
- Based on question 36: "Please indicate your satisfaction with each factor as it relates to your current position"
- (n=10,075)

Table 2: Individual satisfaction with access to research facilities and the balance between teaching and research by career stages

	Research facilities				Balance teaching research			
	R1	R2	R3	R4	R1	R2	R3	R4
North	90.7%	86.3%	82.1%	85.5%	79.1%	73.8%	60.1%	72.9%
South	68.3%	52.8%	50.6%	55.7%	56.4%	60.3%	50.8%	67.1%
West	86.4%	88.6%	83.9%	81.3%	80.9%	84.4%	65.2%	66.2%
East	68.6%	66.7%	62.4%	71.4%	67.4%	63.1%	57.2%	73.8%
EU	83.8%	77.3%	72.9%	74.1%	77.7%	75.0%	60.3%	67.7%

Source: MORE3 EU HE Survey (2016) – Table 11 and Table 13 in MORE3 EU HE report
Notes:
- Share of researchers satisfied with their balance between teaching and research time.
- Average shares of the following country groups are shown: East (CZ, EE, HU, LV, LT, PL, SI, SK, BG, RO, HR), North (NO, SE, FI, DK, IS), South (PT, ES, IT, EL, MT, CY), West (BE, FR, DE, NL, LU, AT, UK, IE, CH) and EU28.
- Green = high compared to the average of the column; Red = low compared to the average of the column.
- Based on question 36: "Please indicate your satisfaction with each factor as it relates to your current position"
- (n=9,412)

CAREER AND MOBILITY PERSPECTIVES

As outlined, career perspectives matter both for scientific knowledge production and for job and financial security. We therefore treat this aspect as a cross-cutting issue relevant for both remuneration and scientific knowledge production. Mobility perspectives shape collaboration patterns, so that they also influence scientific knowledge production. Team size and average number of co-authors is on the rise, so that mobility perspectives become more important overall for scientific productivity and career success.[109]

For both career perspectives and mobility perspectives, more than 2 out of 3 researchers in the EU28 are satisfied with their current position (68% and 73% respectively; 2012: 62%. However, the share of researchers satisfied with their career perspectives in Southern European countries (50%) is somewhat in contrast to the rest of Europe (71%-76%). Overall, the average share of researchers satisfied with their career perspectives outside the EU is slightly lower (62%; exception US: 72%). A similar pattern is observed for the perception of mobility perspectives (Southern Europe: 54%, Northern Europe: 81%, EU28: 73%, 2012: 64%). Outside Europe (in the US) the average share of researchers satisfied with mobility perspectives is by 20 (10) percentage points below the EU28 average (cf. MORE3 Global survey report).

The lowest shares of researchers satisfied with their career perspectives are located in early career stages, particularly in career stage R2 (followed by R1), the highest are located in the group of leading R4 researchers. A similar pattern, but to a lower extent, is also found for mobility perspectives. To some extent this might reflect the higher shares of early stage researchers having fixed-term contracts compared to leading researchers and their rather unpredictable, sometime even erratically career paths. This is plausible, as R4 researchers have made it to the top of the career path and hence enjoy their current position; uncertainty about the feasibility of a research career is highest at the R2 stage, when career progression often depends on the assessment of research performance by others (cf. MORE3 HE EU survey report).

Overall, comparing all aspects of working conditions independent of specific career stages researchers' satisfaction with funding, the balance between teaching and research and career perspectives is lowest.

7.2. EU policy aims and implications of MORE3 findings

The policy context regarding working conditions of researchers in the EU is characterised by a variety of policy aims emanating e.g. from Council Conclusions on young researchers, the communication on creating ERA and the agenda for modernisation of higher education in the EU. Similar to the case of PhD training and recruitment/career paths, a number of general performance goals follows from these polices:

- **Quantity of researchers**: as with PhD training and career paths, working conditions need to be attractive to keep researchers in research careers. Among the various working conditions, those affecting scientific productivity are particularly important.
- **Quantity of research**: the EU aims at R&D expenditures of 3% of GDP by 2020.

[109] Pavlidis, I., Petersen, A. M., & Semendeferi, I. (2014). Together we stand. *Nature Physics*, *10*(10), 700-702; Walsh, J. P., & Lee, Y. N. (2015). The bureaucratization of science. *Research Policy*, *44*(8), 1584-1600.

- **Quality of research**: attractive working conditions are crucial to make sure researchers can fulfil their potential, contributing to EU research excellence.
- **International competitiveness of research jobs in the EU**: worldwide competition for the most talented researchers implies that working conditions in the EU must be attractive enough for the best, ensuring brain circulation rather than brain drain.
- **Reducing intra-EU variation in research performance**: reducing both brain drain, notably from weaker regions, as well as the wide regional variation in research and innovation performance, is a key aim of ERA.
- **Gender equality among researchers**: reduce gender-related differences in working conditions in order to improve attractiveness of research careers for women and to ensure full exploitation of female researchers' potential.

Apart from many initiatives at the national level, the EU level addresses these goals from different angles:

- Recommendations and guidelines for Member States, as in the European Charter for Researchers, stressing the need for career development opportunities and mobility perspectives which are important working conditions; or in the council conclusions on young researchers, which call upon Member States to improve career perspectives, the research-teaching balance, national funding of research and mobility and collaboration schemes.
- Providing funding for individual researchers, e.g. through ERC and MSCA schemes, which provide several key working conditions such as access to research infrastructure and research autonomy.
- Project-based research funding such as through Horizon2020 helps researchers fund their research.
- The EU is encouraging Member States to implement policies boosting gender equality, in particular in decision-making positions, inter alia through providing monitoring of gender balance in research (e.g. The SHE figures; see sections 4 and 6 for more details).

WHICH LESSONS CAN BE DRAWN FROM THE MORE3 KEY FINDINGS ON WORKING CONDITIONS FOR THESE POLICY AIMS?

First, MORE3 findings indicate that **research jobs are attractive by their nature** – intrinsically motivated researchers like what they are doing, in terms of intellectual challenge, responsibility, social recognition etc. This means that for research careers to be attractive, it is sufficient to provide good working conditions and it is not necessary to convince students that research may be an interesting job option for them. Moreover, research based on MORE2 data showed that researchers are willing to trade-off material working conditions such as salary against working conditions for research, including research autonomy and funding, longer time horizons for their research agendas (in the form of long-term career perspectives), etc. Working conditions for research are hence drivers of attractiveness of jobs in research, more so than salaries, quality of life or other non-research related working conditions.[110]

Second, there has been an **upward trend in satisfaction** with working conditions across the board since 2012. Linking these findings to national policy developments would need an in depth country-level analysis, which is outside the scope of this study. Lowest satisfaction is perceived with respect to research funding, career perspectives and

[110] Janger, J., & Nowotny, K. (2016). Job choice in academia. Research Policy, 45(8), 1672-1683.

the balance between time for teaching and time for research. The last two concern particularly early stage researchers, as they are most in need of stable career perspectives and as evaluation benchmarks are often geared towards excellence in research rather than teaching. At the international level, a similar pattern of lower satisfaction with respect to these aspects of working conditions can be observed, with the US usually showing much higher satisfaction levels.

Third, as in career paths and recruitment, a picture of **heterogeneity** in satisfaction with working conditions emerges across the EU, although this time the fault lines are less related to different higher education systems as in section 6 on career paths, but rather to economic development, public budgets for research and research performance, as very low satisfaction in some Southern and Eastern European countries with salaries, pension plans, the quality of peers and research funding shows. On the assumption that real differences are at least partly responsible for these perceptions, this heterogeneity may impact on the completion of the single knowledge market in the EU and on the perspectives of achieving symmetric rather than asymmetric mobility of talented researchers in the EU (i.e. brain drain instead of brain circulation).

Fourth, with respect to every aspect related to working conditions for scientific knowledge production the shares of satisfied male researchers are higher than the shares of satisfied **female researchers**, particularly in terms of balance between research and teaching, but also in terms of career perspectives, where there is gap of 10 percentage points in the perception of satisfaction. However, in early career stage R1 the share of female researchers perceiving themselves as better paid than outside academia is almost 1.5 times greater than the share of male researchers that agree. In later career stages, the share of female researchers perceiving their wage as better or similar is decreasing and converging to the respective shares of male researchers. This result could hint at some improvements regarding the gender wage gap in universities and higher education institutions (e.g. by the implementation of transparent wage schemes in the course of gender action plans), compared to salaries outside academia over the last decades[111]. However, alternative interpretations are also possible, in that female early stage academic researchers do not perceive the same outside options as male early stage researchers.

EU-LEVEL AND NATIONAL POLICY INSTRUMENTS

The **heterogeneity in the perception of working conditions** across the EU can be addressed through a variety of approaches.

- First, overall economic policy for convergence, e.g. through ESIF – structural funds – will also work indirectly towards the convergence of research systems, as wages, researchers' pensions and research funding budgets can grow more quickly in catching up countries. ESIF contribute to the implementation of smart specialisation strategies focused on matching the strengths of national research and innovation systems with business needs.

[111] For instance, some European countries (e.g. Austria, Spain, Norway) motivate or obligate universities to explicitly create equality plans by specific legal provisions. In Denmark gender equality is included in the development contracts of universities with the ministries. For further examples see the report on Gender Equality Policies in Public Research (2013).

- Second, EU research funding can play a role in working against low satisfaction with national research funding. However, low success rates in Horizon2020 imply that only the very best will make it, which are more likely to come from successful research systems in economically developed countries. Most of the basic and applied research funding of the EU (Horizon2020, ERC) now is distributed on the basis of excellence, with good reason, so that primarily countries with well-performing research systems or individually excellent researchers benefit. EU institutions are considering how the research and innovation divide between EU Member States and regions could be reduced and how the problem of brain drain from less developed regions could be mitigated, e.g. also in the renewed EU agenda for higher education. One way to combine "efficiency and equity" may be to increase research infrastructure funding in struggling countries, which would still be open to researchers from across the EU, so that they could serve as European platforms, while still generating positive local spillovers. This merits further research though – firstly, this has to some extent already been pursued by the structural funds, and second, just funding the infrastructure is rarely enough, there also need to be the researchers who can put that infrastructure to use. Institutional co-funding of tertiary education was discussed in section 5 on PhD training. The recent suggestion to introduce European Universities could also be relevant if realised[112].

- Third, if national research funding is limited, then the allocation mode of funding matters all the more, in line with ERA priority 1 on increasing the effectiveness of national research systems. A variety of funding modes can concentrate funding on the most promising research projects or early stage researchers, including ex-ante peer-review on a project basis or more ex-post funding mechanisms such as the REF (Research Excellence Framework) in England. Such mechanisms have advantages and disadvantages, which need to be screened in a country-specific context, reflecting national idiosyncracies which may impact upon the effectiveness of such allocation mechanisms. More or stronger financial incentives for higher education institutions, which include (1) funding for excellence initiatives, (2) competitive/performance-based funding and (3) performance agreements is also a focus of the renewed EU agenda for higher education.

- Fourth, best practice sharing and mutual learning exercises can be very important, as organised by the EU within the PSF (cf. discussion in section 6). Such MLEs could focus on which working conditions to prioritise given limited budgets. MORE3 findings would indicate a focus on research funding (allocation of funding), career paths/perspectives (as mentioned in section 6) and on the balance of teaching and research. This balancing matters more to early stage researchers as they are judged against research performance. To introduce flexibility in universities, when scientific productivity among tenured researchers declines, teaching hours could be increased to free up resources for promising young researchers. Such adjustment may come at the explicit will of more established researchers aiming at imparting more of their knowledge and skills to students; or it may be the outcome of evaluations organised by universities themselves. National legal frameworks should in principle allow for such flexibility.
  Given the known willingness of early stage researchers to give up some salary in exchange for good research conditions, there is a chance that well-designed careers

[112] Cf. Communication on Strengthening European Identity through Education and Culture, COM(2017) 673 final.

and positions in research can compensate for the economic disadvantages of catching up countries, such as lower salaries.
To allow for long-term planning of research agendas, next to career perspectives long-term (national) funding commitments could increase budgeting reliability and planning security.

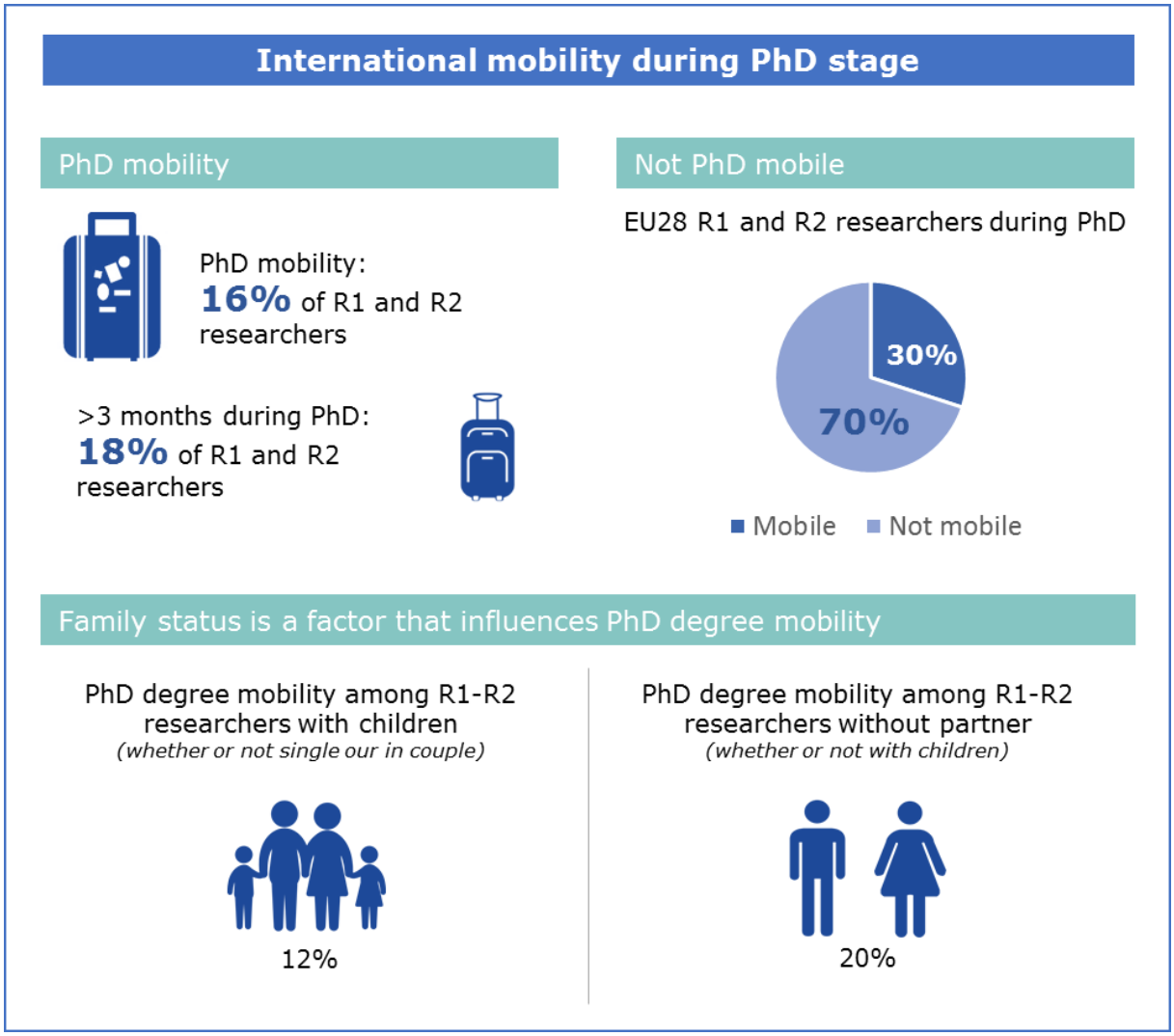
- Fifth, regularly monitoring the attractiveness of working conditions or of jobs offered to researchers can also help spotting trends of divergence at an early stage.

Regarding **gender**, the discussion in section 6.2 partly also holds here. Particularly relevant for improving working conditions are specific funding initiatives for young female researchers (e.g. doctoral programmes, grants) and the implementation of mentorship programmes especially for young female researchers during and after their studies. National policy measures aimed specifically at monitoring and addressing researchers' gender wage gap have already been implemented in some countries (Austria, Cyprus and Finland) and others opted for unsolicitous measures like the voluntary implementation of advisory committees for monitoring wage differences (e.g. Slovenia) (cf. ERA Progress Report 2016). Increased monitoring and national initiatives like Gender Equality Plans might improve gender differences in terms of financial and social security in the long run.

At the national level, Member States' National Action Plans (NAP) announce a number of measures and initiatives. Screening through these announced initiatives shows that policy at national level is also directed to the above-mentioned areas. Without aiming to be exhaustive, and without any further information on the effectiveness of the measure, we list a number of examples that show a variety of measures introduced to improve overall working conditions (cf. also section 4 on gender):

- Harmonising rules and procedures for participating in research funding calls and promoting interoperability between Italy and other EU Member States. (Italy)
- Increasing the stability of research funding and, to this end, increasing the baseline financing of research institutions with the aim of achieving an equal distribution between baseline financing and competitive research grants (action plan 2015-2019 of the Government of the Republic). Making proposals for the State Budget Strategy to ensure that RD is financed according to the objectives set out in the RDI strategy. (Estonia)
- Introducing stable institutional funding based on external evaluation of institutions and thematic areas which shall, in addition to scientific excellence, take into account social relevance, collaboration with innovative industry and the integration in ERA. Optimising the RDI funding system according to principles of flexibility and cost effectiveness. Establishing a comprehensive RDI funding system based on complementarity and synergies among national and European RDI funds that will enable co-funding Slovenian researchers in excellent projects for which sufficient funds on European level are not available (ERC grants, SME instrument, spreading scientific excellence and cooperation instruments, etc.). (Slovenia)
- Introducing incentives for RPOs providing employment and career advancement opportunities to the under-represented gender. (Italy)
- Introduction of a partnership to address shortcomings in terms of qualifications, career and salary structures. (Bulgaria)

8. International mobility during PhD stage



Source: Based on MORE3 EU HE report (sections 7.1.1.1 and 7.1.1.2)

As shown in our conceptual framework in section 3, international mobility is one of the key dimensions for optimal knowledge circulation and exchange. It is beneficial in terms of circulation of qualified researchers and skills, and increased access thereto through the development of international networks[113]. International mobility is a strong enabler for (continued) international collaboration (cf. section 9.1.3 on the effects of mobility and section 10 on other forms of international collaboration) and, through the increased exchange and access to networks and skills, drives scientific productivity[114]. PhD

[113] Guthrie S., Lichten, C., Corbett J. and Wooding S. (2017). International mobility of researchers. A review of Literature. https://royalsociety.org/~/media/policy/projects/international-mobility/researcher-mobility-report-review-literature.pdf

[114] The development of new skills and knowledge through mobility is considered to lead to improved academic performance, see for example Bennion, Alice, & William Locke. 2010. 'The Early Career Paths and Employment Conditions of the Academic Profession in 17 Countries'. European Review 18(1): S7–33.; Franzoni, Chiara, Giuseppe Scellato & Paula Stephan. 2014. 'The Mover's Advantage: The Superior

graduates returning to their home country to continue their research career are found to bring new skills, knowledge and networks to their country's research system.

International mobility during the PhD stage is considered an important asset for the researchers' further career: section 6 documents the crucial role of international mobility for recruitment and career progression. Mobility opportunities are therefore not only a factor of attractiveness in themselves, PhD mobility can also entail a positive choice for better suited training programmes. It is therefore also an indicator of attractiveness for PhD candidates.

8.1. Key findings

In the MORE studies, two types of PhD mobility are considered:

- PhD degree mobility: mobility with the purpose of obtaining a PhD in another country than the country of citizenship AND the country of Master degree.
- During PhD mobility: mobility of three months or more during the PhD while still obtaining the PhD in the country where the researcher has started their PhD (regardless of citizenship of the researcher).

The following paragraphs discuss the key findings in MORE3 in terms of profiles, motives and barriers of both types of PhD mobility.

8.1.1. Mobility profile

Share of researchers with international "PhD degree mobility" (EU) *Of all R2 researchers, or R1 researchers that are enrolled in a doctoral programme*				
	EU total	**Per career stage**	**Per FOS**	**Per gender**
2012 (n= 3,449)	15.3%	R1: 19.4% R2: 12.3%	MED: 16.4% NAT: 14.5% SOC: 15.5%	F: 12.6% M: 17.5%
2016 (n=2,469)	16.4%	R1: 20.0% R2: 14.6%	MED: 17.1% NAT: 16.7% SOC: 15.7%	F: 15.9% M: 16.9%
Share of researchers with international "during PhD mobility" (EU) *Of all R2 researchers, or R1 researchers that are enrolled in a doctoral programme*				
	EU total	**Per career stage**	**Per FOS**	**Per gender**
2012 (n= 3,588)	18.3%	R1: 13.9% R2: 21.5%	MED: 16.6% NAT: 16.2% SOC: 21.9%	F: 17.6% M: 18.9%
2016 (n=2,516)	18.2%	R1: 12.9% R2: 21.0%	MED: 17.1% NAT: 16.5% SOC: 21.0%	F: 18.8% M: 17.7%

The MORE3 EU HE survey shows that 16% of EU PhD candidates obtain their PhD in a country other than that of their citizenship and 18% experiences a move of more than 3 months to another country during their PhD. Eurostat data on the number of mobile PhD candidates (ISCED 6/8) from another EU28 country as a share of total PhD candidates of

Performance of Migrant Scientists'. Economics Letters 122(1): 89–93. doi:10.1016/j. econlet.2013.10.040; Regets, Mark C. 2007. Research Issues in the International Migration of Highly Skilled Workers: A Perspective with Data from the United States. Working Paper SRS 07-203. National Science Foundation Division of Science Resources Statistics.

the country[115] were analysed in the MORE3 Indicator report on researchers. This indicator corresponds most to PhD degree mobility (those enrolled in that country to obtain their PhD) but reaches only half of the MORE3 value: about 8% of PhD candidates are mobile from other EU28 countries. This share is also rather stable over the period 2009-2014.

PHD MOBILITY: COUNTRY OF ORIGIN

Seen from the perspective of the 'origin' of the researchers engaged in PhD mobility, it is important to note that PhD degree mobility is a (negative) indicator of the attractiveness of the PhD training in the country of citizenship and/or a (positive) indicator of the personal willingness of citizens of a specific country to move abroad for their PhD. During PhD mobility does not reflect citizenship, but rather characterises PhD training in a specific country: it shows the extent to which a PhD training in a specific country supports/allows/requires international experiences during this PhD.

The largest shares for **PhD degree mobility** are found among researchers that are citizens from Romania, Greece, Iceland, Ireland, Malta and Cyprus (35% or more). This means for example that around 45% of all researchers with Romanian citizenship are mobile to obtain their PhD in another country than Romania. The share is high when the number of mobile researchers is higher, or when the total number of researchers with this citizenship is lower (e.g. Iceland).

Belgian, Bulgarian and Swedish citizens are the least PhD degree mobile (below 6%). This means that a large majority of Belgian researchers, for example, obtain their PhD in Belgium.

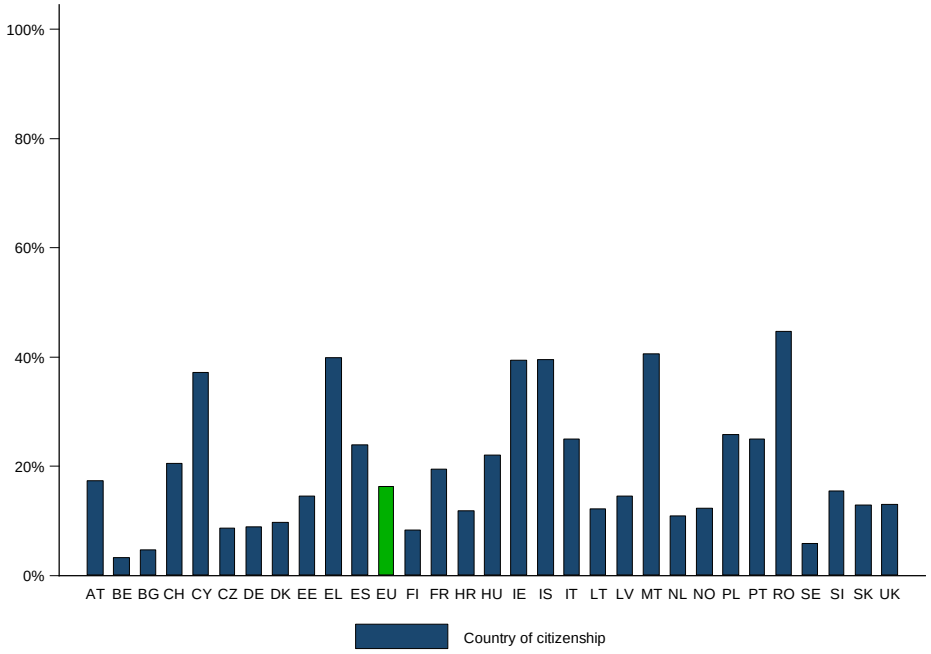
For **moves during PhD**, researchers who will/did obtain their PhD in Spain, Denmark and Italy are considerably more mobile during their PhD to another country than the EU average (between 40% and 60% compared with 18%). This means that the majority of the researchers - of any citizenship – working on a PhD in Spain, have a >3 months mobility experience outside Spain during their PhD.

Slovenia, Slovakia and Iceland are also ranked high for this indicator, with values over 30%. Researchers who obtain(ed) their PhD in Ireland, United Kingdom, Luxembourg, Germany and Sweden were less frequently engaged in during PhD mobility (10% or below). This is in part due to other types of mobility being more prevalent in these countries, such as the PhD degree mobility or Master mobility.

This pattern is confirmed when analysing the researchers that have **experienced neither form of PhD mobility**: PhD candidates in the larger West-European countries are more non-mobile, in particular in Germany (80%). South-European countries and small, open countries have lower shares of non-mobility during the PhD.

[115] Based on Eurostat: Mobile PhD students (ISCED 6/8) from abroad as a share of total PhD students of the country (educ_uoe_mobs02/educ_uoe_enrt01). Cf. indicator 7.1 in the MORE3 Indicator report on researchers.

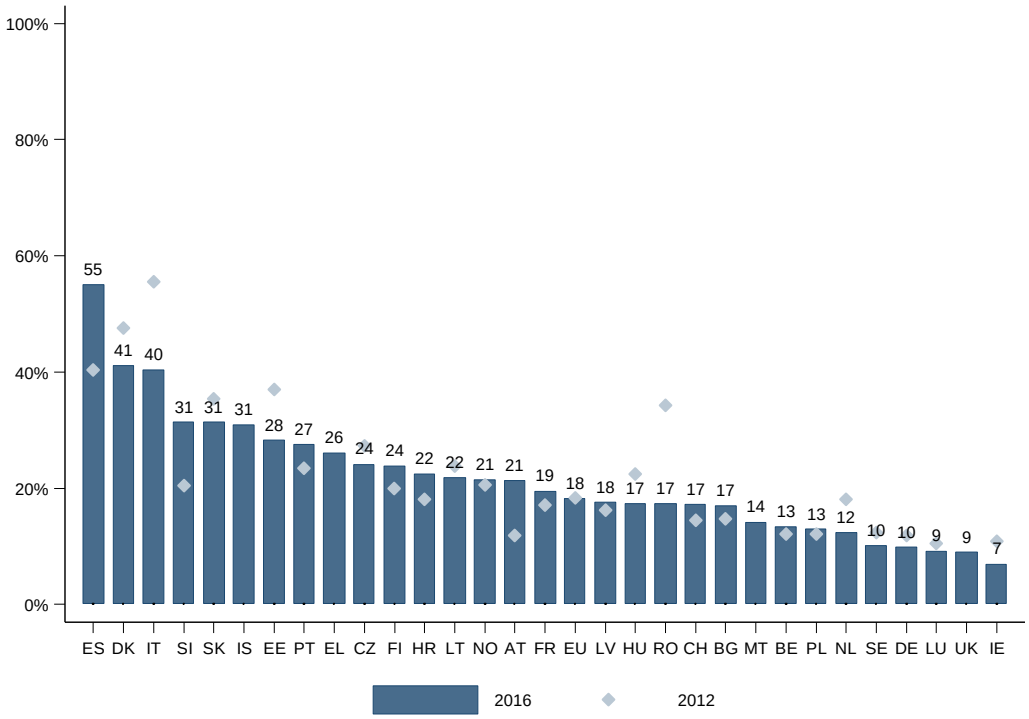
Figure 13: International PhD degree mobility, by country of citizenship (departure)



Source: MORE3 EU HE survey (2016) – Figure 63 in MORE3 EU HE report
Notes:

- Share of R1 PhD candidates and R2 PhD holders that were PhD degree mobile per country of citizenship.
- With 'PhD degree mobility' defined as obtaining or having obtained a PhD in another county than the one where one obtained his/her previous degree.
- Countries with less than 30 observation are omitted: Luxembourg.
- Based on question 57: "Did/will you obtain your PhD in a country other than the one where you obtained your previous degree (the degree that gave access to the PhD)?" and question 5: "What is your country of citizenship?"
- (n=2,587)

Figure 14: >3 month international mobility during PhD, by country of PhD (departure)



Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Figure 65 in MORE3 EU HE report

Notes:

- Share of R1 PhD candidates and R2 PhD holders that were >3 month mobile during their PhD per country of PhD.
- With '>3 month mobility during PhD' defined as moving for 3 months or more to a country than the one in which they obtained or will obtain their PhD.
- Countries with less than 30 observations are omitted: Cyprus.
- Based on question 59: "During your PhD, did you move for 3 months or more to a country other than the country where you did/will obtain your PhD?)"
- (n= 2,764)

PHD MOBILITY: DESTINATION COUNTRY

Seen from the perspective of 'destination' of the researchers engaged in PhD mobility, it is important to note that PhD degree mobility is a (positive) indicator of the attractiveness of the PhD training in the country of destination. The more researchers of foreign citizenship work on their PhD in a specific country, the higher we can assume the attractiveness of the PhD training in that country. During-PhD mobility seen from the perspective of the destination reflects, amongst other things, the attractiveness of the PhD training in a country for a shorter stay (>3 months exchange without the goal of obtaining a PhD in that country). Next to the attractiveness of the research system, other framework factors will also play a role, such as language patterns and selection procedures. E.g., Austria receives many German students due to sharing the same language and due to higher restrictions on PhD entry in Germany.

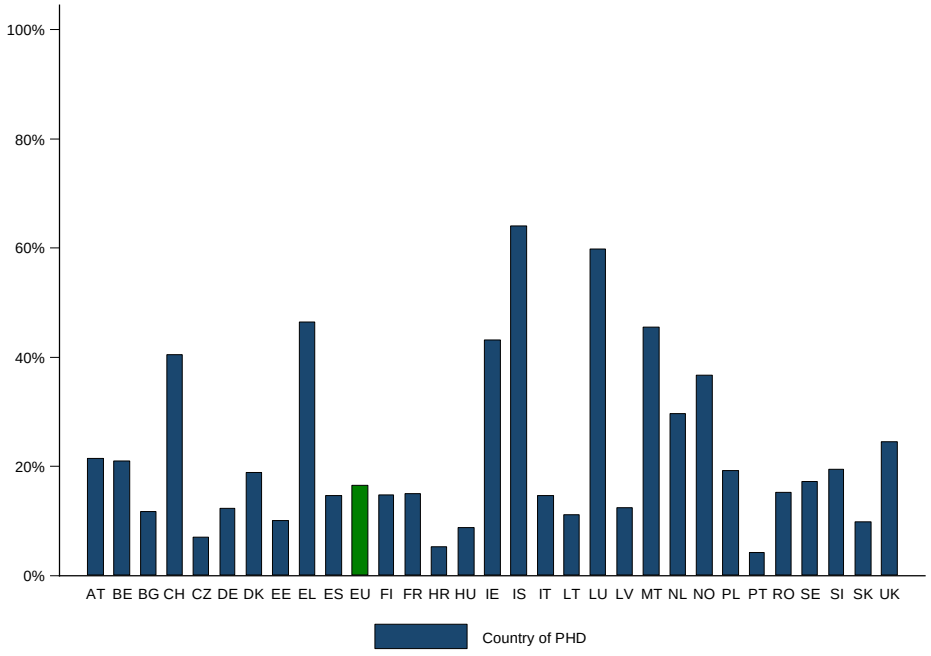
Within Europe, **PhD degree mobility** is highest (in terms of shares) towards small, open countries (besides Luxembourg, also Malta, Switzerland, the Netherlands, Austria and Belgium). This is shown in Figure 15 below. The share can be high due to either a higher number of foreign researchers or a lower number of total researchers in these countries. PhD degree mobility towards the Anglo-Saxon systems is also high.

Eurostat also contains information about the destination of PhD mobility in the monitoring of mobile PhD candidates (ISCED 6/8) from abroad as a share of total PhD candidates of the country[116]. Countries with most PhD candidates from abroad relative to their total PhD candidates are Austria, Belgium, Denmark, Luxembourg, the Netherlands and the UK (between 12% and 17% with the outlier Luxembourg with 71% in 2013). This is thus very much in line with the MORE3 findings on PhD degree mobility. 0% to 1% shares are observed for this indicator in Bulgaria, Croatia, Poland, Italy and Romania.

For **during PhD mobility**, the main destination countries are the United States (12%), the United Kingdom (12%) and Germany (11%), as Table 3 shows. This top three is the same as in MORE2. The top 10 destination countries for during PhD mobility are often visited by R1 and R2 researchers from Southern European countries (Italy, Spain, Greece, and Portugal).

The geographical patterns of >3 month mobility during PhD are very similar to those in post-PhD mobility and seem to be stable over time when compared to the 2012 values in MORE2. In addition, MORE3 was able to collect information on Master mobility, showing that Master mobility is an indicator of international orientation: the share of researchers moving during their PhD is considerably higher among researchers who already moved in their Masters: 33% versus 18% in total.

Figure 15: International PhD degree mobility, by country of PhD (destination)



Source: MORE3 EU HE survey (2016) - Figure 64 in MORE3 EU HE report
Notes:
- Share of R1 PhD candidates and R2 PhD holders that were PhD degree mobile per country of PhD.
- With 'PhD degree mobility' defined as obtaining or having obtained a PhD in another county than the one where one obtained his/her previous degree.

[116] Based on Eurostat: Mobile PhD students (ISCED 6/8) from abroad as a share of total PhD students of the country (educ_uoe_mobs02/educ_uoe_enrt01). Cf. indicator 7.1 in the MORE3 Indicator report on researchers.

- Countries with less than 30 observation are omitted: Cyprus.
- Based on question 57: "Did/will you obtain your PhD in a country other than the one where you obtained your previous degree (the degree that gave access to the PhD)?"
- (n=2,716)

Table 3: Main destination countries for >3 month mobility during PhD (EU28 departing countries)

Destination	Share (%)	Cum. share (%)	Origin1 (citizenship)	Origin2 (citizenship)	Origin3 (citizenship)
United States	11.8%	11.8%	Italy (16.5%)	Denmark (13.9%)	Spain (8.9%)
United Kingdom	11.7%	23.5%	Spain (15.4%)	Portugal (11.5%)	Greece (7.7%)
Germany	11.4%	34.9%	Poland (10.5%)	Croatia (7.9%)	Slovakia (7.9%)
France	7.3%	42.3%	Romania (16%)	Poland (14%)	Spain/ Italy (12%)
Sweden	4.3%	46.6%	Estonia (21%)	Poland (14%)	Finland (13.8%)
Spain	4.2%	50.8%	Portugal (25%)	Italy (14%)	Finland (10.7%)
Italy	3.7%	54.6%	Italy (28%)	Slovakia (16%)	Spain (12%)
Switzerland	3.0%	57.6%	Lithuania (15%)	Germany (10%)	Austria (10%)
Belgium	2.8%	60.4%	Denmark (15.8%)	Greece, Latvia, Poland (10.5%)	
Canada	2.4%	62.8%	Portugal (25%)		

Source: MORE3 EU HE survey (2016) – Table 16 in MORE3 EU HE report
Reading note: Of the total number of researchers currently working in the EU but who were mobile for more than three months during their PhD to the United States, 16% were Italian, 14% Danish and 9% Spanish.
Notes:

- Share of R1 PhD candidates and R2 PhD holders currently working in the EU which were mobile for more than three months during their PhD to a specific destination country.
- Destination countries with less than 15 observations are not included in the table.
- Based on question 60: "To which country(ies) was this?"
- (n=667)

8.1.2. Motives and barriers

WHY MOVE? MOTIVES FOR PHD MOBILITY

Both for PhD degree mobility and during PhD mobility, we find a stable ranking of motives over time. The ranking is also similar for both types of PhD mobility: both rank **working with leading scientists, quality of training and education, career progression and international networking** among the most important motives. Only availability of suitable positions is – not surprisingly – more important for PhD degree mobility, while research autonomy and access to research facilities and equipment are more important reasons for during PhD mobility.

Least important motives in both types of PhD mobility are ameliorating one's pension plan, social security and other benefits, as well was personal or family reasons and improved remuneration and job security. Motives to move are hence related to improving conditions for research, rather than to improving "material" conditions, in line with findings on career paths and working conditions in sections 6 and 7.

Family status is an important determinant of PhD degree mobility, as is whether or not the researcher's partner is also a researcher. The largest difference between those living in a couple versus those that are single is found for personal and family reasons (23.1pp difference) and for culture and/or language (12.1pp difference). Interestingly, the motives that become more important for researchers in couple are again reduced in

importance when the partner is also a researcher. Similar differences are observed for researchers with children (e.g. family reasons: 23 pp difference).

Overall, the motives for PhD mobility are also very similar to those of post-PhD mobility (cf. section 9), with the educational aspect being more important in PhD mobility.

Table 4: Importance of motives for international PhD degree mobility (2012-2016, EU)

Share of respondents that indicate this motive as one of the motives for international PhD degree mobility *Of all R2 researchers, or R1 researchers that are enrolled in a doctoral programme and that were PhD degree mobile*	**2012** (n=653)	**2016** (n=491)
Pension plan	(together with social security benefits in 2012 survey)	49.2%
Personal/family reasons	35.1%	60.3%
Job security	44.5%	62.1%
Culture and/or language	58.9%	62.5%
Social security and other benefits	35.3%	63.6%
Balance between teaching and research time	/	64.7%
Remuneration	50.8%	70.9%
Research autonomy	64.6%	77.9%
Access to research facilities and equipment	69.5%	79.0%
Availability of research funding	72.6%	79.2%
International networking	/	81.8%
Availability of suitable PhD positions	83.9%	84.5%
Career progression	74.5%	84.5%
Quality of training and education	76.4%	86.9%
Working with leading scientists	73.2%	87.8%
Working conditions	62.6%	/

Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Table 17 in MORE3 EU HE report

Reading note: Green = high compared to the average of the column; Red = low compared to the average of the column.

Notes:

- With 'PhD degree mobility' defined as obtaining or having obtained a PhD in another county than the one where one obtained his/her previous degree.
- Based on question 58: "Which of the following factors were important in your decision to obtain your PhD in another country?" The answer options between MORE2 and MORE3 differ slightly.

Table 5: Importance of motives for >3 month mobility during PhD (2012 and 2016, EU)

Share of respondents that indicate this motive as one of the motives for international during PhD mobility (>3 months) *Of all R2 researchers, or R1 researchers that are enrolled in a doctoral programme and that were >3 month mobile during PhD*	**2012** (n=552)	**2016** (n=420)
Pension plan	(together with social security benefits in 2012 survey)	12.2%
Social security and other benefits	13.2%	19.7%
Job security	22.6%	22.7%
Personal/family reasons	52.3%	29.8%
Remuneration	26.2%	34.1%
Balance between teaching and research time	/	47%
Availability of suitable PhD positions	41.6%	56.7%
Availability of research funding	63%	67.3%
Culture and/or language	68.2%	68.2%
Career progression	83.3%	70.6%
Quality of training and education	62.4%	71.0%
Access to research facilities and equipment	78.3%	74.7%
Research autonomy	75.0%	75.4%
International networking	/	86.1%
Working with leading scientists	82.1%	88.5%

Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Table 19 in MORE3 EU HE report

Notes:
- Green = high compared to the average of the column; Red = low compared to the average of the column.
- With '>3 month mobility during PhD' defined as moving for 3 months or more to another country than the country where he/she did or will obtain their PhD.
- Based on question 61:"Which of the following factors were important in your decision to move to another country?" The answer options between MORE2 and MORE3 differ slightly.

WHY NOT MOVE? BARRIERS FOR PHD MOBILITY

The barriers to PhD mobility, as perceived by non-mobile researchers, are also stable over time and comparable to the post-PhD mobility barriers. Emphasis is on **personal or family-related reasons** (58%), **the ability to obtain funding for mobility** (44%) **or for research** (43%) **and finding a suitable position** (42%).

Practical matters such as culture, obtaining a visa or work permit, language of the PhD programme and of teaching on the other hand, are not important as barriers for PhD mobility (4% up to 10%). Their perceived importance is also lower compared to the 2012 survey values.

Barriers are perceived as more important by R1 researchers than by R2 researchers. The general pattern is also more pronounced for female researchers: while only 34% of male researchers report that finding a suitable position was a factor that prevented them from being mobile during their PhD, 50% of women agree. Also finding funding is a bigger barrier for female researchers than for male researchers.

As for the motives of PhD degree mobility, family status plays an important role in the perceived barriers: researchers in a couple pay more attention to logistics, remuneration and personal/family reasons. Funding and network are more important to single researchers and to researchers without children.

Table 6: Importance of barriers for PhD mobility among the non-mobile (2012 and 2016, EU)

Share of non-mobile respondents that indicate this barrier as one of the factors keeping them from international PhD mobility *Of all non-mobile R2 researchers, or non-mobile R1 researchers that are enrolled in a doctoral programme*	**2012** (n=825)	**2016** (n=595)
Culture	(together with language for teaching and language for PhD programme in 2012 survey)	4.1%
Obtaining a visa or work permit	NA	6.0%
Quality of training and education	25.5%	10.1%
Language for PhD programme	22.1%	10.3%
Language of teaching	(together with culture and language for PhD programme in 2012 survey)	12.8%
Transferring social security entitlements	NA	12.9%
Transferring research funding to another country	34.0%	14.6%
Access to research facilities and equipment for research	25.7%	15.4%
Maintaining level of remuneration	NA	21.6%
Loss of contact with professional network	25.8%	22.0%
Logistics	44.0%	28.8%
Finding a suitable position	54.5%	41.9%
Obtaining funding for research	63.8%	43.5%
Obtaining funding for mobility	(together with funding for research in 2012 survey)	44.1%
Other personal/family reason	54.0%	58.0%

Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Table 21 in MORE3 EU HE
Notes:

- Share of non-mobile R1 PhD candidates and R2 PhD holders with some consideration of PhD mobility that indicate the barrier as important for non-PhD mobility.
- With 'non-PhD mobile' defined as never having been PhD degree mobile nor mobile during PhD.
- With 'some consideration of PhD mobility' defined as not having indicated to have never considered it (thus having considered it but made no effort; have considered it and searched and having turned down a concrete offer).
- Based on question 63: "Which of the following factors prevented you from taking part or all of your PhD in another country"? The answer options between MORE2 and MORE3 differ slightly.

8.2. EU policy aims and implications of MORE3 findings

A strong ERA will build on strong researchers. In this context it is important to include and offer attractive career prospects to young researchers. One aspect of this is the internationalisation of PhD training and thus mobility. To this end, open recruitment and mobility support measures are essential. Mobility opportunities are not only a factor of attractiveness of PhD training, but international mobility during PhD stage is also considered an important asset for the researchers' further career: section 6 documents the positive role of international mobility in recruitment and career progression.

International mobility enables international collaboration which is often a key ingredient of scientific productivity and research performance.[117] Several studies on the effects of mobility of students and staff show that experiences abroad enrich the person's professional and academic life while at the same time enhancing personal skills such as language learning, intercultural skills, self-reliance and self-awareness[118]. A Norwegian study on international PhD mobility among Norwegian researchers finds that mobility experiences during the PhD are positively assessed by the PhD candidates, such as leading to stronger motivation and the development of a positive reputation as confident and active members of an international community[119].

The Innovative Doctoral Training Principles[120] (cf. also section 4.1 on PhD training) provide a coordinated framework to achieve excellent doctoral training, and one important principle is that of international networking. As part of this principle, "mobility should be encouraged, be it through conferences, short research visits and secondments or longer stays abroad". The ERA Steering Group on Human Resources and Mobility[121] states that international networking, together with exposure to industry, interdisciplinary research options and transferable skills, are seen as important principles influencing the success of doctoral training and the future career of doctoral candidates. Also the Council Conclusions on 'Measures to support early stage researchers, raise the attractiveness of scientific careers and foster investment in human potential in research and development' stress the importance of supporting international mobility for young researchers.

The main policy goals for PhD mobility could thus be identified as:

- **Quantity of researchers trained at PhD level**: PhD studies need to be attractive to draw in growing numbers of talented students, and options for international mobility is one aspect of this.
- **Quality of PhD training**: PhD candidates will be drawn to the most attractive training and research environments. Mobility thus encourages increased levels and quality of training and, in addition, results in more international collaboration afterwards (cf. section 10). These are two aspects with a direct positive influence on scientific productivity and future careers. This also relates to the point made in section 5, that PhD training programmes in the EU must be attractive enough for the best within a context of worldwide competition for the most talented researchers[122], ensuring brain circulation rather than brain drain.

[117] Jonkers, K., & Tijssen, R. (2008). Chinese researchers returning home: Impacts of international mobility on research collaboration and scientific productivity. *Scientometrics*, *77*(2), 309-333.

[118] Amongst others: EURODATA Student Mobility in European Higher Education (Kelo, Teichler and Wächter 2006), the Erasmus statistics (European Commission 2012a), the Flash Eurobarometers (Gallup Organization 2010; Gallup Organization 2011) and the EU-funded study Mapping Mobility in European Higher Education (Teichler, Ferencz and Wächter 2011a; Teichler, Ferencz and Wächter 2011b), as cited in The Erasmus Impact Study, Effects of mobility on the skills and employability of students and the internationalisation of higher education institutions (2014). CHE Consult et al. (ec.europa.eu/dgs/education_culture/repository/education/library/study/2014/erasmus-impact_en.pdf)

[119] International Mobility among PhD Candidates at Norwegian Higher Education Institutions (2011). Norwegian centre for international cooperation in higher education (SIU).

[120] Report of Mapping Exercise on Doctoral Training in Europe "Towards a common approach" of 27 June 2011(final), adopted by the ERA Steering Group on Human Resources and Mobility.

[121] Report of the ERA Steering Group Human Resources and Mobility (ERA SGHRM): Using the Principles for Innovative Doctoral Training as a Tool for Guiding Reforms of Doctoral Education in Europe.

[122] Hunter, Rosalind S., Andrew J. Oswald, and Bruce G. Charlton. 'The Elite Brain Drain*'. *The Economic Journal* 119, no. 538 (2009): F231–F251.

WHICH LESSONS CAN BE DRAWN FROM THE MORE3 KEY FINDINGS ON PHD MOBILITY FOR THESE POLICY AIMS?

Within this context, the findings of MORE3 show that the mobility patterns of early stage researchers are stable over time (2012-2016), both in terms of numbers and flows (destinations and origins). The PhD mobility flows reflect **heterogeneity** in terms of mobility rates, but also attractiveness of the PhD training across Europe, with high mobility rates in South-European countries, and small and open countries. PhD candidates in the larger West-European countries are relatively more non-mobile.

Young researchers are driven by scientific knowledge production factors such as working with leading scientists, quality of training and education, career progression and international networking. This corresponds to the general vision that international PhD mobility is expected to have a positive impact on academic life and skills. Researchers are however held back by more practical issues like personal or family reasons, or by lack of funding or suitable positions. This is consistent with the previous literature, which sees motivations related to boosting one's career as crucial for moving somewhere else, while personal or family reasons hold researchers back or lead to return mobility.[123] This implies that fostering international PhD mobility is related to two main dimensions: first, **increasing the attractiveness or the quality of PhD studies in general**, i.e. working on the drivers of PhD mobility as outlined in section 5, and second, **reducing barriers to mobility at the PhD stage**.

The importance of the family situation of researchers as a determining factor for PhD mobility, combined with the indicated barriers due to family reasons, point to an opportunity to work on these practical issues in order to broaden the group of researchers that are enabled or convinced to become mobile during their PhD. When addressing the (lack of) positions and funding as a barrier to PhD mobility, actions should pay specific attention to the situation of female researchers who experience this barrier much more strongly than their male counterparts.

Furthermore, the findings for early stage researchers are similar to those for mobility in later career stages. Only the quality of training and education is more important to young researchers. Policy makers should thus see both in relation to each other, and in addition focus particularly on the training aspects for young researchers (cf. section 4.1).

EU-LEVEL AND NATIONAL POLICY INSTRUMENTS

These findings provide insights into the positive factors that drive PhD mobility, and in particular the fact that these are related to scientific productivity and training. Fostering international mobility within Europe and from outside Europe will thus depend on high quality research systems and PhD training across Europe. In section 5, it was noted that the attractiveness of PhD training in general can be further improved by reforms towards more structured training. Important here is that reforms take into account heterogeneity across EU countries and, in the end, lead to high-quality PhD training in all Member States - thus encouraging brain circulation rather than brain drain. The existing frameworks and tools, e.g. Innovative Doctoral Training principles, Charter and Code and the Human Resource Strategy for Researchers (HRS4R), are available to the Member States and research organisations as guidance for further reforms towards structured training. The Innovative Doctoral Training Principles for example (cf. supra) foresee a

[123] Franzoni, C., Scellato, G., & Stephan, P. (2012). Foreign-born scientists: mobility patterns for 16 countries. Nature Biotechnology, 30(12), 1250-1253.

complete framework, including also geographical mobility and international collaboration for PhD Candidates. This framework is generally adopted at national level and supports a common vision on the main principles for PhDs across Europe. It was suggested in section 5 that an increase in the resources for MSCA co-funding and ESIF projects could further support these necessary reforms, in particular in those countries that currently face the highest outflow of PhD candidates (e.g. Romania and several of the South-European countries).

Next to improving the attractiveness of the quality of PhD studies in general (section 5), encouraging and supporting international mobility in itself is also important to stimulate better circulation of ideas and beneficial effects for the individual careers of the researchers. The latter is particularly important in the early career stages. To this, two needs are identified: stronger funding opportunities for research and for mobility, and reduction of barriers, particularly those related to the family situation of the researcher. Also in the Bratislava Declaration of Young Researchers[124], the need is expressed to (amongst others) reorganise funding streams to trust and empower young researchers and to implement supportive and better childcare provision, parental care, flexible working practices and provide dual-career opportunities.

In the ERA process, open recruitment is stressed as an enabling factor for mobility. Access by non-nationals to national grants and portability of grants are mentioned as facilitators for mobility. Advertising vacancies on the EURAXESS Jobs portal and using the European Framework for Research Careers[125] is also encouraged in order to decrease the barriers to non-national researchers in terms of finding suitable positions. EURAXESS Services also play a key role in assisting researchers and their family with relocation issues. The EFRC further increases transparency and supports more comparable research career structures across sectors and countries (meeting objectives stated in the ERA Innovation Union Flagship Initiative[126]). This common understanding on early stage researchers further supports open recruitment and mobility options.

Most of these instruments, however, work on mobility and open recruitment in general, rather than specifically for the benefit of young researchers during their PhD research. Even though the drivers of mobility in this group are generally the same as those of post-PhD researchers, they are at the same time more focused on their training, on the value of their experiences for their further career, and on how to combine their mobility with their family situation. In this respect, actions could focus more specifically on the needs of this specific subgroup and in particular take into account the situation of female researchers who experience lack of positions or funding as a stronger barrier compared to their male counterparts. More could be done also in terms of actual funding of mobility, such as by increasing MSCA funding for early stage researchers.

Members States are also called upon to facilitate and promote participation of early stage researchers in bilateral and multilateral S&T cooperation schemes and projects, to support voluntary return of early stage researchers to pursue scientific careers in their countries of origin, thus facilitating inter-institutional networking throughout Europe and international scientific cooperation, while encouraging mobility throughout their careers, and to consider establishing measures such as a recognition prize for excellent early

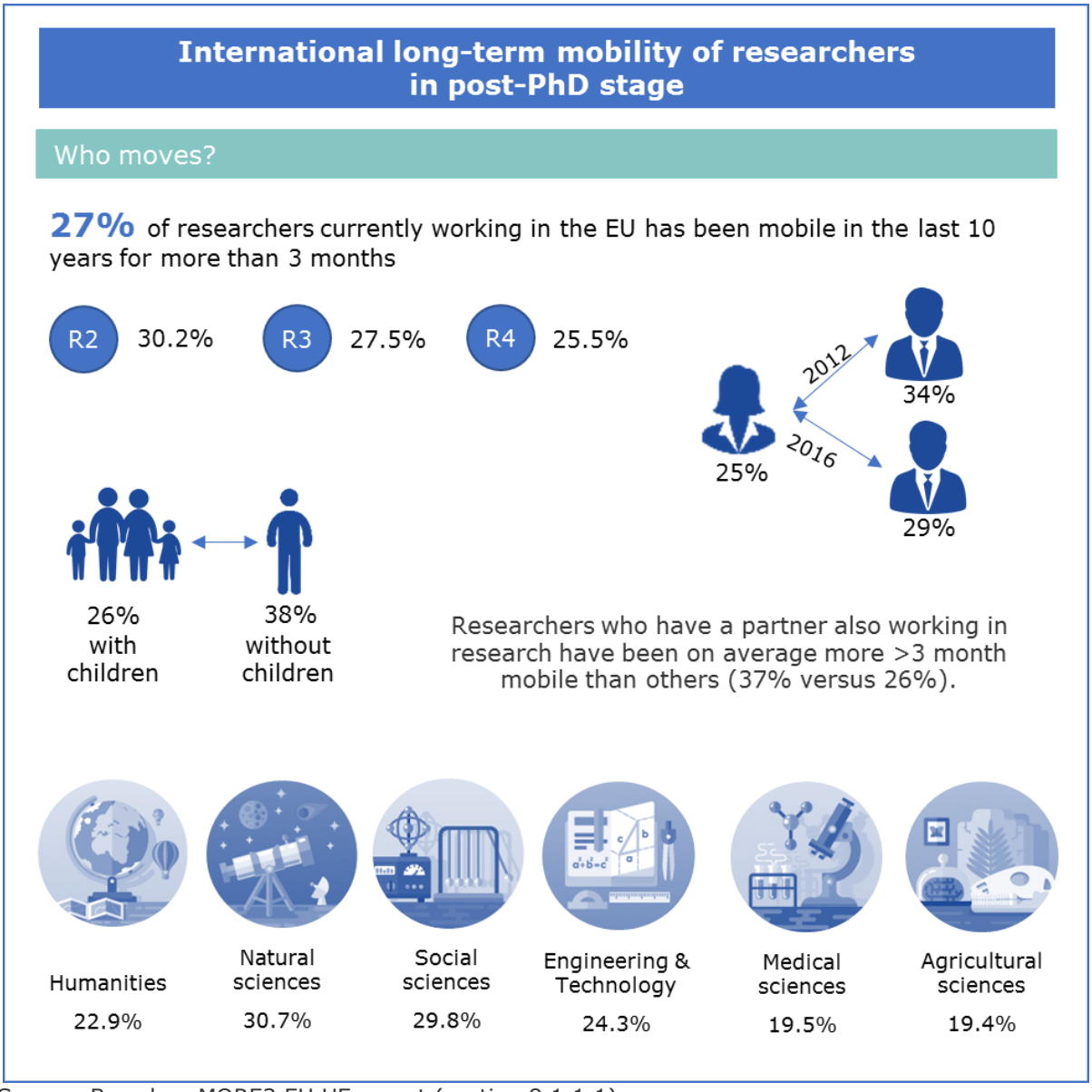
[124] http://declaration.mimuw.edu.pl/
[125] Towards a European Framework for Research Careers (2011), European Commission, Directorate General for Research and Innovation, Directorate B – European Research Area, Skills.
[126] Europe 2020 Flagship Initiative Innovation Union COM(2010) 546 final of 6.10.2010 (Commitment 4).

stage researchers aimed at supporting their independent research, mobility, networking, and entrepreneurial skills[127].

According to the National Action Plans (NAP's), Member States have planned to undertake actions to support PhD mobility and gender balance therein. In the Bulgarian National Action Plan, for example, a partnership to address shortcomings in terms of qualifications, career and salary structures is undertaken that endorses the Innovative Doctoral Training Principles and incentivises PhD mobility, and calls on HR planning with balance between young and later stage researchers as well as a better gender balance.

[127] Council conclusions on 'Measures to support early stage researchers, raise the attractiveness of scientific careers and foster investment in human potential in research and development' (2016).

9. International mobility after PhD stage



Source: Based on MORE3 EU HE report (section 8.1.1.1)

As shown in our conceptual framework in section 3, and as highlighted also in section 8 on international mobility of PhD candidates, international mobility is one of the key dimensions for optimal knowledge circulation and exchange. International mobility has traditionally been analysed on the basis of the perspective of countries (or system-level) and of the researchers' point of view (or individual level). Studies focusing on the former usually analyse the effects of international mobility on global competitiveness and innovation, while the research on the latter tends to focus on the determinants of mobility of individuals.

At system level, international mobility is related to the degree to which countries have a sufficiently large pool of researchers to develop innovative research and ensure the country's competitiveness in the medium and long-term. As such, these works are

usually associated to concepts such as 'brain drain', 'brain gain' and 'brain circulation"[128]. International mobility is beneficial in terms of circulation of qualified researchers and skills, and increased access thereto through the development of international networks[129]. It is a strong enabler for (continued) international collaboration (cf. section 9.1.3 on the effects of mobility and section 10 on other forms of international collaboration) and, through the increased exchange and access to networks and skills, drives scientific productivity[130].

From the perspective of individual researchers, two main avenues of research can be highlighted. First, a set of studies have investigated the effects of mobility on researchers´ career progression, collaboration and scientific productivity. Several works have found that mobile researchers tend to experience positive outcomes in all three areas[131]. The Global Science Research Project (GlobSci), for instance, analysed the patterns of international mobility in 16 countries and found that mobile scientists are more likely to engage in international collaborations, and tend to "*exhibit superior performances in international collaborations than natives*" with no prior experience of mobility[132]. The analysis in section 6 confirmed the positive effect, particularly for the researcher's career progression.

Researchers find the availability of mobility opportunities important, suggesting that this is correlated to the satisfaction in or the attractiveness of their current position. Also at a higher level, international mobility to a country or region is an indicator of the attractiveness of that region. Analysis of the mobility flows and of the main motives for researchers to engage in mobility will thus shed light on the main factors of attractiveness.

[128] Thorn, K., & Holm-Nielsen, L. B. (2008). International mobility of researchers and scientists: Policy options for turning a drain into a gain. The international mobility of talent: types, causes, and development impact. In Solimano, A. (ed), The International Mobility of Talent, Oxford: Oxford University Press, p. 145-167.
Fahey, J. and Kenway, J. (2010) 'International academic mobility: Problematic and possible paradigms', Discourse: Studies in the Cultural Politics of Education, 31: 563–75.

[129] Guthrie S., Lichten, C., Corbett J. and Wooding S. (2017). International mobility of researchers. A review of Literature.
https://royalsociety.org/~/media/policy/projects/international-mobility/researcher-mobility-report-review-literature.pdf

[130] The development of new skills and knowledge through mobility is considered to lead to improved academic performance, see for example Bennion, Alice, & William Locke. 2010. 'The Early Career Paths and Employment Conditions of the Academic Profession in 17 Countries'. European Review 18(1): S7–33.; Franzoni, Chiara, Giuseppe Scellato & Paula Stephan. 2014. 'The Mover's Advantage: The Superior Performance of Migrant Scientists'. Economics Letters 122(1): 89–93. doi:10.1016/j. econlet.2013.10.040; Regets, Mark C. 2007. Research Issues in the International Migration of Highly Skilled Workers: A Perspective with Data from the United States. Working Paper SRS 07-203. National Science Foundation Division of Science Resources Statistics.

[131] Veugelers, R., & Van Bouwel, L. (2015). The effects of international mobility on European researchers: comparing intra-EU and US mobility. Research in Higher Education, 56(4), 360-377.
De Filippo, D., Casado, E. S., & Gómez, I. (2009). Quantitative and qualitative approaches to the study of mobility and scientific performance: a case study of a Spanish university. Research Evaluation, 18(3), 191-200.
Jonkers, K., & Cruz-Castro, L. (2013). Research upon return: The effect of international mobility on scientific ties, production and impact. Research Policy, 42(8), 1366-1377.

[132] The GlobSci project had some limitations: First, respondents were selected only from published articles – and, hence, younger researchers are less likely to be selected; and, second, it only covered some countries and some fields of science: for instance, the humanities and social sciences were not covered.

9.1. Key findings

9.1.1. Mobility profile

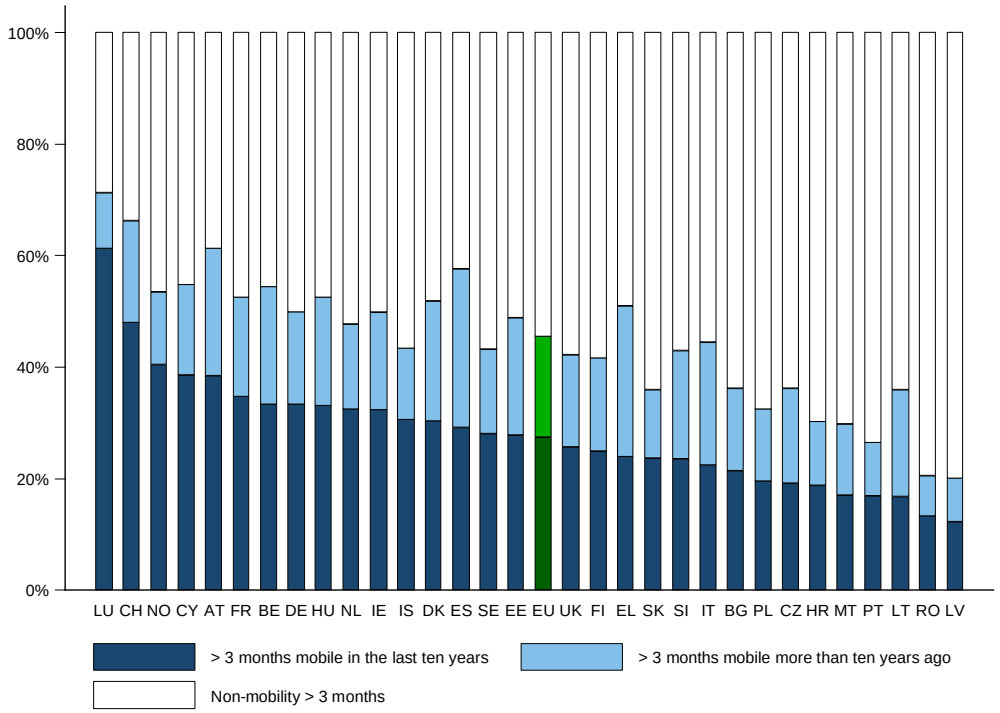
The analysis of international mobility during the post-PhD career stage has revealed a stable pattern in terms of occurrence as well as flows (origin and destinations) of mobility.

The countries where the highest share of mobile researchers (who have been mobile for more than 3 months in the last ten years) are currently found, are Luxembourg, Switzerland and Norway. >3 month international mobility is less common among the researchers currently working in many of the East-European and South-European countries. Latvia, Romania and Malta are at the lower end of the spectrum with 12.4%, 13% and 17% respectively. This is shown in detail in the figure below.

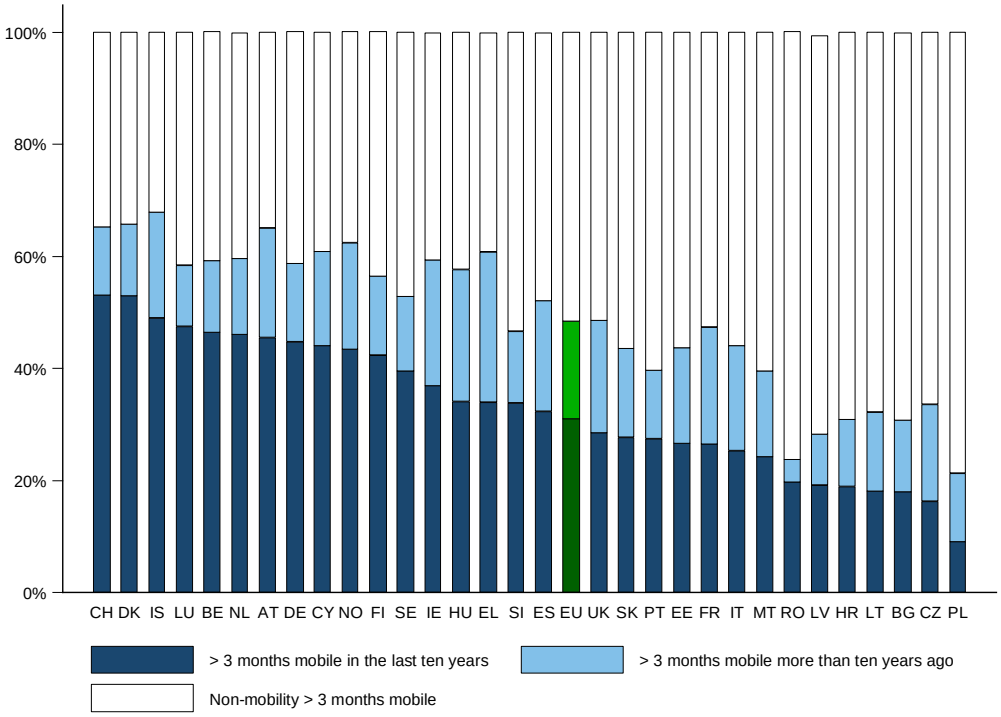
The comparison between the EU and Global survey further indicates that there are many similarities in terms of attractiveness of the main destinations to researchers both in and outside the EU. For the EU HE survey, the detailed results are given in Table 7. Top destinations are United States, and a number of the larger European countries: Germany, United Kingdom, France and Italy. These same European countries are also often mentioned in the Global survey as destinations for non-EU researchers. Looking at the information on origin in Table 7 the larger European countries are not only important destinations, they also represent the higher shares of sending researchers. This is thus also the scale-effect speaking.

Figure 16: >3 month international mobility in post-PhD career stages, by panel country (2016 and 2012)

2016:



2012:



Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Figure 76 in MORE3 EU HE report

Note:
- Only R2, R3 and R4 researchers.
- Based on question 64: "After gaining your highest educational qualification (PhD or other), how would you typify your international mobility experience?"
- (2016: n=8,824; 2012: n = 8,357)

Table 7: The main destination countries for >3 month post-PhD mobility (EU28 citizens currently working in the EU)

Destination	Share (%)	Cum. share (%)	Origin1 (citizenship)	Origin2 (citizenship)	Origin3 (citizenship)
United States	15.5%	15.5%	Greece 9.6%	Germany 9.1%	Italy 8.9%
Germany	11.2%	26.7%	Spain 7.6%	Italy 7.3%	Poland 6.3%
United Kingdom	11.0%	37.7%	Greece 14.8%	Germany 10.3%	Italy 6.1%
France	6.6%	44.3%	Italy 13.4%	France 8.1%	Germany 7.5%
Italy	5.0%	49.3%	Spain 12.8%	Italy 11.3%	Greece 10.6%
Switzerland	4.3%	53.6%	Germany 22.0%	Italy 15.4%	France 8.1%
Spain	3.2%	56.8%	Italy 16.7%	Portugal 11.1%	Greece 8.9% Belgium
Belgium	3.1%	60.0%	France 14.6%	Italy 13.5%	Spain 10.1%
Sweden	3.1%	63.0%	Finland 19.5%	Estonia 12.6%	Germany 10.3%
Austria	2.8%	65.8%	Germany 21.5%	Italy 17.7%	Austria 7.6% Hungary

Source: MORE3 EU HE survey (2016) – Table 23 in MORE3 EU HE report
Reading note: Of the total number of researchers who currently work in the EU but who were mobile to the US for more than three months during post-doctoral career stages, 9.6% are Greek, 9.1% are German and 8.9% are Italian citizens.
Notes:
- Only R2, R3 and R4 researchers.
- An important difference in the question between MORE2 and MORE3 is the number of moves a researcher can register: in MORE2 this was 8 and in MORE3 this was 3. MORE3 thus focuses on the most recent mobility only. In MORE2 however, only 5.4% of the respondents indicated that they had 4 moves or more, limiting the difference between MORE2 and MORE3.
- Based on question 66: "Please indicate the 3 most recent international steps/moves in the last 10 years of your research career after your PhD up to (but excluding) your current position in which you are employed."
- (n=3,249)

9.1.2. Motives and barriers

WHY MOVE? MOTIVES FOR POST-PHD MOBILITY

Cross-time and cross-survey analysis of the motives and barriers for mobility reveals a very stable picture. In other words, independent of the type of international mobility the general motives are the same: international networking, career progression and working with leading scientists. These motives are found in the EU HE survey in two different types of analysis. We first analysed all the motives indicated for the last mobility experience of the researchers (cf. Table 8); and second the one main motive for each individual move by the researcher (cf. Table 9). The same patterns was found in the Global survey where the main motive per individual move was analysed. An overview:

- EU HE survey, mobility within the EU: international networking (83%), career progression (80%; main motive for 23% of individual moves) and working with leading scientists (79%; main motive for 20% of individual moves). More than in 2012, research autonomy is also mentioned as a very important motive (76% of the researchers; main motive for 17% of individual moves) in the 2016 survey.
- Global survey, per move: working with leading scientists (28%), career progression (12%) and international networking (11%).

For EU researchers that move from the EU to a non-EU country, the Global survey finds that the availability of a suitable position (86%) and career progression (84%) are the main motives. When looking into the specific destinations, it is observed that motives for

moving to the US are working with leading scientists (89%); availability of research funding (87%); availability of research facilities and equipment (84%) and international networking (82%). The US thus stands out with respect to factors influencing scientific knowledge production. In the other direction, when a non-EU researcher moves to Europe, the main motives are international networking (96%), working with leading scientists (94%) and career progression (81%).

A detailed overview of all motives in the EU HE survey is given in Table 8, that of the main motive per move in Table 9. The three least common motives in the EU HE survey are job security, social security and other benefits and pension plan. In the Global survey the least common motives are job security, remuneration and balance between teaching and research time.

Both the important and less important motives point at the conclusion that international mobility is driven by scientific knowledge production factors, rather than by "material" factors such as remuneration or social security. This pattern is consistent with the 2012 results of MORE2 and with the results for mobility during PhD.

Motives for international mobility are further determined by the field of science (see Section 8.1.1.3 of the MORE3 EU HE report): we find a stronger emphasis on motives of intellectual support in the Medical field, and on motives of time balance between teaching and research in the Social Sciences. In Natural Sciences, mobility is less often driven by motives related to financial support than in other fields.

Table 8: Importance of motives for >3 month international mobility in post-PhD career stages, last EU move (2012-2016, EU28)

Share of respondents that indicate this motive as one of the motives for their last EU move		
	2012 (n=1002)	**2016** (n=1,097)
International networking	/	83.30%
Career progression	83.10%	80.00%
Working with leading scientists	74.70%	78.80%
Research autonomy	46.70%	76.40%
Access to research facilities and equipment	69.30%	74.70%
Availability of research funding	70.30%	68.20%
Quality of training and education	59.00%	67.90%
Availability of suitable positions	68.70%	65.10%
Culture and/or language	58.10%	57.40%
Balance between teaching and research time	/	55.70%
Remuneration	40.60%	53.30%
Personal/family reasons	46.70%	45.50%
Job security	30.10%	39.40%
Social security and other benefits	21.60%	41.40%
Pension plan		32.10%
Working conditions	56.00%	

Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Table 26 in MORE3 EU HE report

Reading note: Green = high compared to the average of the column; Red = low compared to the average of the column.

Note:

- Only R2, R3 and R4 researchers who were >3 month mobile in the last ten years.
- Based on question 73: "Please consider your last instance of mobility. Which of the following factors were important motives to make this move?"

Table 9: Importance of motives for >3 month international mobility in post-PhD career stages, main motive per move (2012-2016, EU)

Share of moves for which the motive was indicated as the main one	2012 (n= 2,703)	2016 (n=2,804)
Career progression	16.5%	22.9%
Working with leading scientists	10.9%	19.6%
Research autonomy	1.6%	16.8%
International networking	/	6.3%
Availability of suitable positions	7.7%	5.5%
Availability of research funding	7.9%	5.2%
Personal/family reasons	3.2%	4.5%
Quality of training and education	1.1%	3.8%
Access to research facilities and equipment	3.2%	2.9%
Balance between teaching and research time	/	2.1%
Remuneration	1.2%	1.6%
Culture and/or language	0.7%	1.0%
Job security	0.6%	0.7%
Social security and other benefits	0.3%	0.1%
Pension plan		0.0%
Working conditions	0.9%	/

Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Table 29 in MORE3 EU HE report

Reading note: Green = high compared to the average of the column; Red = low compared to the average of the column.

Notes:

- Only R2, R3 and R4 researchers.
- An important difference in the question between MORE2 and MORE3 is the number of moves a researcher can register: in MORE2 this was 8 and in MORE3 this was 3. MORE3 thus focuses on the most recent mobility only. In MORE2 however, only 5.4% of the respondents indicated that they had 4 moves or more, limiting the difference between MORE2 and MORE3. The same remark is applicable to the subsequent sections on contract, destination sector and career progression.
- Based on question 69: "And what was your main motive to move to each of these countries?"

WHY NOT MOVE? BARRIERS TO POST-PHD MOBILITY

Even though funding and positions are less important as motives for international mobility, the lack thereof does form the main barrier for international mobility:

- EU HE survey, moves within the EU: finding a suitable position (38%), obtaining funding for research (38%) and obtaining funding for mobility (36%);
- Global survey, EU researchers trying to return to Europe: finding a suitable job position (74%), obtaining funding for mobility (73%), and obtaining funding for research (72%).

These are, as such, the factors that allow for mobility to take place at all, i.e. they are important enablers of mobility. At the lower end are transferring social security and transferring pension. A detailed overview of all barriers in the EU HE survey is given in Table 10.

Table 10: Importance of barriers for >3 month international mobility in post-PhD career stages, last EU move (2012-2016)

Share of respondents that indicate this barrier as one of the barriers for their last EU move *Of mobile R2, R3 and R4 researchers*	**2012** (n=1,660)	**2016** (n=1,704)
Finding a suitable position	34.8%	38.3%
Obtaining funding for research	43.4%	37.6%
Obtaining funding for mobility	/	36.3%
Logistical problems	36.3%	33.3%
Access to research facilities and equipment for research	27.9%	32.5%
Other personal/family reason	26.5%	28.3%
Quality of training and education	21.1%	28.1%
Loss of contact with professional network	25.1%	28.0%
Maintaining level of remuneration	/	26.2%
Transferring research funding to another country	16.3%	23.5%
Culture	23.8%	23.7%
Language barrier for contact/collaboration with colleagues		22.7%
Language barrier for teaching		20.8%
Obtaining a visa or work permit	/	22.8%
Transferring social security entitlements	/	19.6%
Transferring pension	/	16.8%

Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Table 33 in MORE3 EU HE report

Reading note: Green = high compared to the average of the column; Red = low compared to the average of the column.

Notes:

- Only R2, R3 and R4 researchers.
- Share of mobile researchers who indicate the specific barrier as being important to their last move.
- With 'mobility' defined as having worked abroad for more than three months at least once in the last ten years.
- Based on question 75: "Please consider again your last instance of mobility. Which of the following barriers were important to overcome in making this move?"

In the EU HE survey, the reasons to be non-mobile are similar to the barriers to mobility. Also the distribution across career stages is similar. Only personal and family reasons are more important for the non-mobile: it becomes the most important factor, to a greater extent than in 2012 (77% in MORE3 compared to 67% in MORE2).

Non-EU researchers moving to the EU face other, more practical barriers:

- EU HE survey, non-EU researchers moving to Europe: obtaining a visa or work permit (30%); language for teaching (27%) and for contact or for collaboration with colleagues (23%).
- Global survey, non-EU researchers moving to Europe: logistical problems (39%), transferring social security entitlements (36%) and transferring the pension (34%).

FORCED/ESCAPE MOBILITY

Already in MORE2, it was identified that there are different degrees of freedom in the researchers' decisions to become mobile. With the objective of providing empirical evidence to address this question, the MORE3 surveys asked mobile researchers directly about this. We distinguish between escape (forced), expected (chosen) and exchange (chosen) mobility:

- **Escape mobility** occurs when a researcher is 'pushed' away from his or her environment because of lack of funding, positions, for political reasons, etc. Escape mobility entails that researchers are mobile because they need to be so if they want to pursue a career as a researcher.
- The term **expected mobility** is used for those cases where mobility is perceived as a 'natural' step in a research career but researchers do not feel obliged to move.
- Finally, **exchange mobility** refers to those situations in which a researcher chooses to move (positive motivation, self-chosen) with the aim of exchanging knowledge and work in an international network, or with the aim to use international experience as a way to boost his or her career.

Remarkable is that in moves from EU to non-EU, as analysed from the Global survey, the availability of positions is also an important motive to move outside the EU. Further, EU researchers who tried to return to Europe experienced barriers in finding a suitable job position (74%), obtaining funding for mobility (73%), and obtaining funding for research (72%) (note that these are overall the main barriers for international mobility). Data on the degree of freedom in mobility decisions is however ambiguous in confirming that lack of research positions drives flows from EU to non-EU. While the Global survey points in that direction (for researchers currently working outside Europe), the EU HE survey contradicts this (for researchers currently working in Europe):

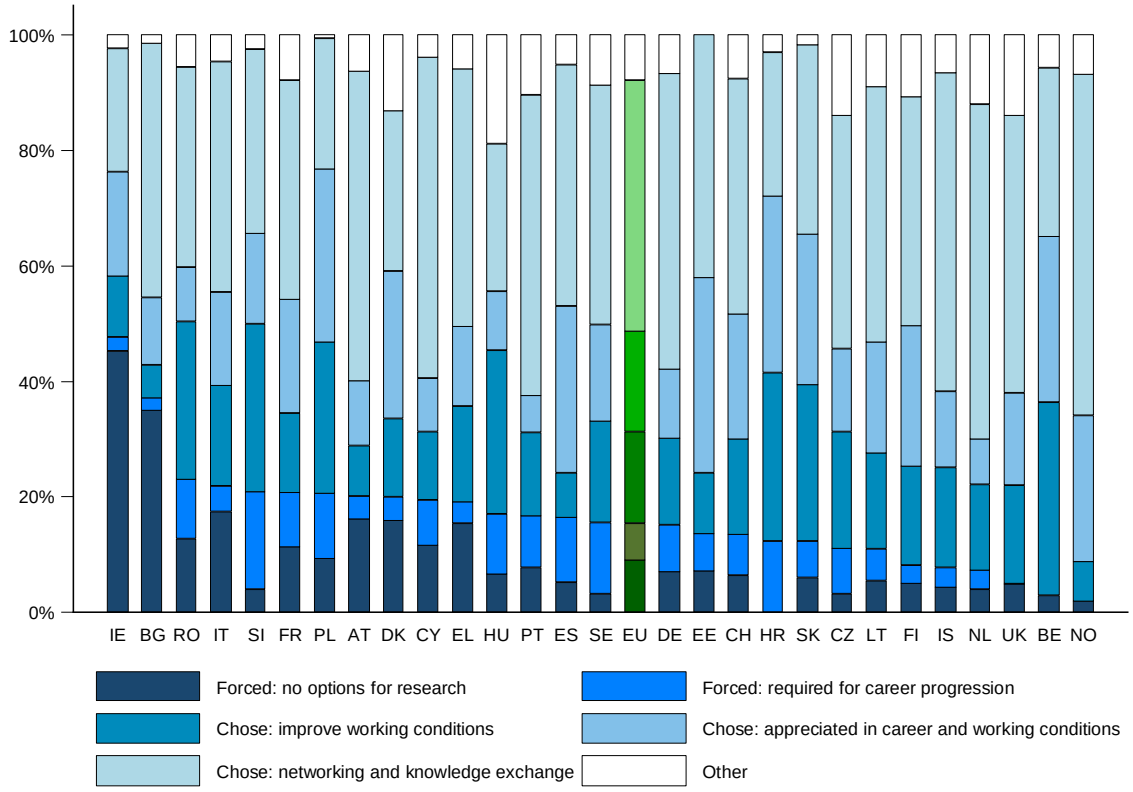
- Global survey: Among all mobile researchers in the Global survey, 28% indicate that they have engaged in forced mobility. Among EU researchers currently working outside the EU, even 37% indicate that they have experienced forced mobility. The majority indicates a lack of career opportunities as reason for the forced mobility.
- EU HE survey: Among the researchers with European citizenship that have moved to a non-EU country (but that are currently working in the EU again), only 12% felt forced in their move to a non-EU country. This compares to around 16% of mobile researchers in general (all moves, EU and non-EU), of which 9% because of a lack of options for a research career in their home country and 7% because it is a requirement for career progression in their home country (cf. Table 11). Figure 17 below gives an overview of the escape mobility (versus expected and exchange mobility) per country of citizenship for the EU HE survey and for all moves (EU and non-EU moves).

Table 11: Escape, expected and exchange mobility (EU28)

		EU moves	Non-EU moves	Total
Escape mobility	Forced: no options for research	12.5%	4.4%	9.1%
	Forced: required for career progression	6.4%	7.9%	7.0%
Expected mobility	Chose: improve working conditions	17.6%	12.2%	15.3%
	Chose: appreciated in career and working conditions	15.5%	18.6%	16.8%
Exchange mobility	Chose: networking and knowledge exchange	38.5%	51.0%	43.7%
	Other	9.5%	5.9%	8.0%

Source: MORE3 EU HE survey (2016) – Table 25 in MORE3 EU HE report
Notes:
- Only R2, R3 and R4 researchers who were >3 month mobile in the last ten years.
- Distribution of >3 month mobile researchers in post-PhD career over applicable situation for their last instance of mobility, for EU and non-EU moves.
- Based on question 74: "Which of the following situations would you say is most applicable to your last instance of mobility?" and question 66: "Please indicate the 3 most recent international steps/moves in the last 10 years of your research career after your PhD up to (but excluding) your current position in which you are employed."
- (n=1,704)

Figure 17: Escape, expected and exchange mobility, by country of citizenship (EU28)



Source: MORE3 EU HE survey (2016) – Figure 94 in MORE3 EU HE report
Notes:
- Only R2, R3 and R4 researchers who were >3 month mobile in the last ten years.
- Share of researchers who have been >3 month mobile in post-PhD career and that experienced a specific degree of freedom in their decision to become mobile.
- Countries with <30 observations are excluded: this is the case for Malta, Latvia and Luxembourg.
- Based on question 74: "Which of the following situations would you say is most applicable to your last instance of mobility?"
- (n=1,989)

EARLY STAGE RESEARCHERS

Finally, the comparative analysis of motives and barriers between the EU HE and Global survey points at a particular evolution over career stages. R2 researchers are found to attach on balance more importance to the main motives of mobility:

- International networking was a motive in the last move for 88% of R2 researchers, versus 84% in R3 and 78% in R4; there is no significant difference as main motive for the last move.
- Career progression was a motive in the last move for 93% of R2 researchers versus 84% in R3 and 62% in R4; it was the main motive for 26% of their moves, compared to 27% in R3 and 14% in R4.
- Working with leading scientists was a motive in the last move for 81% of R2 researchers versus 78% in R3 and 78% in R4; it was the main motive for 17% of their moves, compared to 15% in R3 and 28% in R4.
- Early career stage researchers are overall more focussed on career progression than R3 and R4 researchers. At the same time, they see more often barriers to mobility than R3 and R4 researchers (confirmed in both EU HE and Global survey). The degree of forced mobility is also highest among the R2 researchers. This is consistent with career pressures being highest at the R2 stage, where the decision

whether a career in academia can be pursued or whether outside options need to be considered is usually taken. At this stage, researchers are in general in the post-doctoral phase or in assistant professorships, looking out for further career progression options; they are more likely to be in fixed-term contracts (cf. section 6). At the other end of the spectrum, the R4 researchers are more driven by knowledge exchange motives (cf. 28% of the moves is inspired by working with leading scientists) and look for a status quo of their conditions (deterioration of conditions being a barrier to mobility).

9.1.3. Effects of mobility

The effects of international mobility after PhD are overall positive. For most types of effects in the EU HE survey, the share of researchers who see a positive influence is high and the share of researchers who see a negative influence is low.

The patterns are also stable over time when we compare effects of mobility experiences that took place ten years ago, five years ago and up to current mobility. Also comparison between MORE2 and MORE3 results confirm this finding.

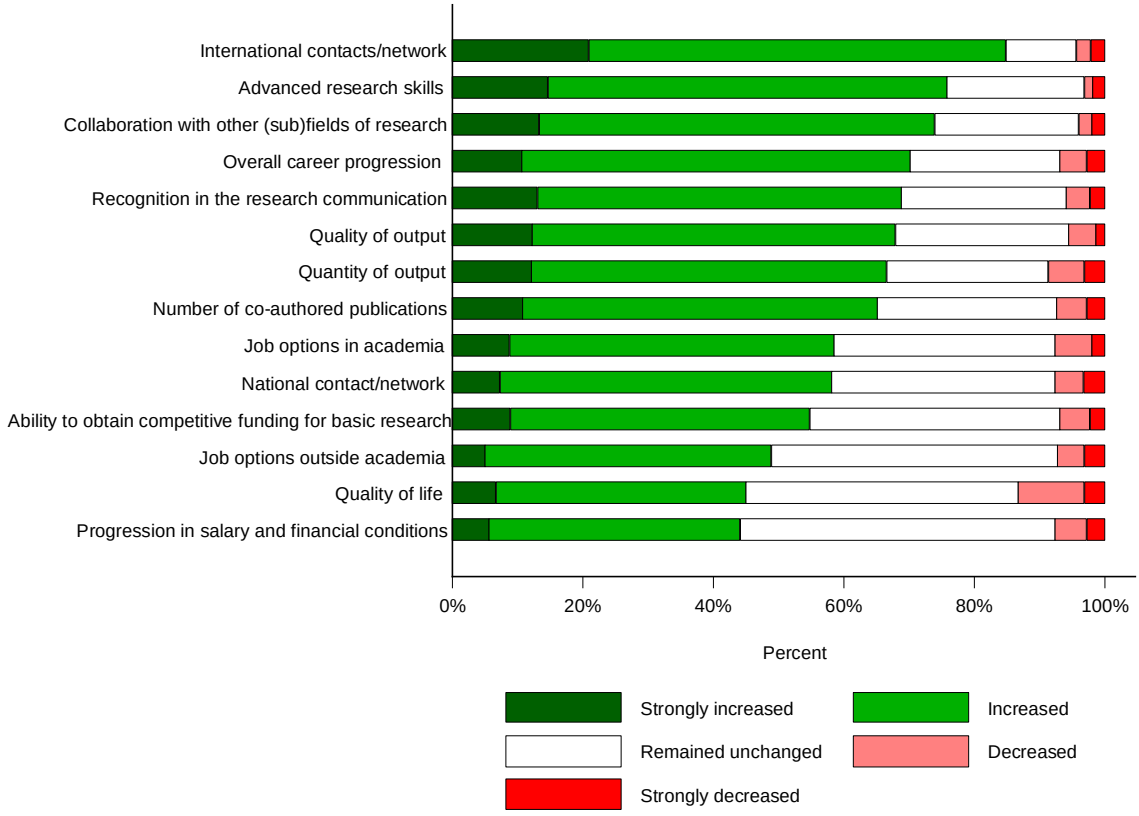
As with the motives and barriers, we find strong agreement across different analyses on effects of mobility. In all types of analyses, regardless of origin or destination, we find that international networking, collaboration and career progression are the main positive effects of international mobility. The main effects thus correspond to the main motives of researchers to become mobile. Remuneration was not one of these main motives and in the effects we similarly find that salary increase is not often an (immediate) effect of mobility. We find:

- EU HE survey (cf. Figure 18): Mobility is perceived as having increased or strongly increased researchers´ international contacts and network (85% of mobile researchers), as well as their collaboration with other (sub)fields (74%). Consistent with the results of MORE2, mobility experiences are also considered to have a positive effect on research output: 68% of researchers see a (strong) increase in quality and 67% in quantity of output. On the other hand, quality of life (personal effects), the salary and financial conditions (financial effects) and job options outside academia (career-related effects) receive lower scores (45%, 44% and 49% respectively).
- Global survey, non-EU researchers that have worked in the EU: There are also indications in a global context that mobility leads to further collaboration. This effect is stronger for non-EU researchers that have worked in the EU than for others. Another finding for this group is that they keep a strong link with their network in the EU.
- Global survey, EU researchers working in the US: Generally, a stay in the US is considered to have particularly strong effects. EU researchers who currently work in the US report much stronger positive effects than their counterparts in other countries. Researchers who have been to or are in the US report that their stay in the US has led to higher research funding, better job options, higher scientific output and more recognition in the research community. The picture is inverse for quality of life, where the effects are unchanged in the US but more positive in other countries where EU researchers work.

Yet, the analysis of motives also showed the frequent occurrence of forced mobility. Whether a move was 'forced' or 'self-chosen' will influence the intensity of the effects of the move. Another factor is the extent to which a country's HE system appreciates mobility as a positive factor for career progression. In most countries, international mobility is seen very positive, with the exception of the US and the UK (cf. section 6).

The career stage of the researcher also influences the intensity of effects of mobility. R2 and R3 researchers feel a stronger effect on the development of their advanced researchers' skills and on job options in academia. The R4 researchers indicate more positive effects on research output. This pattern is also comparable to the one seen in motives: the researchers at earlier career stages put more emphasis on forward-looking perspectives, while the more experienced researchers focus on experience and output.

Figure 18: Effects of entire mobility experience on the research career (EU28)



Source: MORE3 EU HE survey (2016) – Figure 104 in MORE3 EU HE report
Notes:
- Only R2, R3 and R4 researchers who were >3 month mobile in the last ten years.
- Share of mobile researchers who indicated the effect of the entire mobility experience on a specific aspect of their career to be a (strong) increase, (strong) decrease or unchanged.
- Based on question 77: "Please indicate below the effects, if any, of your entire mobility experience on your career to date?"
- (n=1,704)

9.2. EU policy aims and implications of MORE3 findings

As stated before, international mobility is generally considered a key dimension of international networking and knowledge exchange and circulation with positive effects at system level in terms of creating a sufficiently large pool of researchers to develop innovative research, and at individual level in terms of career progression, collaboration and scientific productivity.

In parallel to the development of scientific works on the importance and effects of international mobility, there has been an increase in the policy attention that regions and countries pay to it. The underlying rationale is that *"increased mobility and interaction of researchers lead not only to new patterns of collaboration and career development paths,*

but also to increased scientific performance, improved knowledge and technology transfer, the creation of networks and increased productivity"[133].

With the creation of the ERA, the European Commission underlines the importance of the international dimension in research. Related to the system perspective in literature, the ERA aims at creating a critical mass of excellent researchers and within this, the third ERA Priority[134] sets the goal for an open labour market for researchers (facilitating mobility, supporting training and ensuring attractive careers). A central aspect is also the fifth ERA priority; i.e. optimal exchange and circulation of knowledge, which aims at valorising collaboration and mobility and optimise knowledge exchange without borders. A key condition to this is the implementation of open, transparent and merit-based recruitment practices: public vacancies that are open to international applications (e.g. without language barriers), transparent application procedures and merit-based assessment of applications are essential to remove barriers for international mobility and thus to facilitate optimal knowledge exchange in Europe. ERA also recognises and encourages the effects at the individual level in terms of personal and professional development. International mobility enables international collaboration which is often a key ingredient of scientific productivity and research performance[135]. Section 6 of this report documents the positive role of international mobility in recruitment and career progression.

The main policy goals for international mobility of researchers could thus be identified as:

- **Quantity of researchers**: Research careers need to be attractive to draw in new talented researchers and keep them in the research profession in later career stages. Options for international mobility are one aspect of this.
- **Research excellence**: Researchers will be drawn to the most attractive research environments. Mobility thus encourages the development of competitive research environments and international networks, which is positive for scientific productivity and excellence. This also relates to the point made in section 6 and 7, that career paths and working conditions in the EU must be attractive enough for the best within a context of worldwide competition for the most talented researchers[136], ensuring brain circulation rather than brain drain.

WHICH LESSONS CAN BE DRAWN FROM THE MORE3 KEY FINDINGS ON MOBILITY FOR THESE POLICY AIMS?

The analysis of the motives, barriers and effects of international mobility in MORE3 clearly shows that there is a distinction between factors driving researchers to engage in mobility and those that take away barriers, thus enabling more researchers to engage in mobility. The first are mainly scientific knowledge production factors (career progression, international networking, working with leading scientists) that point at the importance of research excellence for researchers. The latter are more practical in nature and relate strongly to the family situation of researchers and/or to preconditions of mobility such as research funding and the availability of a suitable position. These findings are in line with literature – researchers move to improve their career, and stay or come back more for personal reasons, or for lack of funding and position. In sum, **improving scientific**

[133] Fernández-Zubieta, A., & Guy, K. (2010). Developing the European Research Area: Improving knowledge flows via researcher mobility. JRC Scientific and Technical Report, JRC-IPTS, p.12.
[134] http://ec.europa.eu/research/era/open-labour-market-for-researchers_en.htm
[135] Jonkers, K., & Tijssen, R. (2008). Chinese researchers returning home: Impacts of international mobility on research collaboration and scientific productivity. *Scientometrics*, *77*(2), 309-333.
[136] Hunter, Rosalind S., Andrew J. Oswald, and Bruce G. Charlton. 'The Elite Brain Drain*'. *The Economic Journal* 119, no. 538 (2009): F231–F251.

knowledge production factors will hence create motives or incentives to move to a country in the first place – they are drivers of mobility and indicators of the attractiveness of a research system. Reducing barriers to mobility will enable mobility, so **increased research funding and the availability of suitable positions are also enablers of mobility**[137].

Important to note is that drivers and enablers of mobility are different across the post-PhD career stages, with R2 researchers emphasising career progression and availability of positions more than R3 and R4 researchers. R4 researchers in particular are driven by motives of knowledge exchange.

At country level, a report carried out by the Joint Research Centre of the European Commission[138] already pointed out that countries with a stronger research capacity were able to attract a higher number of foreign researchers. This was also partly due to their greater propensity to advertise internationally their job vacancies than those countries with a weaker research capacity. The analysis of mobility flows in both the MORE3 EU HE survey and Global showed indeed that the same countries are each time popular destinations for researchers. This finding points at the **heterogeneity** between countries in the EU in terms of research capacity and systems, leading to asymmetric mobility flows. Policy actions will thus need to address drivers and enablers, but with sufficient attention to the heterogeneity between countries.

Specific analysis from the Global survey on the motives, barriers and effects of mobility of non-EU researchers having worked in Europe and vice versa, will be discussed in section 13 to assess the attractiveness and policy implications for Europe as research area. However, at this point the analysis of international mobility already emphasises positive network effects of global exchanges: non-European researchers maintain a strong network in Europe and often continue their cooperation with European partners after their stay in Europe (cf. MORE3 Global survey). The most important effects of a current stay in Europe by non-EU researchers are indeed identified in the EU HE survey as gaining an international network and recognition in the research community. Research funding and career progression also seem to have benefited from mobility to the EU. On a positive note, the ERA Progress Report 2016 observes an increased number of co-publications with non-ERA partners.

Also in view of mobility at the global level, it will thus be important to maximise the positive effects of international mobility and exchange, e.g. by addressing policy actions at the factors that determine Europe's attractiveness for non-EU researchers or for return mobility (as analysed in section 13) with the aim of making the ERA an attractive region for researchers from outside Europe and of encouraging collaboration between EU and non-EU researchers (knowledge exchange) – in line with the third but also with the sixth ERA priority.

EU-LEVEL AND NATIONAL POLICY INSTRUMENTS

Within the context of the ERA and its third priority, a central aspect is the optimal exchange and circulation of knowledge, aiming to valorise collaboration and mobility and optimise knowledge exchange among ERA countries. The Commission put forth a series of initiatives to achieve this goal by promoting transparent, open and merit-based

[137] Note that research funding affects of course also scientific knowledge production, it is however not a main motive to become mobile.
[138] Fernández-Zubieta, A., & Guy, K. (2010). Developing the European Research Area: Improving knowledge flows via researcher mobility. JRC Scientific and Technical Report, JRC-IPTS.

recruitment as a way to remove barriers for international mobility. Examples of these actions are[139]:

- Strengthening the EURAXESS network so that it becomes an efficient provider of support for researchers, with EURAXESS Services covering social security issues in different aspect of their functioning;
- Setting up a European Accreditation Mechanism for the development of human resources management in research institutions in alignment with the European Charter of Researchers and the Code of Conduct;
- Support a greater automatic recognition of comparable degrees;
- Addressing social security barriers for researchers in the EU and facilitating the entry and stay of third country national researchers (pension portability, supplementary pension rights and funds).

The commitment in the 2012 ERA Communication to support employers in removing pensions as an obstacle for researchers' mobility was followed by the establishment of a Retirement Savings Vehicle for European Research Institutions (RESAVER). RESAVER incorporates a pan-European supplementary pension fund for researchers, ensuring portability of this supplementary pension between countries and positions.

In addition, the international mobility dimension is embedded in several funding schemes at EU level. This is the case, for instance, in the Marie Skłodowska Curie Actions (MSCA)[140]. These actions are rooted in the "Excellence" Pillar of the Horizon2020 Programme, and provide funding opportunities for mobility, training and career development at all stages of a researcher's career. By focusing on the pan-EU dimension, the MSCA aim at developing an open and accessible ERA and to foster the development of an EU labour market for researchers. International mobility is therefore a key component of the MSCA. Funding is allocated with the objective of "*permitting researchers to cooperate freely across borders and at enabling undertakings to exploit the internal market potential to the full*" [141]. Partial evidence of the success of the actions in this sense is shown by the data of the MORE3 EU HE survey. Although causality links cannot be established, researchers that have worked under an MSCA in the past display much larger shares of long-term international mobility in the last ten years (40%[142] compared to 27% in the general population of researchers).

The European Research Council (ERC) grants are also designed to promote the development of the ERA as an open labour market. These grants are allocated to individual researchers that can then decide where they want to carry out their research - i.e. in which country and at which university (the "money follows researcher" principle). By facilitating the portability of grants, the ERC also aims at fostering researchers´ working conditions (cf. section 7): HEI are incentivised to offer better working conditions to attract these top level researchers. As such, the ERC grants do not require international mobility, but they facilitate it from two angles: they allow for individual mobility through portability of funding (they enable mobility) and they set incentives for more attractive working conditions for researchers (they "drive" mobility). Interestingly, according to the MORE3 EU HE survey, researchers that have worked in ERC-funded

[139] http://ec.europa.eu/research/era/open-labour-market-for-researchers_en.htm
[140] http://ec.europa.eu/programmes/horizon2020/en/h2020-section/marie-sk%C5%82odowska-curie-actions
[141] OJEU. 2012. Consolidated versions of the Treaty on European Union and the Treaty on the Functioning of the European Union.
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A12012E%2FTXT
[142] The item on international mobility used for his comparison only referred to mobility in the last ten years. This explains why this share is not even higher.

projects in the past display very similar levels of international mobility as the general population of researchers (24% versus 27%).

In parallel to these EU initiatives, the Member States also develop their own policy framework for international mobility. The ERA Progress Report 2016[143] observes that there is still a need to further facilitate international mobility of researchers through equal access to national funding by foreign researchers and portability of grants. Several Member States are responding to this call, as is seen from the Member States' National Action Plans (NAP). The announced measures show that policy at national level is also directed to this. Without aiming to be exhaustive, and without any further information on the effectiveness of the measure, we list a number of examples:

- In Germany, the German Rectors' Conference commits to more flexible systems of retirement provisions: it regularly informs HEI and works on developments in retirement provisions for mobile scientists.
- Czech Republic announced a general action to promote international mobility in different ways, among which financial support for the realisation of the Individual Fellowships within Marie Skłodowska-Curie Actions (MSCA) that were positively evaluated but could not be financed from the Horizon2020 due to budgetary limitations (seal of excellence).
- Slovenia will work on the elimination of mobility obstacles and on internationally compatible mechanisms to recognise researcher qualifications.
- Austria announced initiatives to facilitate accessibility to information and networks by improving access to the EURAXESS network and embedding existing information services in the framework of the EURAXESS initiative. It will further implement projects of the universities for a culture of welcome and suggest improvements to the Red-White-Red Card for criteria-based immigration in Austria from a country outside the EU.

Moreover, several National Action Plans refer to specific policies to attract non-EU researchers. Planned actions go from funding and bilateral agreements for cooperation with specific non-EU countries to better communication on the achievements of researchers and/or innovation activities. Countries where this kind of initiatives are planned are for example: Austria, Belgium, Czech Republic, Estonia, Germany, Italy, Ireland, Malta, The Netherlands, Norway, and Portugal. Actions to increase the position of South, Central and East-European countries versus the West-European countries as destinations for EU- and non-EU researchers can also be interesting to consider given the destinations analysis mentioned above. Malta mentions its involvement in the PRIMA initiative: "Partnership in Research and Innovation in the Mediterranean Area". If successful, PRIMA will establish permanent collaboration among Member States and countries in the Mediterranean region on specific topics related to the societal challenges.

The actions announced by the Member States in their National Action Plans, mentioned in the ERA Progress Report, seem more designed to remove barriers than to improve conditions that drive researchers' mobility. However, other types of actions also occur: in the initiative to promote international mobility in the Czech Republic (cf. supra), there will be one action on the integration of internationally experienced researchers into the Czech R&D and innovation ecosystem.

A balance between both removing barriers and improving conditions that drive the mobility of researchers will be essential to both attract mobile researchers and enable them to undertake this step to or within Europe. Given that some of the most important

[143] https://ec.europa.eu/research/era/pdf/era_progress_report2016/era_progress_report_2016_com.pdf

drivers of inward mobility are those related to scientific excellence, policy attempts focusing on administrative factors (e.g. visa procedures), human resource practices (e.g. Charter and Code) or even social security and pension will only address part of the problem. As stated by the Joint Research Centre in a report on international mobility[144], divergences between countries will persist as long as excellence in research is fragmented and dispersed. By contributing to the Member States´ research excellence and by harmonising existing best practices, the EU will not only foster 'internal' international circulation but also strengthen its attractiveness outside Europe. The policy aim here could thus be to optimise circulation and international mobility by both reducing barriers (enabling mobility) and improving the factors driving mobility at the same time, thereby encouraging knowledge circulation within Europe and attracting researchers from outside Europe.

Next to removing the barriers to enable mobility, and next to the funding schemes that exist to support and encourage mobility, a number of other measures can thus be considered to drive mobility and to increase the effects of mobility. The effects of mobility can also be further optimised by encouraging instruments that allow researchers to return voluntarily to their home country, maintaining their network from their mobility experience and benefiting from the knowledge exchange this entails, as the Member States are called to consider. The MORE3 Global survey indicated that interest in return mobility (in the next year) is low among later stage researchers. This is probably explained by the fact that later stage researchers are more settled and established in their current positions and are therefore less inclined to look for a change in that position. In order to be effective, it is important that this kind of actions run in parallel with actions for improved attractiveness of research conditions in the home country.

A number of national programmes in the EU address this point, for example the FiDiPro Finland distinguished Professor Programme in Finland or the Odysseus programme in Flanders, Belgium. Alternative forms with dual positions or virtual mobility exchanges can be further investigated. Also maintaining a stronger network with the mobile researchers is important in this respect. The MORE3 findings from the Global survey show that a very strong connection continues to exist with the EU for non-EU researchers who worked in the EU and left the region. This effect could be strengthened also the other way around for EU researchers working outside the EU, through the existing EURAXESS networks and/or national initiatives to keep in touch with their researchers abroad.

Another way of increasing effects of international mobility, in particular within Europe, is to support the conditions needed to turn asymmetric mobility (brain drain) into symmetric mobility (brain circulation). As such, synergies between Horizon2020 and ESIF are being explored in a pilot project of the European Parliament, named the 'Stairway to Excellence' or S2E[145]. If a number of practical bottlenecks to implementing the available tools for synergies between funds are addressed, the project expects that these synergies will help in closing the innovation gap and promote excellence in all regions and EU countries, also related to the Smart Specialisation Strategies. It would lead too far to explore the full range of possibilities and practical actions in this report, but the

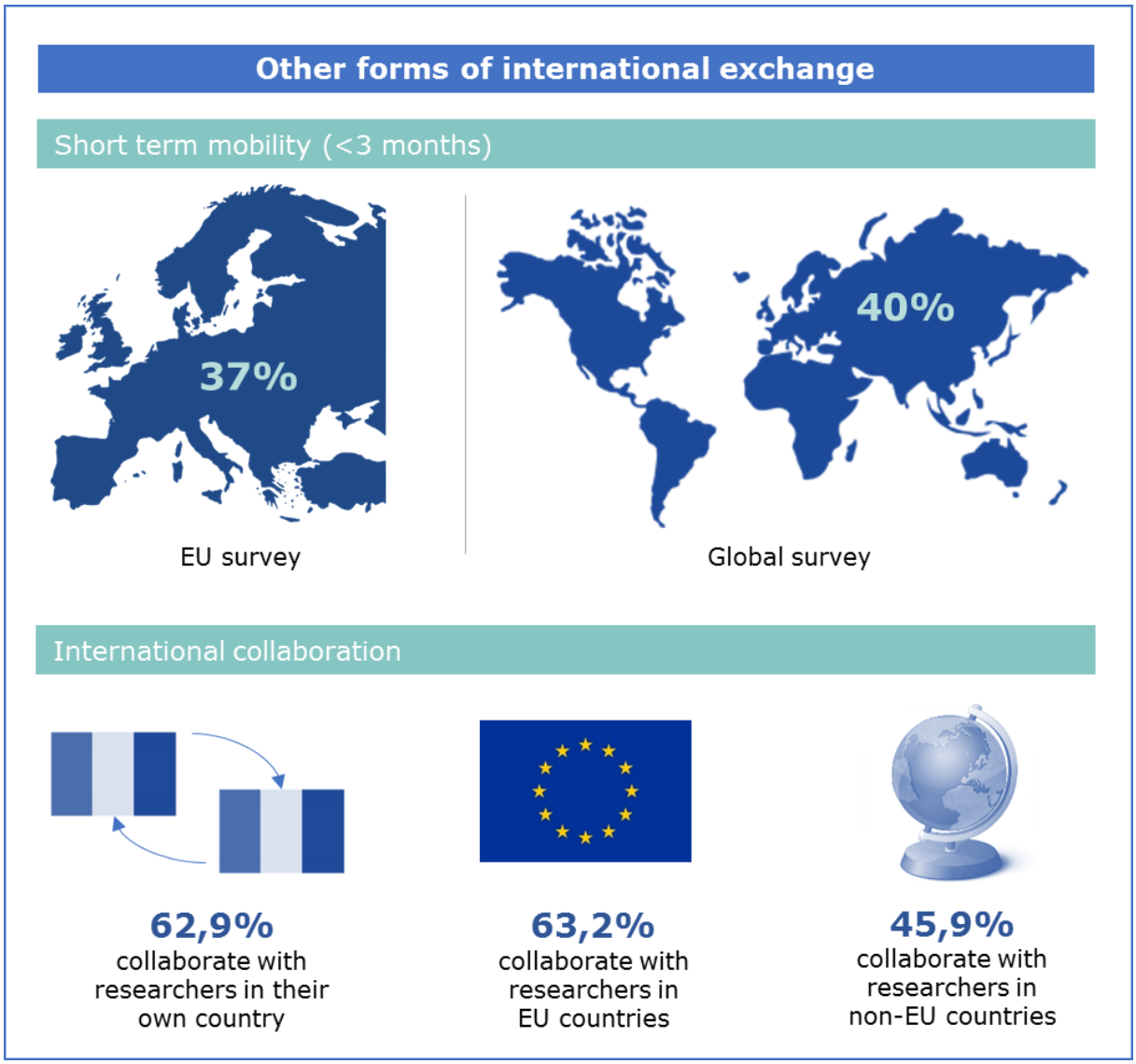
[144] Fernández-Zubieta, A., & Guy, K. (2010). Developing the European Research Area: Improving knowledge flows via researcher mobility. JRC Scientific and Technical Report, JRC-IPTS.

[145] The "Stairway to Excellence" (S2E) initiative is a pilot project funded by the European Parliament (EP) and implemented by the European Commission through its Directorates-General Joint Research Centre (JRC) and Regional and Urban Policy (REGIO). It is focused on supporting European Regions and Member States in enhancing synergies in the use of different EU funding sources for research, development and innovation (European Structural and Investment Funds and Horizon 2020, also taking account of COSME, ERASMUS+, Creative Europe and so on).
https://ec.europa.eu/jrc/en/event/conference/2017-stairway-excellence-s2e-conference.

example of seeking synergies between regional support and building excellence in research and innovation is a good practice that deserves further research.

Section 13 will further elaborate on the importance of a balance between both the drivers and enablers, not only for mobility but also more generally for the development of attractive research careers (cf. sections 6 and 7). This section will also match the findings on importance of these aspects for mobility, careers and working conditions, with the findings on how the European research area is perceived with respect to these aspects (strengths, weaknesses and attractiveness). It is clear from this analysis, however, that convergence in terms of attractiveness across Member States and with other regions is an important policy priority in order to fully benefit the effects of international mobility and knowledge exchange.

10. Other forms of international exchange: short-term mobility, collaboration, virtual mobility, conferences



Source: Based on MORE3 EU HE report (sections 8.1.2 and 8.1.3)

Being in contact with researchers in other countries, inside and outside the EU, offers researchers the possibility to join scientific networks, initiate collaborative projects and promote knowledge circulation. There are different mechanisms through which this type of collaboration can be fostered. In addition to long-term mobility, as described in the previous chapter, researchers can also engage in shorter-term moves to carry out research stays, attend meetings and visit supervisors or colleagues. Another mechanism that can foster international collaboration is virtual mobility, understood as virtual communication or collaboration using information and communication technologies.

The MORE3 project has gathered evidence on the extent to which researchers engage in this other types of international exchange, which is discussed in this section.

10.1. Key findings

First, the findings show that nearly four out of ten researchers have engaged in short-term mobility in the last ten years, that conferences are the most frequent reason for this type of moves and that long-term mobile researchers are more likely to undertake short-term moves. Second, virtual mobility is perceived as having a greater impact reducing short-term mobility than long-term mobility. Earlier career stages seem to approach virtual mobility as independent from physical mobility to a greater extent than researchers in more established positions.

10.1.1. Short-term mobility

Share of researchers with <3 month international mobility experience in the last ten years
Of all R2, R3 and R4 researchers

	EU total	Per career stage	Per FOS	Per gender
2012 (n=7,131)	41.0%	R2: 35.8% R3: 41.0% R4: 45.1%	MED: 36.5% NAT: 42.3% SOC: 41.0%	F: 37.0% M: 43.3%
2016 (n=8,073)	37.2%	R2: 31.0% R3: 37.8% R4: 40.1%	MED: 34.9% NAT: 37.8 % SOC: 37.4%	F: 35.1% M: 38.4%

Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Table in section 8.1.2 in MORE3 EU HE report

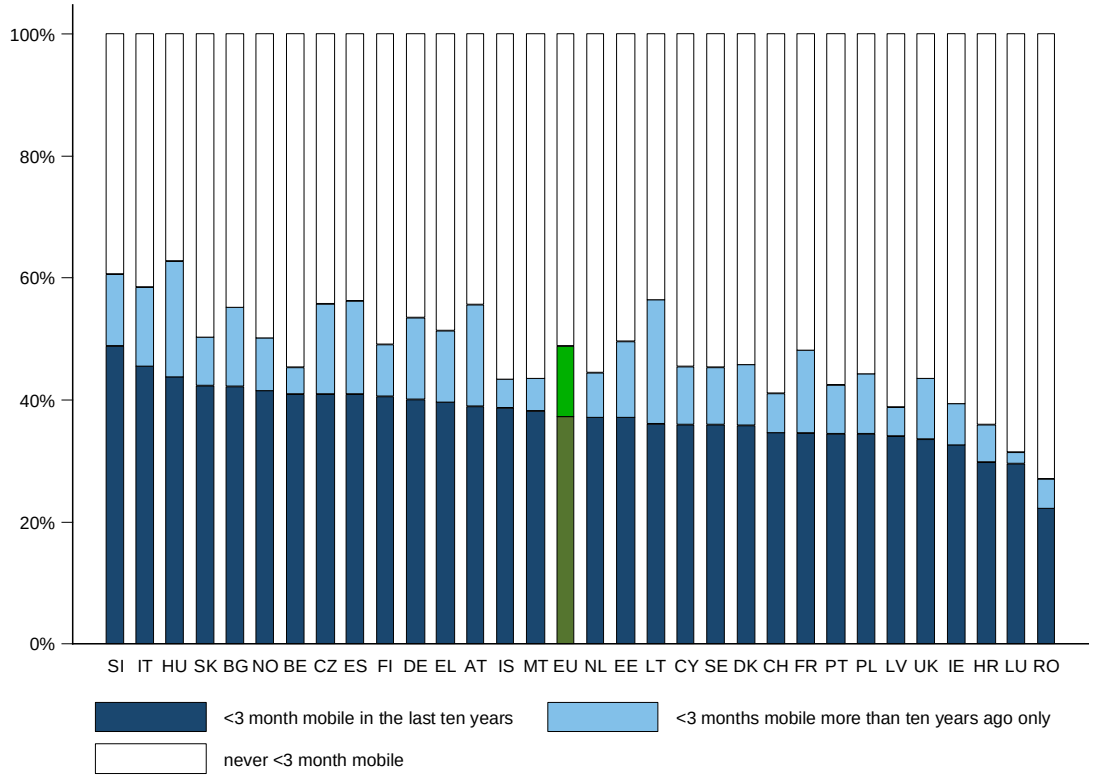
Note:
- Based on question 79: "Short-term mobility (<3 months)"

The share of researchers in EU HE that have moved abroad for a short period in the last ten years is more or less stable compared to 2012: 41% in 2012 compared to 37% in 2016. A similar share is found for researchers currently working outside the EU (40%). The results further indicate that long- and short-term mobility are related. For example, 60% of the researchers that has never been short-term mobile have not been long-term mobile either. One out of three researchers who have been short-term mobile in the last ten years have also been long-term mobile in the last ten years. These figures indicate the existence of mobile and non-mobile researchers, the former being more prone to engage in all types of international mobility and the latter less likely to move. However, the effects of both types of mobility are not the same: Researchers having been long-term mobile (i.e. for more than three months) in the last ten years tend to attribute collaboration to mobility to a greater extent than those who have been short- term mobile (<3 months) or those who have never been mobile. This occurs in all types of collaboration, also in the one taking place within the same country. Yet the strongest differences are found in the collaboration with researchers located in the EU (8 pp) and in non-EU countries (10 pp)[146].

At country level, Slovenia (49%), Italy (46%) and Hungary (44%) have the highest share of short-term mobile researchers. Croatia (30%), Luxembourg (29%) and Romania (22%) display the lowest shares. However, there have been some important changes since 2012. Luxembourg and Romania, now at the lower end of the spectrum, had the second (51%) and seventh (55%) highest positions respectively for this indicator in 2012. On the opposite, Italy, now at the higher end of the spectrum, had the fourth lowest value in 2012 (37%).

[146] More information in Figure 120 of the MORE3 EU HE report.

Figure 19: <3 month international mobility in post-PhD career stage, in the last ten years, by country (2016)



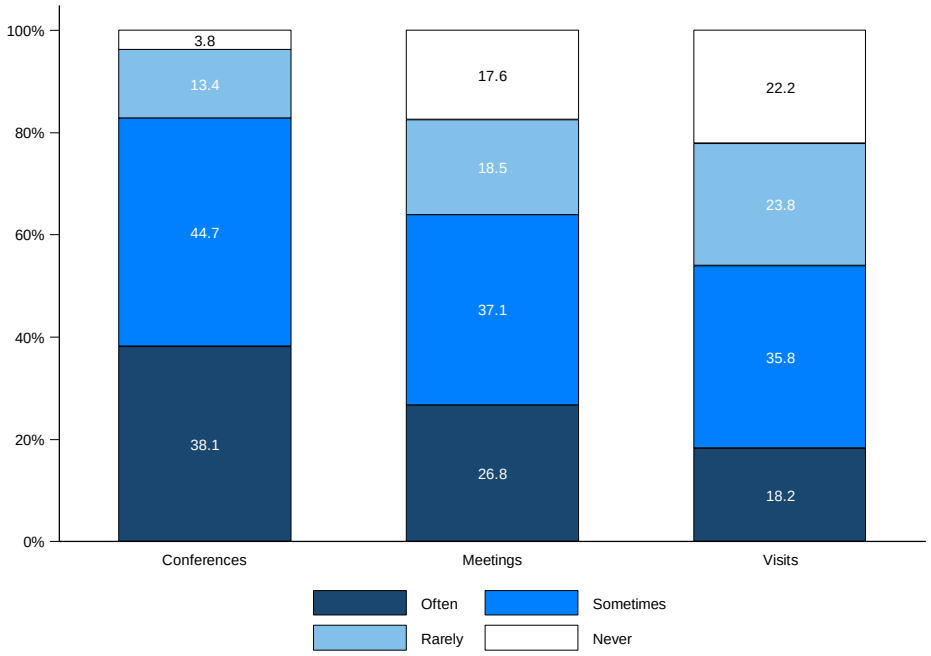
Source: MORE3 EU HE survey (2016) – Figure 110 in MORE3 EU HE report
Notes:

- Only R2, R3 and R4 researchers.
- Percentage of R2, R3 and R4 researchers who have worked abroad for under 3 months at least once in the last ten years, per country.
- Based on question 79: "Short-term mobility (<3 months)"
- (2016: n=8,824; 2012: n = 8,357)

10.1.2. Conferences

Among the types of short-term international travel and consistent with the results of MORE2 (2012), conferences stand out as the type of travel that is more frequent among researchers, followed by meetings and visits to supervisors or colleagues (cf. Figure 20).

Figure 20: Participation in conferences, visits and meetings, by frequency (EU28)



Source: MORE3 EU HE survey (2016) – Figure 123 in MORE3 EU HE report
Notes:
- Only R2, R3 and R4 researchers.
- Percentage of R2, R3 and R4 researchers, distributed over types of <3 month mobility and their duration.
- Per type, the respondent could only indicate one frequency category.
- Based on question 80: "What types of work-related international travel have you undertaken during your research career (but after you PhD)?"
- (n=7,746 for conferences, n =6,628 for meetings and n =6,456 for visits)

10.1.3. International collaboration

International collaboration *All researchers (n=9,412)*	EU total	Per (current) career stage	Per FOS	Per gender
Researchers in your country	62.9%	R1: 51.2% R2: 54.4% R3: 63.1% R4: 73.7%	NAT: 67.0% ENG: 64.1% MED: 61.9% AGR: 61.3% SOC: 60.6% HUM: 60.4%	F: 62.2% M: 63.4%
Researchers in EU countries	63.2%	R1: 39.5% R2: 48.3% R3: 67.7% R4: 78.2%	NAT: 70.0% ENG: 65.1% MED: 56.0% AGR: 60.0% SOC: 60.9% HUM: 65.3%	F: 60.1% M: 65.2%
Researchers in non-EU countries	45.9%	R1: 22.9% R2: 31.0% R3: 47.1% R4: 64.8%	NAT: 56.6% ENG: 43.1% MED: 40.4% AGR: 47.2% SOC: 42.7% HUM: 44.4%	F: 40.5% M: 49.3%

Source: MORE3 EU HE survey (2016) – Table in Section 8.1.3 in MORE3 EU HE report
Notes:
- Multiple collaboration types per respondent are possible.
- Based on question 88: "Please indicate with whom you collaborate in your research"

Also the pattern of international collaboration is stable over time: 63% of EU HE researchers collaborate with other EU researchers, 46% with non-EU researchers[147]. At individual level some patterns emerge: in general all types of national and international collaborations are more likely in later career stages, in the Natural Sciences, and among male researchers.

Researchers working in Benelux, Anglo-Saxon and Scandinavian countries are more likely to collaborate with researchers from other countries (EU and non-EU), while international collaboration is lower in large West-European systems, such as Germany, France, Italy, or Spain (Table 35 in MORE3 EU HE report). This is confirmed in the analysis of co-publications performed in the framework of the MORE3 project (Section 5.4.4 of the MORE3 Indicator report on researchers). This analysis, based on SCOPUS data, indicated that those countries with a smaller population that speak a language other than English have a greater tendency to collaborate internationally. This pattern does not hold for Eastern European countries: these countries display low figures of international co-publications. This is partly due to the fact that journals in the languages spoken in those countries are underrepresented in the underlying databases of SCOPUS.

[147] Changes in the wording of this question compared to the MORE2 study do not allow to compare the evolution of these indicators over time.

10.1.4. Virtual mobility

The survey included questions on virtual mobility; that is the extent to which researchers engage in virtual communication or collaboration using information and communication technologies, and on its effects on reducing short-term and long-term international visits. The findings indicate that virtual mobility has a greater impact on reducing short-term mobility (51% of the researchers that collaborate with international partners) than on reducing long-term mobility (11%). This pattern is identical to MORE2 findings of 2012, with respective shares of 50% and 9%.
The impact of virtual mobility on short-term mobility is smaller in large and affluent Western European countries, such as the United Kingdom, France and Germany, and among researchers in earlier career stages, possibly due to the fact that they have grown up in the digital era.

10.2. EU policy aims and implications of MORE3 findings

International collaboration can be analysed from two angles: first, as collaboration with researchers located in other EU countries and, second, as collaboration with researchers located outside Europe. The MORE3 survey indicates that intra-EU collaboration reaches similar levels to that carried out among researchers within the same country, but that collaboration with non-EU researchers lags behind. This is related to the policy efforts on improving the latter. In this sense, it is important to note that international cooperation is the sixth of the ERA priorities. It is conceived of as a way "to address grand societal challenges, ease access to new emerging markets and increase the attractiveness of the ERA for talented minds and investors worldwide"[148].

The European Commission, acknowledging that R&D is increasingly performed at a global level is fostering the access of EU researchers to this knowledge. This aim has been translated into the "Open to the world" pillar of Commissioner Moedas´ three O's strategy.

- At the policy level, the Commission is strengthening the EU´s science diplomacy to develop collaboration agreements between the EU, the Member States, Associated Countries and third countries.
- At the researchers' level, this need for collaboration with research carried out outside Europe is translated into the need for collaboration with researchers located in other countries. This can be done through short-term stays, carrying out joint research projects, or attending conferences and other events as places for knowledge exchange.

The topic as such relates to **research excellence** and the link with the **global research area** in policy priorities.

WHICH LESSONS CAN BE DRAWN FROM THE MORE3 KEY FINDINGS ON INTERNATIONAL COLLABORATION FOR THESE POLICY AIMS?

The data from the MORE3 project show that the EU is well-placed in the extent of this international collaboration. At EU level 63% of the researchers collaborate with researchers in other EU countries, but the share drops to 46% when asked about collaboration with researchers outside the EU[149]. Further research will be useful to analyse the extent to which policies and initiatives launched under the "Open to the World" pillar

[148] ERA Roadmap (2015).
[149] Changes in the wording of the question on international mobility with respect to MORE2 hinder the comparison of this indicator over time.

contribute to fostering collaboration. Support for international mobility (cf. section 9) can play an important role at the individual level among the initiatives that can be promoted to strengthen international collaboration. The MORE3 EU HE survey shows that international collaboration is often the result of previous mobility experiences and that long-term mobility (e.g. more than three months) has a stronger effect on this than short-term mobility.

With respect to those researchers that have worked in projects funded by an MSCA or an ERC grant in the past, the analysis of the MORE3 EU HE survey indicate that they present much higher shares of international collaboration (49% and 50% respectively) than the overall population of researchers (36%). No causal links can be established on the basis of the available data, but nonetheless there seems to be an association between these grants and a higher level of collaboration with researchers working in other countries.

With regard to other types of mobility, it is interesting to note the role of virtual mobility. It is one of the means through which international collaboration can be pursued without the need to physically travel to other countries, reducing the costs of international collaboration and at the same time facilitating knowledge exchange. The advantages of virtual mobility, however, cannot be equated to the benefits of long-term "physical" mobility. This is confirmed by the MORE3 data: in general terms, the responses to the survey indicate that virtual mobility has a greater impact on reducing short-term mobility (51% of the researchers that collaborate with international partners) than on reducing long-term mobility (11%). These results suggest that virtual mobility and long-term mobility do not fulfil the same needs: while virtual mobility can be useful during the development of research projects (e.g. through the reduction of short-term visits, instantaneous communication, etc.), international long-term mobility can be considered to be key for the generation of new contacts and collaborations.

It is interesting to note that researchers´ perceptions of the extent to which virtual mobility has no impact on their physical mobility decisions is stable over time: 35% of the researchers declared in 2012 that virtual mobility had no effect on their mobility decisions, compared to 38% in 2016. This is especially relevant among early stage researchers. Researchers in this group are more likely to perceive virtual mobility as being independent from their mobility to other countries. This might be explained by the fact that these researchers tend to be younger, have grown up in the digital era and consider digitalisation as the standard. The Council Conclusions on 'Measures to support early stage researchers, raise the attractiveness of scientific careers and foster investment in human potential in research and development'[150] made explicit mention to the need to foster virtual mobility among early stage researchers. The MORE3 data shows that there might not be a need to promote this type of mobility: these researchers are naturally rooted in the digital world and take for granted that virtual mobility is a natural aspect of their work.

EU-LEVEL AND NATIONAL POLICY INSTRUMENTS

There are several EU programmes fostering short-term mobility and international collaboration. Erasmus+, a number of MSCA, such as RISE, and the EU-ICI ECP activities are some notable examples of this. The different aims and formats of these programmes hinders finding commonalities with respect to the ways through which they promote international exchanges through collaboration, short-term mobility, or virtual mobility. However, the characteristics of these programmes clearly relate to the findings of the

[150] This text is available at: http://www.consilium.europa.eu/media/24214/st14301en16.pdf

MORE3 EU HE survey on, for instance, the links between short and long-term international experiences or on the benefits in terms of fostering collaboration associated to each type of international exchange. Hence, continued support for international mobility is expected to foster international collaboration.

To the best of our knowledge there are no specific EU initiatives targeting regional or cross-country imbalances with respect to these forms of international exchange. The lower levels of international collaboration found in Eastern European countries will not converge with that of Western European countries unless specific measures for this are taken. As international collaboration is often driven by international mobility experiences, promoting mobility (cf. sections 8 and 9) will also promote international collaboration. Beyond the geographical dimension and the expected positive impacts at country level[151], fostering the convergence of the levels of collaboration across European countries is also expected to have an important impact on individual researchers. In general, international collaboration with researchers from other countries tends to lead to higher citation rates than that of publications by one author or by contributors from the same country[152]. Given that citation rates are key for researchers´ career prospects in many fields and the increasingly globalised academic labour market, fostering the access of Eastern European researchers to international collaboration might mitigate the current imbalances found in this regard.

At the national level, Member States' National Action Plans (NAP) indicate that several countries have planned to launch specific initiatives aiming at increasing scientific collaboration with other countries. Without aiming to be exhaustive, and without any further information on the effectiveness of the measure, some countries such as Estonia or Austria specifically address the need to increase collaboration with other EU countries, most notably through the participation in EU initiatives (e.g. an increasing participation in Euraxess) or the alignment of the national funding schemes with strategies defined at EU level. Initiatives often echo the Commission's priority to increase collaboration with third countries. However, the National Action Plans often are targeted towards selected countries and offer a somewhat fragmented picture. The focus of the strategies is sometimes put on the basis of similar historical and linguistic grounds, such as the emphasis on Portuguese-speaking countries in the Portuguese plan. Geographical proximity also matters: the focus on Euro-Mediterranean relations in the French strategy or the focus on Nordic and Baltic countries in the Estonian plans are examples of this approach. Strengthening the collaboration with China is highlighted in the Irish, Maltese and Greek plans.

The fragmentation and variety of these initiatives responds to the varying drivers for international collaboration found across countries. The extent to which countries put emphasis on the role of international scientific collaboration on diplomatic relationships, on the impact of research on competitiveness, or on tackling global sciences to name but a few[153], impacts the target countries and the forms of collaboration. At the individual level, however, researchers have to operate within these frameworks. In this sense, the EU level, with bottom-up programmes such as the ERC grants, offers researchers greater freedom.

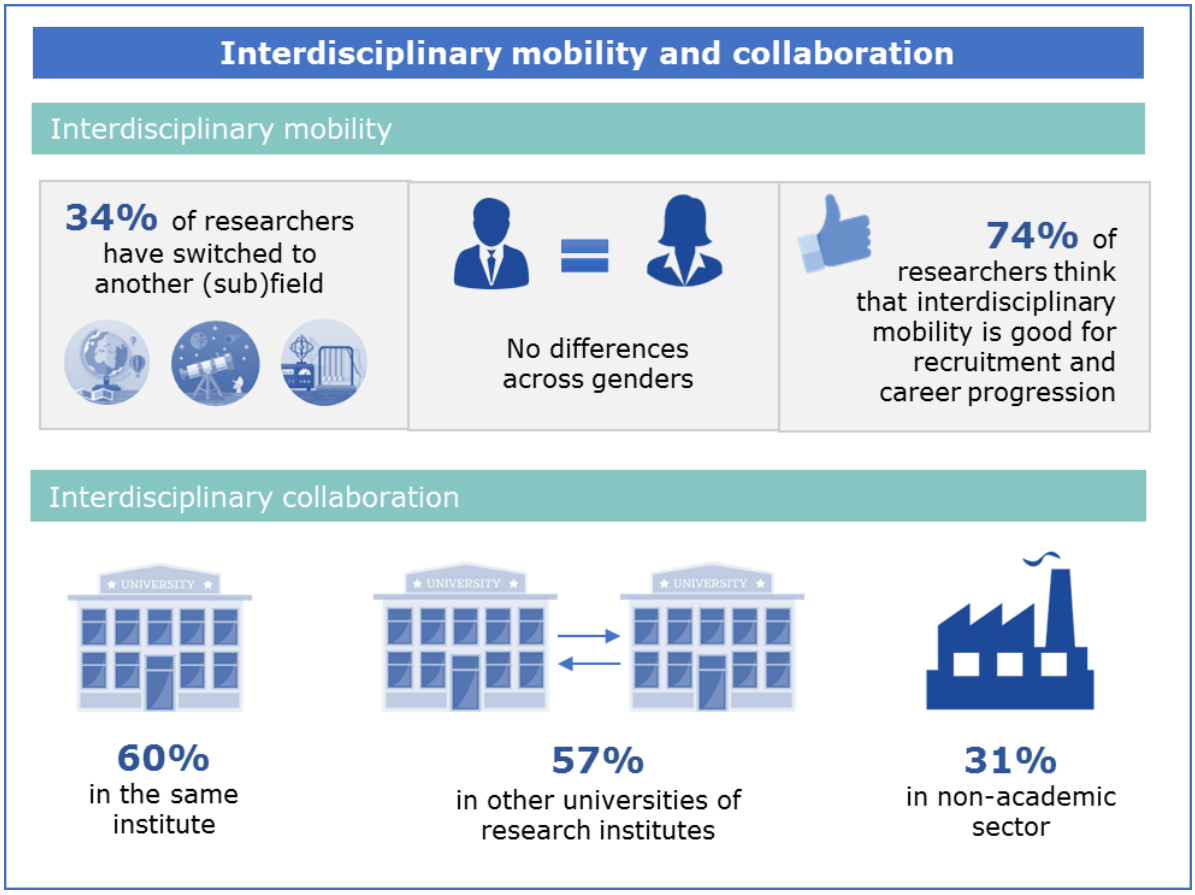
---

[151] Bote, G., Vicente, P., Olmeda-Gómez, C., & Moya-Anegón, F. (2013). Quantifying the benefits of international scientific collaboration. Journal of the Association for Information Science and Technology, 64(2), 392-404.

[152] Schmoch, U., & Schubert, T. (2008). Are international co-publications an indicator for quality of scientific research?. Scientometrics, 74(3), 361-377.

[153] Boekholt, P., Edler, J., Cunningham, P., & Flanagan, K. (2009). Drivers of International collaboration in research. European Commission, Final report.

11. Interdisciplinary mobility and collaboration



Source: Based on MORE3 EU HE report (sections 8.2.1 and 8.2.2)

There is no common definition of interdisciplinarity. It can be understood as a way of doing research beyond the frontiers of traditional disciplines. In practical terms, this can entail that a researcher crosses these frontiers in the elaboration of his/her own research agenda or that a researcher works with other researchers specialised in other disciplines. Those in favour of the promotion of interdisciplinarity argue that interdisciplinary mobility and collaboration are well-suited to address complex societal challenges and that it fosters academic excellence and innovation[154]. The conclusions of the Interdisciplinarity and Research Integrity in Open Science Workshop of the Working Group "Science in Transition" of the Research, Innovation, and Science Policy Expert High-Level Group (RISE) are aligned with this idea. According to the participants in the workshop, interdisciplinarity would not only foster academic excellence, it can also "nurture cohesion at European level, innovative capacities of EU, and may play a key role in science diplomacy"[155]. Interdisciplinarity is therefore understood as a way to stimulate

[154] http://ec.europa.eu/research/openvision/pdf/rise/berlin_workshop_042015-freigabe-ja.pdf#view=fit&pagemode=none
[155] http://ec.europa.eu/research/openvision/pdf/rise/berlin_workshop_042015-freigabe-ja.pdf#view=fit&pagemode=none

disruptive innovation and to bridge the gap between research communities and the practical application of research results[156].

Other scholars are, however, not so convinced about the positive results of interdisciplinarity in terms of social impact or the scientific outputs. First, there is little evidence of the positive economic and social impact of interdisciplinary research due to methodological limitations and the lack of commonly accepted definition of this type of research. Second, interdisciplinarity can jeopardise scientific rigour since it requires the evaluation by peers with different backgrounds and scientific standards[157]. In relation to this, some authors argue that interdisciplinarity can entail the development of unconventional claims and approaches that are usually penalised[158] in terms of the possibility of being published in recognised scientific journals. Therefore, interdisciplinary research is often riskier than disciplinary research and can lead to less efficiency, for instance by publishing fewer articles. The reverse of this argument was put forth by Leahey et al. [159] (2017) who showed that interdisciplinary works received more citations than disciplinary ones.

There are hence mixed positions with respect to the impact of interdisciplinary mobility on researchers´ career progression. In general, interdisciplinary research remains a risky endeavour but the MORE3 survey indicates that this factor is seen by researchers working in the EU as having a positive effect on both recruitment and career progression.

11.1. Key findings

11.1.1. Interdisciplinary mobility

Share of researchers who have switched to another (sub)field during their academic career *Of all researchers (n=9,412)*				
	EU28 total	**Per career stage**	**Per FOS**	**Per gender**
2016	34.3%	R1: 28.9% R2: 29.5% R3: 33.6% R4: 40.9%	NAT: 35.5% ENG: 36.8% MED: 32.5% AGR: 34.2% SOC: 37.2% HUM: 28.7%	F: 34.2% M: 34.4%

Source: MORE3 EU HE survey (2016) - Table in section 8.2.1 in MORE3 EU HE report
Note:
- Based on question 14: "Did you switch to another (sub)field of research during your academic career?"

Based on the question whether or not the researcher switched to another (sub)field of research during his or her academic career, 34% of all researchers indicate that they did.

[156] https://ec.europa.eu/research/openvision/pdf/rise/allmendinger-interdisciplinarity.pdf
[157] Carrillo, R. & Núñez, L. (forthcoming). Interdisciplinarity. The interaction of different disciplines to understand common problems. In Morin, J.F., Olsson, C. and Atitkan, E.O., *Key Concepts in Research Methods*. Routledge.
[158] Frodeman, Robert. 2010. The Oxford handbook of interdisciplinarity. Oxford: Oxford University Press.
[159] Leahey, E., Beckman, C. M., & Stanko, T. L. (2017). Prominent but less productive: The impact of interdisciplinarity on scientists' research. Administrative Science Quarterly, 62(1), 105-139.

The question is thus not limited to moves between the six main fields of science (Natural Sciences; Engineering and Technology; Medical and health sciences; Agricultural and veterinary sciences; Social Sciences; Humanities and the Arts), but allows the respondents to also think of moves between subfields, and the extent to which such a move between subfields was an interdisciplinary move. Only small differences occur between genders and fields, although the Humanities have a considerably lower share of interdisciplinary mobile researchers (29%). Large differences are observed across countries, with shares ranging from 18% to 60%.

These findings are similar to the ones found in the Global survey: 33% of the researchers working outside the EU state that they have worked in other (sub) fields during their research careers.

Table 12: Share of researchers having switched to another field or subfield during their research careers, per country

Country	Percentage	Country	Percentage
Austria	33.4%	**Latvia**	44.7%
Belgium	21.3%	**Lithuania**	49.7%
Bulgaria	60.2%	**Luxembourg**	32.9%
Croatia	41.0%	**Malta**	37.2%
Cyprus	38.8%	**Norway**	42.2%
Czech Republic	27.9%	**Poland**	28.3%
Denmark	38.1%	**Portugal**	28.7%
Estonia	33.9%	**Romania**	32.3%
Finland	42.3%	**Slovakia**	41.3%
France	29.4%	**Slovenia**	54.1%
Germany	37.5%	**Spain**	30.9%
Greece	42.5%	**Sweden**	39.1%
Hungary	44.0%	**Switzerland**	33.9%
Iceland	26.2%	**The Netherlands**	40.1%
Ireland	36.2%	**United Kingdom**	37.1%
Italy	17.5%	**EU28**	**34.3%**

Source: MORE3 EU HE survey (2016) – Table 39 in MORE3 EU HE report
Notes:
- Based on question 14: "Did you switch to another (sub)field of research during your academic career?"
- (n=10,394)

11.1.2. Interdisciplinary collaboration

Share of researchers who have collaborated with or worked in more than one field in their current position *Of all researchers (n=9,412)*				
	EU28 total	**Per career stage**	**Per FOS**	**Per gender**
2016	73.5%	R1: 66.2% R2: 73.7% R3: 73.2% R4: 77.5%	NAT: 74.4% ENG: 75.5% MED: 76.2% AGR: 84.7% SOC: 67.7% HUM: 71.6%	F: 74.0% M: 73.2%

Source: MORE3 EU HE survey (2016) - Table in section 8.2.2 in MORE3 EU HE report
Note:
- Based on question 88: "Please indicate with whom you collaborate in your research"

73.5% of researchers have collaborated with other fields: interdisciplinary mobility is strongly related to this type of collaboration. This type of collaboration is higher among those that have worked in another (sub)field: 80% versus 70% of those without interdisciplinary mobility.

The MORE3 Global survey investigated the patterns of interdisciplinary collaboration among researchers working outside Europe. There are indications that European researchers working outside Europe have lower levels of interdisciplinary collaboration than those working in Europe (60% versus 74% respectively).

Table 13 displays the shares of researchers that engage in each type of interdisciplinary collaboration in each country: with researchers in the same institute, in other institutes and in the non-academic sector. Differences across countries are relatively small when comparing the shares of researchers engaging in interdisciplinary collaboration within academia (i.e. with researchers in the same institute or in other institutes). Large differences are observed between countries when it comes to interdisciplinary research when researchers working in the non-academic sector, ranging from 17% in France to 48% in Romania. Differences are also observed between fields, with the highest shares of multidisciplinary collaboration in Agricultural Sciences (85%) and the lowest in Social Sciences and Humanities (68% and 72% respectively).

Table 13: Types of interdisciplinary collaboration per country

Country	Researchers in another discipline but within the same institute	Researchers in another discipline and working at other institutes	Researchers in another discipline and working in the non-academic sector
Austria	52.2%	57.2%	33.2%
Belgium	61.6%	45.1%	23.2%
Bulgaria	71.7%	62.1%	34.0%
Croatia	69.9%	64.5%	35.9%
Cyprus	45.5%	53.1%	24.6%
Czech Republic	65.0%	62.2%	42.9%
Denmark	66.5%	65.1%	38.0%
Estonia	58.7%	55.0%	31.3%
Finland	45.9%	59.2%	26.0%
France	67.1%	44.2%	17.2%
Germany	50.9%	46.8%	24.2%
Greece	62.6%	67.0%	38.5%
Hungary	62.3%	47.9%	31.7%
Iceland	66.1%	55.5%	30.1%
Ireland	59.8%	59.9%	40.4%
Italy	69.1%	68.9%	38.8%
Latvia	71.0%	68.7%	41.0%
Lithuania	60.6%	51.3%	26.1%
Luxembourg	62.1%	42.8%	26.2%
Malta	69.8%	58.0%	43.6%
Norway	58.2%	58.7%	19.7%
Poland	61.2%	70.8%	37.8%
Portugal	70.0%	66.5%	23.2%
Romania	81.4%	74.9%	48.1%
Slovakia	57.9%	57.8%	33.3%
Slovenia	69.3%	65.6%	37.2%
Spain	57.6%	52.7%	27.4%
Sweden	64.6%	62.8%	36.0%
Switzerland	60.7%	42.7%	19.0%
The Netherlands	62.3%	58.6%	33.0%
United Kingdom	58.3%	59.3%	35.4%
EU28	**59.7%**	**56.6%**	**30.7%**

Source: MORE3 EU HE survey (2016) - Table 49 in MORE3 EU HE report
Notes:
- Multiple collaboration types per respondent are possible.
- Darker colours reflect higher shares of researchers within each type of collaboration
- Based on question 88: "Please indicate with whom you collaborate in your research"
- (n=10,394)

11.2. EU policy aims and implications of MORE3 findings

Interdisciplinary mobility and collaboration are not explicitly mentioned in the ERA priorities. They are however referred to – and positively valued - in some of the most important research programmes at EU level, such as the ERC grants or other Horizon2020 programmes. For instance, the ERC grants focus on an investigator-driven system designed to offer more flexibility to researchers pursuing ground-breaking research areas where borders across disciplines have become increasingly blurred.

At doctoral level, the Principles of Innovative Doctoral Training also explicitly refer to "Interdisciplinary Research Options". According to this idea, doctoral training "must be embedded in an open research environment and culture to ensure that any appropriate opportunities for cross-fertilisation between disciplines can foster the necessary breadth and interdisciplinary approach".

Interdisciplinary mobility has been related to the **strengthening of certain skills** that are becoming increasingly important. Examples of these skills are those related to the capacity to effectively communicate beyond the frontiers of one's own field, to having an entrepreneurial mind-set and a greater capacity to adapt to changing environments[160]. The topic as such relates to **research excellence** in policy priorities.

WHICH LESSONS CAN BE DRAWN FROM THE MORE3 KEY FINDINGS ON INTERDISCIPLINARY MOBILITY FOR THESE POLICY AIMS?

Results from the MORE3 EU HE survey shows that 34% of the researchers working in the EU report having switched to another field of science or discipline in the past, and that the share of researchers having collaborated with researchers working in another disciplines reaches 75% (the 2012 MORE2 survey did not include a question on these dimensions). This survey also enables us to explore the difference between those researchers that have worked in projects funded by an MSCA or by an ERC grant[161] at some point during their research career and the rest of the population.

Although the figures should be taken with caution since the survey was not designed to offer representative data for these groups, some interesting patterns emerge. Those researchers that have worked in a project developed under an MSCA or an ERC grant display higher shares of interdisciplinary mobility (45% and 38% respectively) than the general population (34%). They also tend to collaborate more with researchers working in other disciplines (80% of those that have worked in a MSCA-funded project and 82% of those that have worked in the framework of an ERC grant), compared to 74% in the general population of researchers. Higher shares are found across career stages and across fields of science. Interestingly, this trend is not observed for women. Female researchers in the MSCA group[162] show a similar disposition to work with researchers from other disciplines than women in the general population of women researchers. On the opposite, their male counterparts seem to engage in this type of collaboration much more (74% of women researchers versus 83% of male researchers). The MORE3 EU HE survey was not designed to produce representative figures of the researchers having had

[160] More information on skills and training is provided in Chapter
[161] The survey did not include any questions on when these projects were carried out nor on whether the respondents were the principal investigators (in the case of ERC) or unique beneficiaries (in the case or MSCA) of the grants. On the basis of these data it is only possible to refer to those that have worked in a project funded by a MSCA or an ERC grant.
[162] This group refers to those women that have worked in projects funded by an MSCA.

these grants in the past or having worked in projects funded by these schemes. However, the differences found in the analysis suggest that further research could shed light on the effects of these grants on interdisciplinary mobility and the causes that might explain these differences.

Furthermore, interdisciplinary mobility is generally perceived as a positive factor for recruitment (74%) and for career progression (74%) – much more so than intersectoral mobility (cf. section 12). These figures indicate that researchers tend to have a positive view on this type of mobility in spite of the debates on the caveats of interdisciplinarity – e.g. the difficulties to publish articles based on interdisciplinary approaches, the limitations over the peer-review process and scientific standards[163]. Interestingly, researchers working outside Europe have a less positive opinion on the effects of this type of mobility: only 58% and 56% of the researchers think that interdisciplinary mobility has a positive effect on recruitment and on career progression respectively. This shows that in comparative terms, EU researchers tend to attribute more positive effects to this type of experience.

However, it is interesting to note that the perceptions on the effects differ depending on the experience of the researchers: the share of interdisciplinary mobile researchers that think that this type of mobility is positive for recruitment and career progression is slightly lower (71% and 70%) than among those without interdisciplinary moves (76% and 77%). The data do not allow to analyse whether these perceptions vary across disciplines, but future research should look into the drivers of this type of mobility as well as the effects thereof in order to produce more detailed evidence-based policy recommendations.

EU-LEVEL AND NATIONAL POLICY INSTRUMENTS

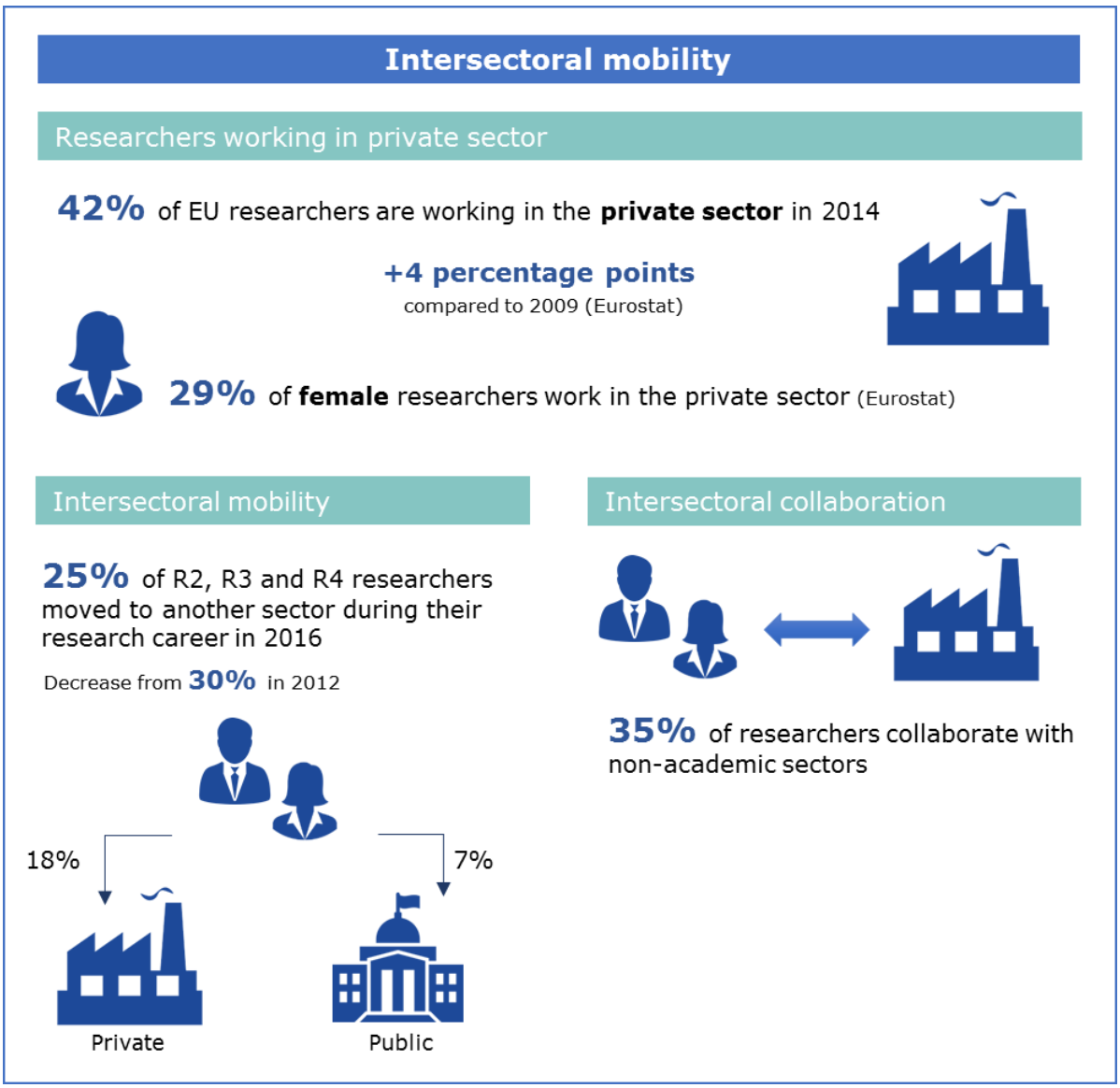
The overarching objectives defined in the Horizon2020 Framework Programme (and, previously, in the Seventh Framework Programme) explicitly address the need to foster interdisciplinary research. As such, some of the most well-known granting programmes of the European Commission for researchers include this objective. This is the case, for instance, of the grants of the European Research Council (ERC). In this context, interdisciplinary research is associated to excellent research although the ERC does not put forth a clear-cut definition of the term "interdisciplinarity". This type of mobility or collaboration is therefore not part of its objectives. Other granting instruments, such as the MSCA do not explicitly require the need for interdisciplinary research, mobility or collaboration. As mentioned above, the results of the MORE3 EU HE survey indicate that the share of researchers having been interdisciplinary mobile is higher among those that have worked in projects funded by an ERC or MSCA grant than in the general population. This type of mobility is not explicitly envisaged in the objectives of these granting schemes, but these higher shares point at the existence of some type of relationship between the grants and the mobility across disciplines that only further and more targeted research can unveil.

At the national level, Member States' National Action Plans (NAP) announce a number of measures and initiatives. The screening of these announced initiatives shows that interdisciplinarity is not referred to very often in the National Action Plans and when it does, the concept of interdisciplinary 'research' appears more often than that of interdisciplinary 'mobility'. The newly created NWO (Netherlands Organisation for

[163] Allmendinger, J. (2015). Quests for interdisciplinarity: A challenge for the ERA and HORIZON 2020. Policy Brief by the Research, Innovation, and Science Policy Experts (RISE). Directorate-General for Research and Innovation. Research, Innovation, and Science Policy Experts High Level Group.

Scientific Research) and the British 5-year £1.5Bn Global Challenges Research Fund (GCRF) aim at supporting interdisciplinary research. The latter also addresses disciplinary research and the former also focuses on multidisciplinary research. These initiatives therefore target the outcome of research and not the specific career paths and collaboration patterns of individual researchers.

12. Intersectoral mobility



Source: Based on MORE3 EU HE report (section 8.3)

Knowledge transfer, understood as the means through which research developed in universities and other research organisations is transferred to industry[164], is being increasingly important in the context of a globalised economy and knowledge society. Closing the gap between academia and the business sector is often perceived as one of the ways to address the grand societal challenges, as well as to guarantee the future competitiveness and growth of European economies. It is often claimed that the EU is not exploiting to the maximum the potential of the research carried out in its universities and research organisations[165]. Fostering knowledge transfer and the market uptake and

exploitation of research results is seen as a key element of this approach. Intersectoral mobility, understood as the mobility of researchers from academia to industry (and vice versa), is an important mechanisms to promote knowledge transfer. Other important channels are graduates working in industry, collaborative R&D projects as well as (informal) consulting.

12.1. Key findings

12.1.1. Intersectoral mobility

Of all R2, R3 and R4 researchers					
	EU total	**Per (current) career stage**	**Per FOS**	**Per gender**	**Per destination sector**
2012 (n=7,131)	30.0%	R2: 27.3% R3: 28.9% R4: 33.3%	NAT: 28.6% ENG: 34.0% MED: 26.6% AGR: 44.9% SOC: 33.0% HUM: 26.3%	F: 28.1% M: 31.0%	Public sector:15.5% Private sector: 17.8%[166]
2016 (n=8,073)	24.8%	R2: 22.1% R3: 24.5% R4: 26.7%	NAT: 22.8% ENG: 29.9% MED: 18.5% AGR: 33.2% SOC: 29.6% HUM:19.4%	F: 23.5% M: 25.4%	Public sector:12.7% Private sector: 15.7%

Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) – Table in section 8.3.1 in MORE3 EU HE report

Note:

- Based on question 88: "Have you ever worked as a researcher (excluding PhD) in the non-university/higher education sector (e.g. companies, NGOs, charities, non-university research institutes, governmental bodies/agencies)?"

STOCK OF RESEARCHERS WORKING IN THE PRIVATE SECTOR

Based on Eurostat data[167], the MORE3 Indicator report on researchers outlined that four out of ten EU researchers work in the private sector in 2014 (not including not-for-profit organisations). However, the balance between these two differs considerably across EU countries: the share of private sector researchers peaked with 67% in Sweden while it was the lowest in Croatia with 15%. Austria, Denmark, France, Malta, the Netherlands and Ireland show shares above 60% in 2014 and already had these high shares in 2009. On the other side of the spectrum, the EU Member States with the lowest shares are Croatia, Greece and Slovakia, with less than 20% of researchers in the private sector.

By comparing the shares in 2009 and 2014 as well as the annual average growth rates, one can observe large increases in several Eastern Member States such as Latvia (from 9% to 21%), Lithuania (from 13% to 23%), Bulgaria (from 14% to 27%), or Poland (from 16% to 32%), achieving two-digit growth rates.

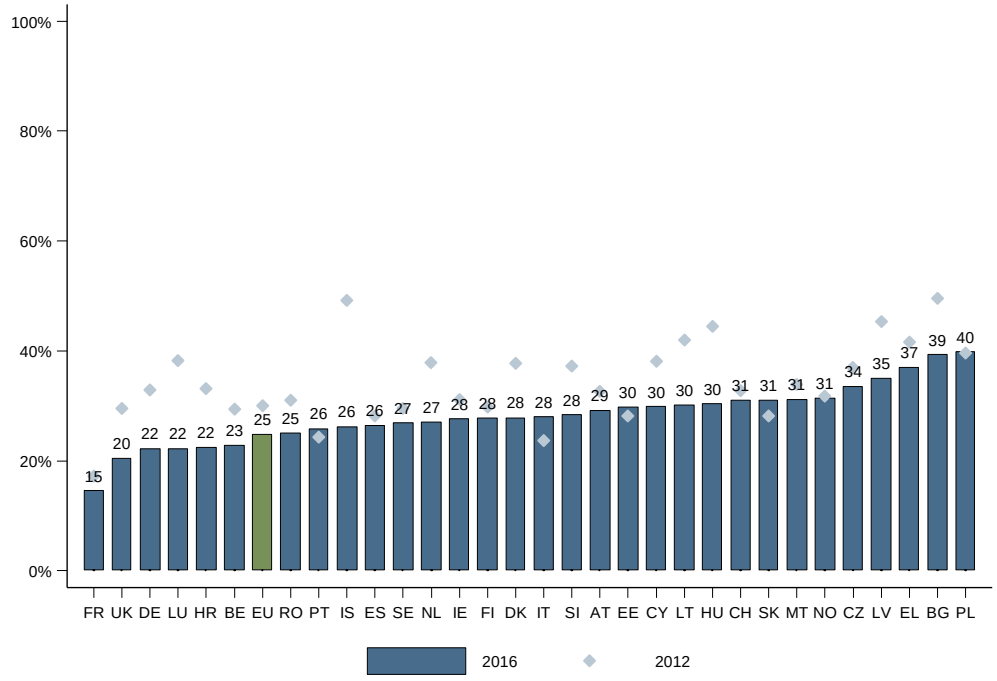
[166] The share of private sector mobility includes the private not-for-profit sector.
[167] Based on Eurostat, Total R&D personnel (researchers) by sectors of performance, occupation and sex (rd_p_persocc). Cf. indicator 1.6 in the MORE3 Indicator report on researchers.

In terms of gender, about one third (29%) of the researchers in the private sector are female. This share is constant in the period 2012-2013. In 2013, countries where at least 50% of the female researchers are employed in the private sector are Ireland (50%), Malta (57%), and Sweden (54%). Shares below 20% can be found in Bulgaria (19%), Croatia (13%), Cyprus (18%), Greece (10%), Latvia and Lithuania (both 14%), Luxembourg (16%), Poland and Portugal (both 17%) and Slovakia (8%).

STOCK OF RESEARCHERS WORKING IN HEI HAVING WORKED IN OTHER SECTORS

Later career stage researchers are more inclined to take a position in government organisations, whereas R2 researchers tend to move to private industry and in particular to SMEs and start-ups. R3 researchers are more likely to move to the not-for-profit sector.

Figure 21: Evolution of intersectoral mobility (2012-2016)



Source: MORE3 EU HE survey (2016) and MORE2 EU HE survey (2012) - Figure 131 in MORE3 EU HE report

Notes:
- Only for R2, R3 and R4 researchers.
- Based on question 89: "Please indicate in which sector(s) you have worked that were not a university or higher education setting"
- (n=8,073)

For researchers currently working outside the EU, the overall result – 22% - is similar to that found in the EU (25%), but there are differences across countries: the shares range between 31% in South Africa to 11% in the US[168].

[168] In the US, the shares of intersectoral mobility differ substantially across fields, with higher-than-average shares in Engineering and Technology (31% vs 21% in the overall sample) but lower-than-average shares

MOTIVES

Networking is still the most important motive for working outside academia, regardless of the destination sector (70% of the cases). Other motives depend more on the destination sector e.g. contribution to society is more common as a motive to move to government and not-for-profit sectors, whereas gaining first-hand experience of industry, remuneration and bringing research to the market are more common in moves to the private industry.

Motives for moving to private industry also depend on the family situation: researchers with a family seek more security in terms of pension plan, quality of life, positions etc. However, researchers without a family are on average driven by career-related aspects such as increasing their employability, remuneration, access to research equipment and infrastructures, etc.

Table 14: Three most frequently cited motives for intersectoral mobility per destination sector (EU28)

Top three motives for intersectoral mobility per current sector of employment ***Only R2, R3, R4 researchers who have undertaken an intersectoral move in the last ten years***	
Public sector or government organisation	Network (73.1%) Contribution to society (72.6%) Career progression (64.3%)
Private, not for profit sector	Contribution to society (71.9%) Network (71.7%) Research autonomy (69.9%)
Private sector: large companies	Gaining first-hand experience of industry (72%) Remuneration (66.3%) Career progression (64.5%)
Private sector: SMEs and start-ups	Gaining first-hand experience of industry (77.71%) Network (73%) Bringing research to the market (59.7%)

Source: MORE3 EU HE survey (2016) – Table 42 in MORE3 EU HE report
Note:
- Based on question 99: "Which of the following factors were important in your decision to undertake this move?"
- (n=1,333)

EFFECTS ON RECRUITMENT AND CAREER PROGRESSION

Six out of ten researchers consider that intersectoral mobility is positive for recruitment or for career progression. Having been intersectorally mobile does not imply a more positive view on the effect of this type of mobility on these aspects: only those having worked in a large company perceive it more positively than average (65%). Less positive results are found among researchers working outside Europe: only 29% of these researchers see this type of mobility as positive for recruitment and 37% for career progression.

in the other fields, in particular in Natural Sciences: US-based researchers working in this discipline display much lower shares of intersectoral mobility than the general population of researchers working outside Europe: 6% vs 16% respectively. The results are to be interpreted with care however, the Global survey was not designed to provide representative data at country level.

12.1.2. Intersectoral collaboration

Intersectoral collaboration[169] *All respondents (n=9,412)*	EU total	Per (current) career stage	Per FOS	Per gender
Academic	80.2%	R1: 66.8% R2: 71.3% R3: 81.2% R4: 91.0%	NAT: 85.9% ENG: 80.8% MED: 73.9% AGR: 80.0% SOC: 79.5% HUM: 81.0%	F: 78.6% M: 81.2%
Non-academic	35.5%	R1: 24.6% R2: 25.6% R3: 35.3% R4: 47.3%	NAT: 41.0% ENG: 44.5% MED: 34.5% AGR: 43.0% SOC: 29.2% HUM: 26.4%	F: 30.5% M: 38.7%

Source: MORE3 EU HE survey (2016) – Table in Section 8.3.2 in MORE3 EU HE report
Note:
- Based on question 84: "Please indicate with whom you collaborate in your research (e.g., joint projects, joint papers, etc.)"

35% of researchers working in HEI collaborate with researchers in non-academic sectors. It is more common in later career stages (47% in R4), for male researchers (39%) and less common in SSH fields (26% in Humanities and 29% in Social Sciences). Female researchers are thus less inclined to non-academic collaboration (31% versus 39%), this difference is larger than for the academic collaboration (79% versus 81%).

The survey included questions on the extent to which intersectoral collaboration was the result of a previous mobility experience. Intersectoral mobility has a small but still positive effect on intersectoral collaboration: the effect is larger for academic collaboration than for non-academic collaboration.

12.2. EU policy aims and implications of MORE3 findings

The ERA Priority 5 – Optimal circulation and transfer of scientific knowledge – explicitly recognises the mobility of researchers between the private and the public sectors as one of the most efficient ways to achieve this aim. Together with the professionalisation of intellectual property management, the fostering of collaborative research between HEIs and private research organisations, and the training of students in entrepreneurship and corporate culture, intersectoral mobility would entail positive consequences for society, researchers and the institutions that employ them.

- First, this type of mobility is meant to foster the match between research results and market needs, hence increasing the **application potential** of (publicly) funded research.
- Second, it helps researchers acquire a **broader set of skills** – entrepreneurship, management of IPR, etc. - that can allow them to be better equipped to the challenges of the current and future labour market.

[169] The MORE2 EU HE survey (2012) included a similar question on collaboration, but with less categories of collaboration partners. The data are not sufficiently comparable to include the MORE2 results as comparison basis here.

- Third, the companies and institutions that employ intersectoral researchers can benefit from the **access to new collaborations and knowledge** that can help them be more efficient and innovative.

As such, intersectoral mobility is one of the key elements of the ERA and it is included in a series of policy relevant documents, such as the Council Conclusions of the 24/12/14, the Study on the Open, Transparent and Merit Based Recruitment of Researchers and the Report prepared for the 2014 ERAC Mutual Learning Workshop.

WHICH LESSONS CAN BE DRAWN FROM THE MORE3 KEY FINDINGS ON INTERSECTORAL MOBILITY FOR THESE POLICY AIMS?

This brief overview of the role of intersectoral mobility in EU policy shows that attention to this topic has increased in recent years. Data collected in the framework of the MORE2 and the MORE3 projects provide a good opportunity to shed light on the evolution of the situation across EU countries over time. Note that section 5 on PhD training and section 6 on careers have also looked intersectoral mobility from their specific angles (integrating intersectoral mobility into PhD training and diversifying research careers through intersectoral mobility).

One observation from the MORE3 Indicator report on researchers is that, in comparative terms, the EU lags behind the US and Japan with respect to the number of researchers employed in the private sector[170] and the employment of doctorate holders in the business sector remains low in comparison with these economies[171]. Four out of ten researchers in the EU are currently working in the private sector, significantly lower compared to 69% in the US and 73% in Japan. Eurostat data[172] indicate a growth of 4pp, which is considerable given the overall growth rates of researcher stock. Yet, this type of indicator is not expected to fluctuate or evolve strongly and will need to be monitored in the longer run to see the effect of policy actions since 2000-2010. It is important to note that there are large country differences that relate to the economic structure and research intensity of the different Member States. Policy initiatives for attractive career paths in industry research settings will thus need to take this diversity in the national contexts into account and allow for sufficiently flexible approaches.

The MORE3 EU HE results show that, in general terms, there has been a decrease of the share of researchers that have had a previous intersectoral experience: the share has dropped from 30% in 2012 to 25% in 2016. However, it is important to note that at EU level this decrease is mainly due to a decrease of moves towards the public sector, indicating that this is the sector where the interest to hire researchers has decreased the most. This can be partially explained by the context of budgetary cuts in the public sector that have affected a number of EU countries in the last years. Across countries, the decrease has been more acute: Iceland, Hungary or Luxembourg stand out as the countries where intersectoral mobility has witnessed the strongest decline. As in the MORE2 study, the shares of intersectorally mobile researchers reach the lowest levels in large and affluent EU countries, such as Germany, the UK and France.

The MORE3 data also provides interesting insights into the reasons why these figures remain relatively low. First, there is an apparent paradox: on the one hand, researchers

[170] Vandevelde, K (2014) Intersectoral mobility. Report from the 2014 ERAC mutual learning workshop on Human Resources and Mobility.
[171] OECD (2010), Careers of Doctorate Holders dataset. www.oecd.org/sti/cdh.
[172] Based on Eurostat, Total R&D personnel (researchers) by sectors of performance, occupation and sex (rd_p_persocc). Cf. indicator 1.6 in the MORE3 Indicator report on researchers.

working in the higher education sector tend to perceive that the working conditions outside academia are better than those found in academia and this perception is even stronger among those that currently also have a position in the private sector. This affects all the factors included in the MORE3 survey except for research autonomy. On the other hand, the share of researchers having worked in another sector remains rather low (this is expected though from the fact that the survey targets only researchers that currently work in HEI). The analysis of the data point outlines several reasons behind this paradox:

- Incentives to work outside academia differ from the incentives to work in academia. Intersectoral mobility is considered as a positive factor for recruitment and for career progression by six out of ten researchers that currently work in HEI, but those with this type of experience do not value it more than those without it. Researchers in HEI have on average much more positive views on the effects on their career progression of other types of mobility, such as international or interdisciplinary mobility (85% and 74% respectively). The promotion of incentives to valorise intersectoral moves in recruitment processes and career progression would probably make this type of move more attractive for researchers. Along similar lines, it has been pointed out that the efforts made to facilitate the return to academia after an experience in the private sector have been limited in most EU countries[173]
- Trainings on skills that could be valorised the most in an intersectoral move towards the private sector are still rather exceptional. The shares of R1 and R2 researchers having received trainings on entrepreneurship, intellectual property rights or negotiation during PhD are smaller than those having received training on the typical research-based skills (research skills, thinking, and even communication skills) (cf. section 5).
- Aligning future policy developments aiming at fostering intersectoral mobility with researchers´ motivations (cf. Table 14 above) and providing incentives for this type of mobility to be more valued in academic career paths might help to close the gap between industry and academia.

EU-LEVEL AND NATIONAL POLICY INSTRUMENTS

The Horizon2020 Framework Programme has several objectives related to intersectoral mobility and collaboration along similar lines to those put forth in the Seventh Framework Programme. Several objectives can be cited in relation to these topics, such as the promotion of interdisciplinary and cross-sectoral research and innovation; of international networks for excellent researchers and innovators; and the aim of facilitating cross-border and cross-sector mobility of researchers[174].

Intersectoral collaboration, and to a lesser extent intersectoral mobility, are therefore at the basis of many Horizon2020 granting schemes together with excellent research and international and interdisciplinary research and mobility. Several EU instruments explicitly promote intersectoral mobility and collaboration. Regarding the former, the Marie Skłodowska-Curie Actions (MSCA) stand out as one of the instruments that puts a greater emphasis on this type of mobility. In the European Commission's words, it aims at providing "*excellent and innovative research training as well as attractive career and*

[173] Vandevelde, K (2014) Intersectoral mobility. Report from the 2014 ERAC mutual learning workshop on Human Resources and Mobility.
[174] These are included in Article 14 of the Regulation No 1291/2013.

knowledge-exchange opportunities through cross-border and cross-sector mobility of researchers to best prepare them to face current and future societal challenges"[175].

Forms of industry professorships and the MSCA Research and Innovation Staff Exchange (RISE) (previously IAPP or Industry-Academia Pathways and Partnerships) are examples of this. The RISE programme supports short-term mobility of research and innovation staff at all career levels, from the most junior (post-graduate) to the most senior (management). They are based on flexible inter-sector (within Europe) and international (with third countries) exchanges of highly skilled research and innovation staff. Interviews carried out in the framework of a study on the impact of business participation in MSCA on researchers´ careers and job creation showed that the programme had very positive effects on the beneficiaries through the acquisition of new knowledge and industry-relevant skills[176]. This study also showed other positive outcomes, such as the considerable effect at the level of the participating business: around 45% of them indicated that at least one FTE job was created as a result of the participation in the programme. The recommendations included in that study pointed out the need to enhance the job-creation effect of the programme by funding the researchers´ salaries of the seconded staff and the experienced researchers.

Previous studies have interestingly pointed out that, in spite of the existence of this priority in the definition of the programmes, it has not been translated into practical results: a study carried out in 2012 showed how nearly all MSCA researchers worked in a HE institution before receiving the grant and that most grants are awarded to work in HE institutions[177]. While the MORE3 EU HE survey does not allow us to establish causal links, it sheds light on the extent to which researchers that have been granted an MSCA – or worked in a project funded by an MSCA – in the past present higher shares of intersectoral mobility than the overall population of researchers. The survey was not designed to obtain representative figures for this group, but it can be noted that 30% of the researchers having worked in MSCA-funded projects have been intersectorally mobile (compared to 25% in the general population of researchers), and 23% have previously worked in the private sector (compared to 18% in the general population of researchers).

The MORE3 EU HE survey offers different insights into the grants provided by the European Research Council (ERC). The ERC´s main objectives are focused on fostering excellent research in Europe through a bottom-up approach. Intersectoral mobility is not an explicit objective of these grants. However, the highest shares of this type of mobility are found in the ERC group (36%). Similar findings are found when looking into the types of sectors in which this intersectoral experience has taken place: researchers in the ERC group are more likely to have worked in the private sector (26%).

At the national level, Member States' National Action Plans (NAP) announce a number of measures and initiatives. Screening through these announced initiatives shows that also policies at national level address the above mentioned points. Without aiming to be exhaustive, and without any further information on the effectiveness of the measure, we list a number of examples that many countries have developed initiatives fostering knowledge transfer through various mechanisms, such as fostering management and marketing skills, developing new intellectual property rights frameworks, or supporting

[175] https://ec.europa.eu/programmes/horizon2020/en/h2020-section/excellent-science
[176] PPMI Group et al (2017). Study of business participation and entrepreneurship in Marie Skłodowska-Curie actions (FP7 and Horizon 2020). Final report. Directorate-General for Education, Youth, Sport and Culture. European Commission.
[177] (2012). Ecorys. FP7 Marie Curie Life-long Training and Career Development Evaluation: Individual Fellowships and Co-funding Mechanism. Final Report. European Commission.

innovative ecosystems or the access to research and demonstration facilities. Intersectoral mobility between industry and academia receives less attention.

Ireland stands out for being the country with a more fully-fledged initiative to promote intersectoral mobility. Action 3.12 of the Innovation 2020 programme aims at supporting the bilateral flow of researchers between academia and industry, increasing the share of researchers moving to industry from 25% to 35% by 2020 and developing a tracking system of researcher mobility into industry[178]. Another interesting initiative is the Business Interaction Vouchers in the UK, which offers financial support for researchers to carry out work within a business organisation for a short period (usually between 2-3 months). The attractiveness of this scheme lies on the simplicity of the application process and the short delays[179].

A report developed by the Joint Research Centre (JRC) of the European Commission[180] noted that most initiatives at country level have only recently been launched and that as a consequence there is little evidence available on their effect. According to this report, the most frequent intersectoral mobility policies in the Member States are:

- Increasing the funding and the regulatory support for Industrial PhDs and industrial traineeships;
- Fostering post-doctoral researcher placements in industry (Industrial Post-Docs and other similar measures); and
- Supporting the creation of spin-offs.

This overview reveals that little attention is being paid to fostering key incentives, such as the recognition of intersectoral mobility as a valuable experience both in industry and in academia. On the one hand, having a PhD degree or academic experience is not equally recognised in the private sector across EU countries. Furthermore, working in the private sector is usually not valued for career progression in academic institutions. A recent survey on intersectoral mobility carried out by Science Europe among research funding organisations found that 25 out of the 30 organisations that participated in the survey had some type of initiative aiming at fostering this type of mobility. However, intersectoral mobility was a strategic priority for only nine organisations[181]. The relatively poor attention to this type of mobility can be, at least, partially explained by the fact that the effects of intersectoral mobility are difficult to measure and that it is often perceived as only having "intangible effects"[182], such as knowledge transfer. The results of that study go along the lines of the MORE3 findings: intersectoral mobility is not being widely recognised in the evaluation performance of researchers. This hinders researchers´ incentives to engage in this type of career move.

[178] Source: Ireland National Action Plan.
[179] More information available at the Biotechnology and Biological Sciences Research Council´s (BBSRC) website: https://www.bbsrc.ac.uk/
[180] Hristov, H., Slavcheva, M., Jonkers, K., & Szkuta, K. (2016). Intersectoral mobility and knowledge transfer. Preliminary evidence of the impact of intersectoral mobility policy instruments. JRC Science for Policy Report, (28027).
[181] Five organisations from the United Kingdom, two from Ireland, one from Luxembourg, and one from Portugal.
[182] https://www.scienceeurope.org/wp-content/uploads/2017/01/SE_Intersec-Mobility_Survey_Report.pdf.

13. Attractiveness of the European Research Area

When knowledge is the principal factor behind competitive advantage, leading to increasing competition for talented knowledge workers, the attractiveness of research areas is crucial for sustainable and dynamic knowledge economies. Research based on MORE2 data[183] and the findings of MORE3 provide a clear picture of what drives attractiveness among researchers in academia, as illustrated in our conceptual framework in section 3. Attractiveness is driven by research job characteristics influencing a researcher's scientific productivity, such as research autonomy, career perspectives and working with high quality peers. "Material" working conditions related to remuneration, pensions and job security and other non-science related conditions influence job choice ceteris paribus, but are not decisive factors for job or mobility decisions.

Career perspectives are cross-cutting working conditions, as they influence both financial conditions and scientific knowledge production and by this have an impact on setting time horizons for long-term research agendas. Long-term research agendas are more conducive to fundamental breakthroughs than research agendas limited by fixed-term contracts. Career perspectives are particularly important to early stage researchers, for whom a performance-based model ("tenure-track" versus a seniority-based model) can make a substantial difference to their careers.

As our conceptual framework in section 3 has made clear, attractiveness of postgraduate research jobs is hence a result of the structure of recruitment, career paths and the quality of working conditions (analysed in sections 6 and 7). The attractiveness of research areas is also determined by the attractiveness of PhD studies. International or intersectoral mobility may be driven by perceptions of varying attractiveness. In turn, mobility indicators, e.g. in terms of which countries researchers choose for their international mobility experience, can also be interpreted as indicators of attractiveness, and mobility perspectives influence working conditions as they enable international collaboration, a driver of scientific productivity.

This section presents MORE3 results of survey questions asking EU and non-EU researchers to directly compare the EU with non-EU research systems on a number of such determinants of attractiveness, more precisely in terms of working conditions for research, material working conditions and cross-cutting working conditions, as well as in terms of a range of additional characteristics such as ease of industry collaboration.

13.1. Key findings

Overall, whether researchers appreciate the non-EU research system as being either better or worse than the EU system regarding various aspects depends heavily on their experience, i.e. which system they know. Four groups of researchers who have knowledge of at least one EU and non-EU system were asked to compare the systems:

- EU researchers who have been mobile to a non-EU country in the past, differentiated by country of mobility – associated EU, non-EU OECD, BRICS and other emerging countries (MORE3 EU HE survey; top right panel of Figure 22);

[183] Janger, J., Strauss, A., Campbell, D., (2013) Academic careers: a cross-country perspective, WWWforEurope; Janger, J., Nowotny, K., "Job choice in academia". *Research Policy* 45, Nr. 8 (Oktober 2016): 1672–83. doi:10.1016/j.respol.2016.05.001.

- EU researchers who currently work abroad, differentiated by country of employment – USA, non-EU OECD, BRICS and other emerging countries (MORE3 Global survey; top left panel of Figure 22);
- Non-EU researchers who currently work in the EU, differentiated by citizenship – associated EU, non-EU OECD, BRICS and other emerging countries (MORE3 EU HE survey; bottom left panel of Figure 22);
- Non-EU Researchers who have been mobile to the EU in the past, differentiated by country of employment - non-EU OECD, BRICS and other emerging countries (MORE3 Global survey; bottom right panel of Figure 22).

Figure 22 contrasts the share of respondents assessing the EU research system as more attractive against the share of researchers who assess it as less attractive. The graph contains net shares (i.e. share of "better in the EU" minus share of "worse in the EU", in percentage points), and the line where better and worse are equally balanced, taking the value 0, is shown explicitly as the line "EU = outside EU". This implies that lines within or below the line at the value 0 indicate "EU = worse" (taking negative values), and lines outside or above indicate "EU = better" (taking positive values). Note that these results include information from both the MORE3 Global survey (researchers currently outside the EU) and the MORE3 EU HE survey (researchers currently inside the EU). These surveys followed different sampling strategies, so that the results should be interpreted with care (cf. section 1.3). The panels summarise more detailed categories:

- **Remuneration and other material factors** includes remuneration, social security and other benefits, quality of life, job security, and pension plan;
- **Conditions for scientific knowledge production** includes availability of research funding, access to research facilities and equipment, working with leading scientists, research autonomy, administrative burden, and balance between teaching and research time;
- **Engagement with industry** includes ease of commercialisation of research results, and ease of industry collaboration.

Non-summarised categories are:

- Mobility perspectives;
- Attractive career paths;
- Availability of suitable positions;
- Quality of education and training.

In case of the non-EU researchers mobile to the EU in the past (bottom right panel), an additional item was added:

- Political situation.

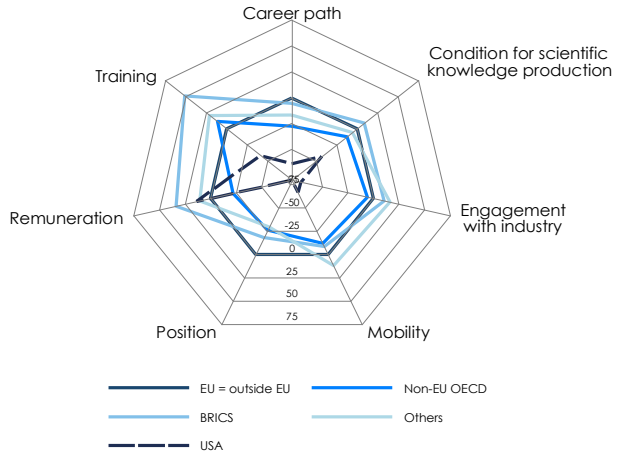
The main insights are that:

- The more advanced the non-EU research system researchers are coming from or in which researchers have worked, the less positive the EU is seen as a place to do research;
- The EU's strong points are perceived within elements of the group **remuneration**, such as social security, job security, quality of life (vs. the US, but not overall) and pension plan (less so for salaries) and of the group **education and training**; the weak points are perceived particularly with regard to **attractive career paths**, and to a certain extent also with regard to the **availability of suitable positions.** The other categories follow the pattern of the first insight, in that e.g. researchers from non-EU OECD countries, including the US, tend to find conditions of knowledge production worse in the EU relative to researchers from emerging countries.

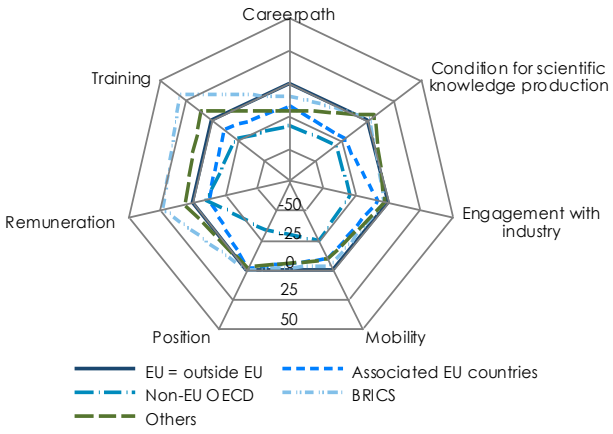
- The non-EU researchers who have been mobile to the EU in the past (lower panel, right) generally see the EU as better across the board than their current countries of employment. This group mainly came to the EU for chosen exchange mobility (cf. section 9 on mobility). The three other groups on balance rate conditions inside the EU as worse than outside, with the exception of researchers from less developed research systems (BRICS and other emerging countries).
- Within the group of EU researchers currently abroad (upper panel, left), researchers in the US perceive the US as a much better place to do research, with the exception of social and job security as well as quality of life. Among conditions for scientific knowledge production, there are very few researchers who think that working with leading scientists, research funding and career paths are better in the EU than in the US. The ease of commercialisation of research results or collaboration with industry is also perceived to be better in the US than in the EU, similar to the availability of research positions more generally.
- EU researchers currently working abroad in other OECD countries show generally the same pattern as EU researchers who have been mobile to these countries in the past (upper right panel), but are more positive, e.g. with respect to the quality of education and training.
- Within the group of non-EU researchers currently working in the EU (lower panel, left), researchers from associated EU-countries – Iceland, Norway and Switzerland – perceive the EU on balance much worse than their countries of citizenship. This is in line with university rankings and research performance indicators, where the US and Switzerland as one of the three EU Associated Countries regularly get top spots.
- Within the EU, there is strong heterogeneity. Researchers who have been mobile outside the EU and who are now working in Eastern and Southern Europe find it relatively more attractive to work outside the EU than inside than researchers from Western and Northern Europe. This indirectly reflects on the attractiveness of their current countries of employment.

Figure 22: Comparison between working outside the EU and working inside the EU as a researcher (Task 1)

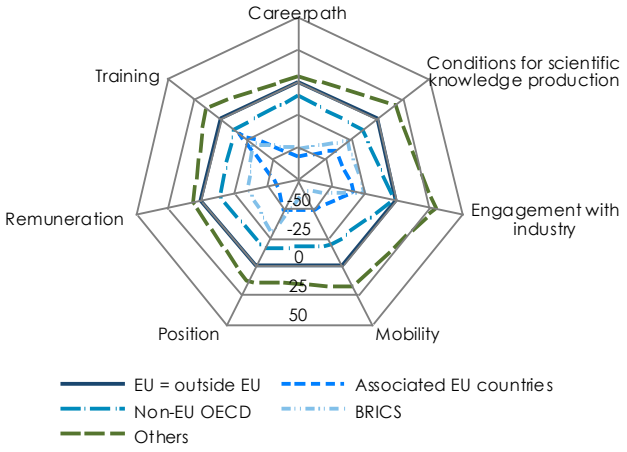
EU researchers currently outside EU



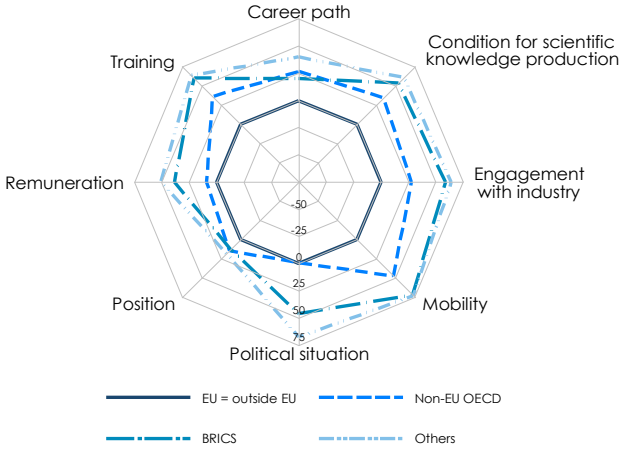
EU researchers currently in EU and in the past mobile to non-EU



Non-EU researchers currently in EU



Non-EU researchers currently outside EU and in the past mobile to EU



Source: MORE3 EU HE Survey (2016) – top right and bottom left panel
Notes:

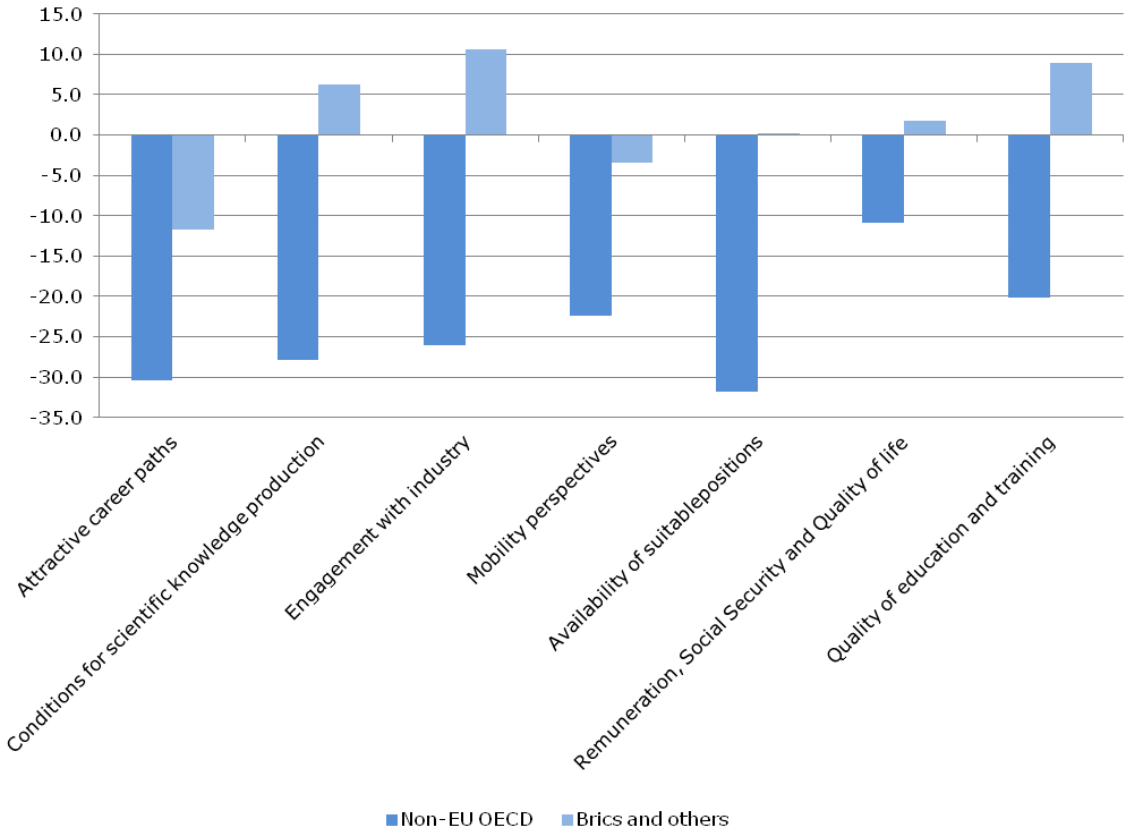
- Non-EU researchers working in the EU are grouped by country of citizenship, EU researchers with mobility experience by their mobility destination country.
- Working conditions are bundled together; for a full picture, see annex 5.
- Based on question 47: "How does working as a researcher outside the EU compare to inside the EU? Please indicate if something was worse, similar or better outside the EU than in the EU." and question 76: "How does working as a researcher outside the EU compare to inside the EU? Please indicate if something was worse, similar or better than in the EU."
- (bottom left panel: n=339, top right panel: n=805)

Source: MORE3 Global survey (2017) – top left and bottom right panel
Notes:

- EU researchers who work abroad (TG1) and non-EU researchers who worked in the EU in the past (TG2) are each grouped by their current country of employment.
- Based on question 50: "How does working in … compare to working as a researcher in Europe? Please indicate if something is worse, similar or better in … than in Europe." and question 60: "How does working as a researcher in Europe compare to your current employment in …? Please indicate if something is worse, similar or better in Europe than in ..."
- (top graph/left half of the table: n=415, bottom graph/right half of the table: n=261)

Figure 23 summarises Figure 22 by aggregating the four researcher groups based on the number of respondents and by forming two groups, researchers working in or with mobility experience in non-EU OECD countries and researchers working in or with mobility experience in the BRICS or other emerging countries. The figure should be interpreted with caution as it aggregates different groups of researchers from different surveys. However the aggregate picture illustrates clearly the observed difference in the perception of the attractiveness of the EU between researchers with experience in stronger research systems and researchers with experience in research systems of economically less developed countries.

Figure 23: Balance of researchers perceiving the EU as better or worse than other research areas



Source: MORE3 EU HE Survey (2016) and MORE3 Global survey (2017)
Notes:
Working conditions are bundled together; for a full picture, see

Table 23: Comparison between working outside the EU and working inside the EU as a researcher: full set of data of the figures above

	EU researchers abroad				Non-EU researchers mobile to the EU		
	USA	Non-EU OECD	BRICS	Others	Non-EU OECD	BRICS	Others
Career path	-63.6	-27.2	-5.4	-16.7	26.7	20.0	40.0
Condition for scientific knowledge production	-42.9	-12.1	8.8	-5.6	34.5	53.8	60.9
Administrative burden	-26.2	6.1	16.7	-12.0	37.6	38.0	54.5
Autonomy	-50.0	-29.2	-18.4	-12.5	13.2	29.3	24.3
Facilities	-55.1	-16.3	15.4	17.4	33.6	63.8	78.4
Working with leading scientists	-66.7	4.9	52.6	29.2	52.1	83.9	84.2
Research funding	-51.2	-19.6	-10.8	-20.8	41.5	54.9	72.2
Teaching	-8.1	-18.6	-2.9	-34.8	28.8	53.1	51.5
Engagement with industry	-70.6	-5.5	10.5	16.3	27.9	59.0	64.2
Commercialisation of results	-71.4	-4.3	21.1	21.4	20.6	56.1	59.3
Industry	-69.8	-6.7	0.0	11.1	35.2	61.9	69.2
Mobility	-66.3	-11.6	-8.6	12.0	47.3	72.0	72.7
Position	-79.5	-26.0	-17.9	-29.2	14.4	12.8	18.2
Remuneration	13.9	-22.2	33.8	10.7	9.0	38.4	50.9
Remuneration	-64.8	-47.4	28.2	-40.0	3.9	57.4	54.8
Social security	57.8	-2.5	51.4	28.0	16.7	33.3	51.7
Pension	48.2	4.9	65.7	64.0	6.8	23.7	44.0
Job security	11.6	-12.7	8.3	21.7	-2.1	14.6	39.3
Quality of life	16.7	-53.4	15.4	-20.0	19.9	63.0	64.9
Training	-41.2	11.4	51.4	20.8	36.2	60.4	63.9
Political situation	-	-	-	-	-0.8	45.8	67.7

Source: MORE3 Global survey (2017)
Notes:
- See Figures 30 and 31
- Negative numbers indicate higher share of researchers who think that it is better outside the EU than inside.

- Figure 32 and **Error! Reference source not found.** in annex 5.
- Based on weighted averages of the questions 47 and 76 of the EU survey, and on questions 50 and 60 of the Global survey (see Figure 22 above); n=1820.
- Negative values indicate that working inside the EU is perceived as worse than outside the EU.

13.2. EU policy aims and implications of MORE3 findings

As the preceding sections have shown, determinants of attractiveness are mostly linked to factors which influence the scientific productivity of researchers. Aiming for higher research quality or excellence is hence tantamount to fostering attractiveness in general. Higher research quality encompasses many of the EU policy goals as stated in the recent communication on strengthening European identity through education and culture, the communication on ERA, the council conclusions on young researchers, innovation union, etc. and as illustrated in the preceding sections:

- Improved doctoral training, e.g. as envisaged by the IDTP (Innovative Doctoral Training Principles);
- Improved recruitment procedures and career paths;
- Improved working conditions;
- Improved perspectives for international and interdisciplinary mobility;
- Work towards European Universities, which are enabled to network and cooperate seamlessly across borders and compete internationally;
- Reducing intra-EU variation in research performance: reducing the wide regional variation in research and innovation performance – through convergence of the weaker systems - is a key aim of ERA.

WHICH LESSONS CAN BE DRAWN FROM THE MORE3 KEY FINDINGS ON ATTRACTIVENESS FOR THESE POLICY AIMS?

In a nutshell, key career-related job characteristics or characteristics influencing researchers' productivity are perceived to be better on balance in a number of economically advanced countries with strong research systems, than in the EU. The EU is seen to be better concerning quality of life and job/social security. International evidence[184] and the MORE surveys show that career-related aspects are decisive factors for researchers to move away from their home country (e.g. independence, working with leading scientists and attractive career paths), while they move back rather for personal or family reasons. Barriers to mobility are related to research and mobility funding, the availability of positions and issues such as portability of pensions. This is further confirmed in the analysis of motives to move in the MORE3 surveys (cf. section 9).

This general finding means that the current advantages of the EU in terms of quality of life and job characteristics related to social and job security work less as drivers of attractiveness, or as attractors of researchers, than characteristics which influence the scientific productivity of researchers and where the advantages of the EU are less clear cut, again depending on the strength of the research system the EU is compared with. Put differently: all other things being equal, quality of life and social security will play a role, but the conditions for scientific knowledge production need to be attractive first. The survey results therefore show a clear opportunity for the EU to strengthen its attractiveness as a place to do research through improving conditions for scientific knowledge production.

EU-LEVEL AND NATIONAL POLICY INSTRUMENTS

Attractiveness is a cross-cutting area where the policy implications of the preceding sections come together. Improving the attractiveness of the EU as a destination for researchers hinges on many factors. The analyses in the previous sections have not only shown us the general picture of how attractive different areas are as research areas, but also which factors are decisive in determining this attractiveness, and which are enablers rather than drivers. Working conditions for research, or for scientific knowledge production, are drivers of attractiveness and of international mobility. When they are perceived to be attractive, they contribute to researchers choosing the EU as a location for their research because it will foster their career and advance their research agenda. Among these are attractive career paths (a tenure track model), career perspectives and working with leading scientists. Important enabling framework conditions – or barriers to coming to the EU - are immigration options (rules relating to non-EU nationals working in

[184] Franzoni, C., Scellato, G., & Stephan, P. (2012). Foreign-born scientists: mobility patterns for 16 countries. Nature Biotechnology, 30(12), 1250-1253.

the EU), the general availability of jobs as well as getting funding for research. The latter is a working condition relevant for scientific productivity, but generally is not the main motive for mobility as outlined in section 9. Measures boosting research by firms, such as related to access to finance, entrepreneurship and wider regulations influencing innovation will also create positive feedback loops with reforms in higher education, as the perception of attractiveness will increase generally and more attractive outside options are available for academic researchers.

Many policies at the EU, national and regional level address the factors that are potentially relevant for attractiveness. We will provide such cross-cutting discussion in section 14. In this section, we focus more specifically on two EU-level policy instruments, Euraxess and EU research funding instruments – regarding their appropriateness and awareness among researchers outside the EU as we are interested in increasing the attractiveness of the EU for researchers currently outside the EU[185]. In the following we present MORE3 findings on the role of EU funding and on the availability of positions (the EURAXESS jobs portal) for attractiveness.

The two most important barriers to mobility are the availability of a suitable position and availability of research funding (cf. section 8 and 9). Euraxess and EU research funding can as a result play a potentially very important role as **enablers** of mobility or of attractiveness, of course next to instruments at the national level, as they directly address the availability of positions and research funding. The results on awareness and usage of these instruments among researchers in our sample of researchers currently working outside the EU show that among researchers who single out the availability of positions or funding as main barriers to mobility, the awareness is higher, in particular as regards the Euraxess portal (cf. Figure 24). This suggests that EU instruments manage to reach their intended target group. EU funding and Euraxess can as a consequence in principle contribute to the foundation of attractiveness in terms of enabling mobility to the EU – or preventing forced outward mobility of talents - if researchers want to come to the EU in the first place.

Both in terms of awareness, e.g. for non-EU researchers who were not mobile to the EU, but also in terms of actual usage, there is however room for improvement.[186] There is e.g. high general interest by non-EU researchers in EU research funding (cf. Figure 25), but a frequently indicated barrier – the main one - to using it is the lack of knowledge about specific EU research programmes. The results of the MORE3 Global survey (as in other studies) also show that policies aiming at return mobility of senior researchers may be limited in their effectiveness, as interest in return mobility is highest among early stage researchers.

Funding and the availability of positions are however not the main motives driving self-chosen mobility to attractive research systems. The factors which drive this are much more related to the available career perspectives, in terms of a clear-cut tenure-track model where a permanent position depends only on performance, on working with leading scientists and other factors influencing scientific productivity (e.g. early independence in research).[187]

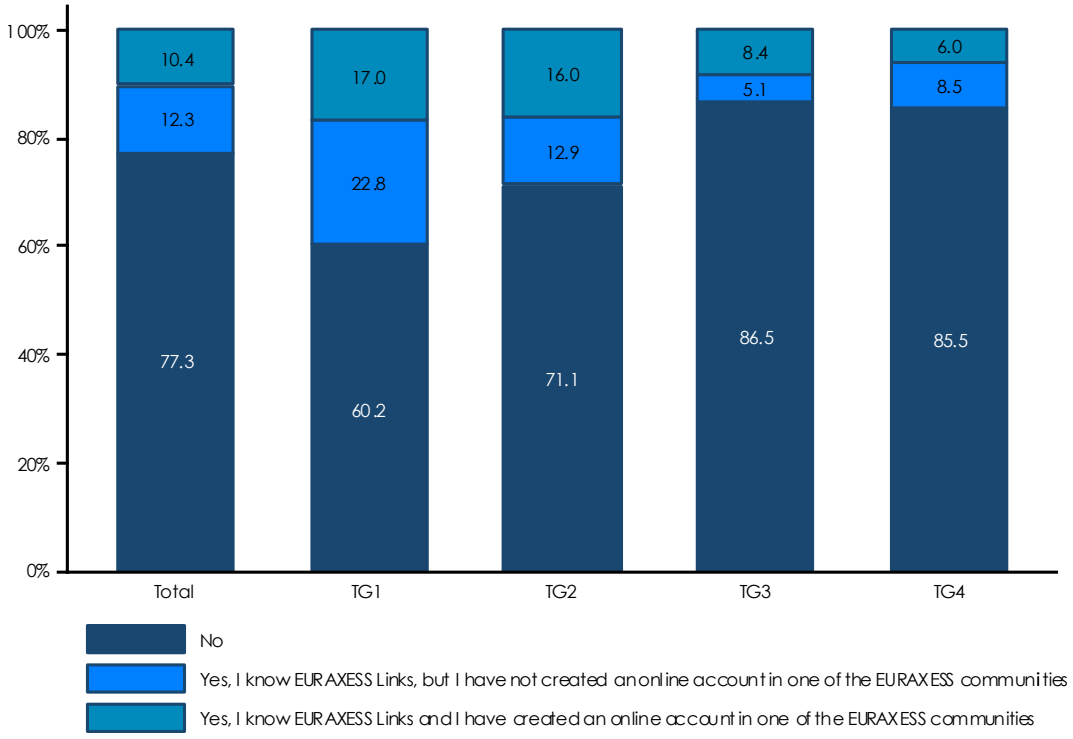
[185] The MORE3 EU HE survey includes an analysis of awareness and use of EURAXESS and EU research funding. EURAXESS is only known by 16% of researchers in the EU, and used by 16% of those. 22% of EU researchers have benefitted from EU funding.

[186] The MORE3 Global survey contains a detailed analysis of awareness and usage patterns of EURAXESS and EU research funding.

[187] Note that forced mobility involving a change of employer is associated with the availability of positions as a main motive. However, the EU or ERA certainly wants to be attractive even to researchers from well-working systems who are not forced to move because of a dire situation in their home country.

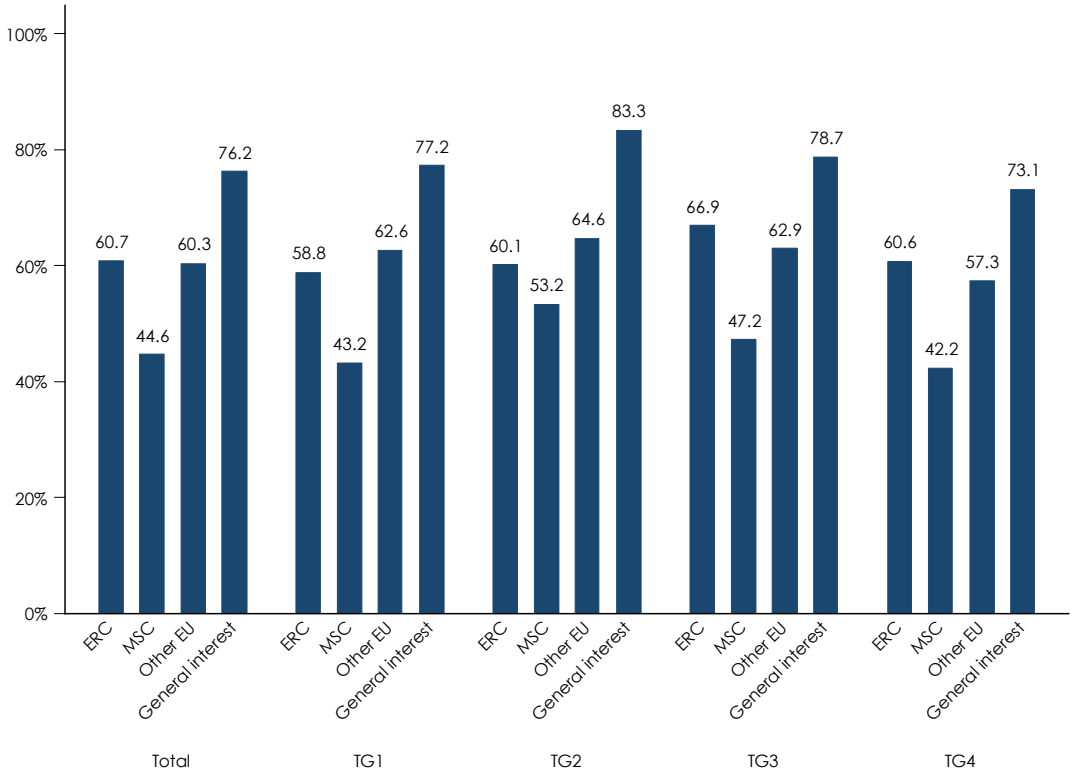
Improving the attractiveness of ERA hence needs in addition to enablers also an improvement of the **drivers** of scientific productivity. These drivers relate to conditions for scientific knowledge production in Europe in terms of e.g. attractive career paths, innovative funding models which allocate funding to the most promising research (so more than just availability of funding), procedures for selection of young talented scientists, high quality structured PhD training etc. These elements can in general be more effectively dealt with at the national level through reforms in higher education institutions, universities and research institutions; improving the effectiveness of national research systems is indeed the first ERA priority. But the EU also has an important role to play here, as outlined in the previous sections, e.g. through facilitating the diffusion of best practice and monitoring of progress in implementing ERA, and e.g. through funding high quality training, as done through the MSCA doctoral training subsidies. Note that funding schemes such as the ERC indirectly affect public research systems, as universities and higher education policy try to improve to be able to obtain more funding for excellent research. Working to increase the portability of pensions and social security will reduce barriers to mobility and hence enable more mobility, but this needs to be combined with also boosting drivers of attractiveness/mobility.

Figure 24: Awareness of Euraxess across researcher groups



Source: MORE3 Global survey (2017); figure 103 in MORE3 Global survey.
Note:
- Total: Researchers currently working outside the EU (n=1,727)
- TG1: EU researchers currently working outside the EU (n=417)
- TG2: Non-EU researchers who have worked in the EU in the past (n=263)
- TG3: Non-EU researchers who have worked abroad but not in the EU (n=178)
- TG4: Non-EU researchers who have never worked abroad (n=869)
- Based on question 81: "Do you know Euraxess Links?"

Figure 25: Interest in applying for EU funding across researcher groups



Source: MORE3 Global survey (2017); figure 107 in in MORE3 Global survey
Note:
- Total: Researchers currently working outside the EU (n= 1,727)
- TG1: EU researchers currently working outside the EU (n= 417)
- TG2: Non-EU researchers who have worked in the EU in the past (n=263)
- TG3: Non-EU researchers who have worked abroad but not in the EU (n=178)
- TG4: Non-EU researchers who have never worked abroad (n=869)
- Based on question 87: "Are you interested in applying for (other) EU funding in the future?

Part 3 Policy implications and recommendations for further research

14. Overarching policy implications

In this section we summarise the overarching findings of the policy-relevant analysis in this final report. We start with the two main dimensions in the conceptual framework: attractiveness of the ERA in the first section and optimal knowledge exchange and cooperation in research in the second section. Given the horizontal importance of gender equality in policy and in each of the two mentioned dimensions, the third section will zoom in on this horizontal concept. Finally, we conclude with reflections on a number of key policy instruments and how they can be further strengthened to meet the implications of the analysis.

14.1. Attractiveness of the ERA: Global awareness of drivers of attractiveness meets heterogeneity in national research systems

STATE OF PLAY

There is something like a global mind-set on what makes for an attractive research career (in academia), or on which characteristics of research jobs are most conducive to a successful research career. Characteristics relative to long-term career perspectives, research autonomy, working with leading scientists, an appropriate balance between time for teaching and time for research, sufficient funding to allow the implementation of research agendas are characteristics that influence the scientific productivity of researchers much more than those characteristics relating to the material conditions of a job or to quality of life.

There is also a shared understanding on which skills and training (a PhD) matter for a research career and on which factors matter for recruitment and career progression. Intersectoral mobility between public research or higher education institutions and firms are regarded as less important for recruitment or career progression than international and interdisciplinary mobility. The findings of the MORE3 Global and EU HE surveys on what matters for attractive jobs in research are also consistent with the previous literature.[188]

By contrast, perceptions on how countries organise and structure research systems, i.e. the conditions they provide for researchers to reach the maximum of their creative research potential, are much more diverse. While diversity can be good and provide opportunities for learning, low satisfaction levels with funding and financial security or very high shares of fixed-term contracts are not a sign of positive diversity. Another example is that the structure of PhD training varies considerably, with the more traditional master-apprenticeship model still widespread in many countries, also in the EU, while doctoral schools or more team-based PhD programmes dominate in US research universities. More structured PhD training may also make it easier to impart a wider set of transferable skills. And satisfaction with merit-based recruitment and career progression are diverging within the EU.

The discrepancy between a 'global awareness' on what matters for successful research careers and the national differences in research systems gives rise to varying perceptions of attractiveness between countries, as well as varying patterns of international mobility, including asymmetric mobility or brain drain. This is not only pertinent at the global level

[188] E.g., Friesenhahn, I., Beaudry, C.. *The Global State of Young Scientists*. Berlin: Akademie Verlag, 2014; Janger, J., Nowotny, K., Job choice in academia, Research Policy 45(8), 2016, p. 1672-1683.

between high-income countries with strong research systems and lower-income countries with weaker research systems, but also at the European level, where MORE3 findings point to persistent heterogeneity among EU countries. This heterogeneity is not just a result of different higher education systems and career structures, but also of economic development influencing public budgets for research and hence research funding and salaries of researchers. **A continued and even increased emphasis on the ERA reform priorities** is hence a clear policy implication of MORE3, particularly regarding the ERA aim of helping weaker research systems catch up with the top systems within the EU. The nature of the relationship – win-win or win-lose – between the "Global Research Area" and the "European Research Area" will also depend to some extent on how level the playing field will be. Research institutions of similar attractiveness will lead to knowledge exchange and brain circulation, while big differences may lead to brain drain.

OTHER LESSONS FROM THE MORE3 SURVEYS ON THE EVOLUTION OF THE ERA

MORE3 findings cannot causally attribute changes between MORE2 and MORE3 to reforms both at the EU and at the national level. However it is possible to summarise changes and the status quo **with respect to EU policy aims** based on MORE3 findings:

- On the one hand, there are **several positive developments**. Among these are the growing share of externally advertised positions, the rising agreement of researchers that recruitment and career progression are merit-based and transparent, a decreasing share of fixed-term contracts and increasing satisfaction with working conditions, although these results need to be interpreted with care. As an example, these positive developments at the EU level mask strong country variation. The limitations outlined in section 1.3 hold as well, as regards the margin of error e.g. In terms of gender, positive developments among early stage researchers are observed, but it is not clear yet whether these will be sustained to significantly change the glass ceiling phenomenon observed in most EU countries.
- Another important finding is that **research careers are attractive by nature**: intrinsically motivated researchers enjoy the intellectual challenge and the level of responsibility which comes with the activity of research. Increasing the number of researchers is hence less a task of building motivation, but of improving working conditions and career paths have to enable researchers to do what they are interested in. Bad working conditions lead to opting out of a research career or to "forced" international mobility. Attractive working conditions and career paths, together with the high satisfaction with the content of research jobs, can also compensate for dissatisfaction with pay, where the EU is perceived to be worse than both non-EU countries and BRICS countries.
- There are also **areas where little change has taken place without necessarily reflecting insufficient policy efforts**. One such example is international mobility, which remains comparable in 2016 to 2012. This is a kind of indicator that is not expected to change in the short run; evolutions are to be monitored in the longer term to assess influences by the continued policy support.
- On the other hand, **several areas addressed by EU policy aims seem to be in further need of reform**. The level of heterogeneity has already been pointed out. As a further example, somehow surprisingly a majority of PhD candidates or recent graduates indicate that they are supervised by single researchers only, whereas positive developments towards increased structured training were noted on the basis of university initiatives e.g. by the EUA and the ERA Working Group on Human Resources. The scale of recent progress to date may simply not have been enough to compensate for the large gap between the EU and the US, where structured doctoral training in research universities is the dominant mode.

- MORE3 findings also show that interest in **intersectoral mobility** among researchers currently working in EU HEI remains low, not just in terms of dual positions, or mobility stints, but also in terms of whether industry exposure or intersectoral mobility is perceived as important for PhD training, or whether entrepreneurship and IPR rights are important skills for a research career. However, it needs to be pointed out that this picture is not different in countries outside the EU, and the available evidence from the MORE3 Global survey suggests an even lower role of intersectoral mobility for recruitment and career progression in the US which is often cited as being good at turning knowledge into growth. Important in this respect is that **scientific productivity is positively associated with commercialisation of research results**, so that fostering the first will also boost the second[189].
- Transferable skills are regarded by more than 80% of researchers in the EU as very important for career progression and recruitment, just after international mobility. Yet only 33% of PhD candidates and recent graduates indicate having received training in transferable skills such as time and people management, grant writing or communication and presentation skills.

As regards the attractiveness of the EU as a place to do research, several findings emerge among others:

- First, the more advanced the non-EU research system researchers come from or in which researchers have worked, the less positive the EU is seen as a place to do research (and the other way around);
- Second, the EU's strong points are perceived to be job characteristics such as social and job security, pension plan and the quality of (undergraduate) education and training (with the mentioned variation between countries). The EU is perceived to be less good on balance than the most advanced research systems when it comes to drivers of attractiveness and international mobility (factors influencing scientific productivity of researchers, particularly career paths) and also in enablers of attractiveness (research funding and availability of positions).
- Third, among four groups of EU and non EU-researchers[190] with comparative knowledge of EU versus non EU-research systems, only the non-EU researchers who have been mobile to the EU in the past generally see the EU as better across all dimensions than their current countries of employment. The EU is seen as better in selected aspects of working conditions of research by some groups, e.g. with regard to working with leading scientists by EU researchers working abroad in OECD countries.

[189] See e.g., Perkmann, M., King, Z., & Pavelin, S. (2011). Engaging excellence? Effects of faculty quality on university engagement with industry. *Research Policy*, *40*(4), 539-552; Di Gregorio, D., & Shane, S. (2003). Why do some universities generate more start-ups than others?. *Research policy*, *32*(2), 209-227; Abramovsky, L., Harrison, R., & Simpson, H. (2007). University research and the location of business R&D. *The Economic Journal*, *117*(519); Van Looy, B., Landoni, P., Callaert, J., Van Pottelsberghe, B., Sapsalis, E., & Debackere, K. (2011). Entrepreneurial effectiveness of European universities: An empirical assessment of antecedents and trade-offs. *Research Policy*, *40*(4), 553-564.

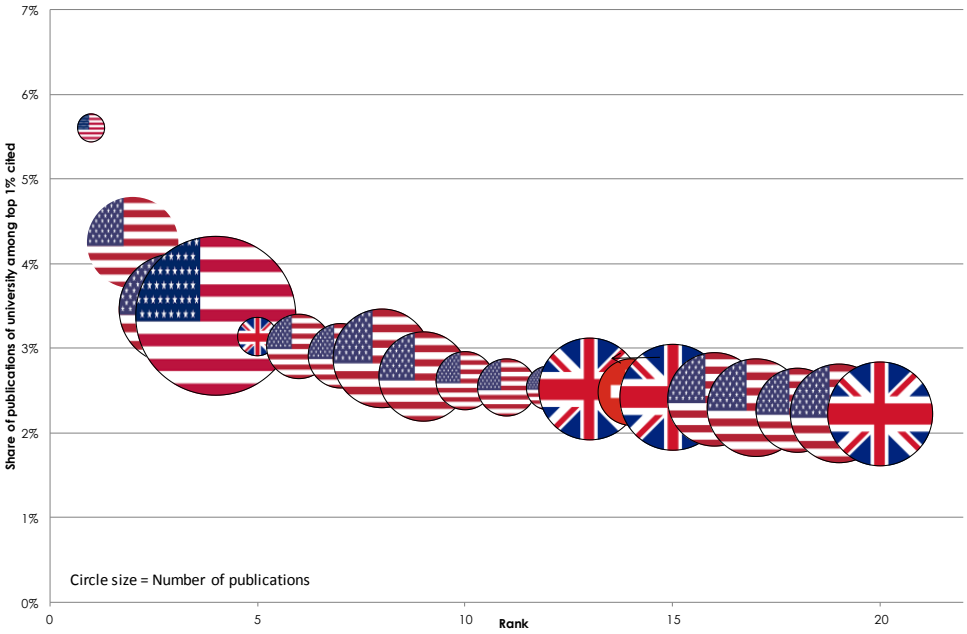
[190] The four groups were EU researchers currently working abroad, EU researchers currently working in the EU but with a mobility experience outside the EU, non-EU researchers currently working in the EU and non-EU researchers currently working abroad but with a mobility experience to the EU.

- Fourth, in terms of specific countries or regions, the US is perceived as being much more attractive, as well as the EU Associated Countries consisting of Iceland, Norway and Switzerland. EU researchers who are currently working in the BRICS or have been mobile to the BRICS have a similar pattern of assessment in perceiving education and training as well as – to a lesser extent – conditions for knowledge production to be better in the EU, but in perceiving career paths to be better in the BRICS.

This points to well-known EU strengths, such as social and job security, quality of life (vs. the US) but also the quality of broad (undergraduate) education and training. However after basic education and training, talented EU researchers seem to perceive better working conditions for a career in science in the US or in Switzerland, e.g. possibly due to earlier independence (autonomy), collaboration with leading scientists and in the case of the US, attractive career paths (tenure track models which link a tenured position to a researcher's output only). Again, substantial heterogeneity has to be borne in mind. This perception of attractiveness is consistent with recent bibliometric studies of EU research performance[191] and various university rankings: in the purely bibliometric ranking by the university of Leiden (cf. Figure 26 below), the US takes 20 spots, of the top 25, 31 of the top 50 and 58 of the top 100. Among the top 25, there is one Swiss HEI and four UK HEI. These results are hence different in emphasis to the report of the High Level Group on maximising the impact of EU R&I programmes, which sees excellent scientific knowledge production in Europe but deficits in turning this knowledge into innovation and growth. While there is definitely excellent research in the EU and the structure of some of EU basic research makes this excellence less visible (e.g., top German and French basic research institutes such as Max Planck Institutes or CNRS research institutions do not appear in the university rankings), there is definitely room for broadening research excellence in the EU.

[191] See, e.g., Rodríguez-Navarro, Alonso, and Francis Narin. 'European Paradox or Delusion—Are European Science and Economy Outdated?' Science and Public Policy. Accessed 22 May 2017; Albarrán, Pedro, Juan A. Crespo, Ignacio Ortuño, and Javier Ruiz-Castillo. 'A Comparison of the Scientific Performance of the U.S. and the European Union at the Turn of the 21st Century'. Scientometrics 85, no. 1 (20 April 2010): 329–44; Bonaccorsi, Andrea, Tindaro Cicero, Peter Haddawy, and Saeed-UL Hassan. 'Explaining the Transatlantic Gap in Research Excellence'. Scientometrics, 11 November 2016, 1–25. doi:10.1007/s11192-016-2180-2; Hunter, Rosalind S., Andrew J. Oswald, and Bruce G. Charlton. 'The Elite Brain Drain*'. The Economic Journal 119, no. 538 (2009): F231–F251. Note also the much stronger mobility flows of talented Chinese researchers towards US research universities than to European universities (Veugelers, R., The challenge of China's rise as a science and technology powerhouse, bruegel Policy Contribution Issue N.19, July 2017.

Figure 26: Rank of universities by share of publications among the top 1% publications in terms of citations, as well as number of publications (circle size)



Source: CWTS Leiden Ranking 2017

In conclusion, MORE3 findings would suggest the need for **a continued and even increased emphasis on the ERA reform priorities**, or more generally on reforms to make the EU more attractive as a place to do research, including measures to increase the effectiveness of national research systems, to make PhD training, career paths and working conditions, including perspectives for mobility, more attractive by international comparison. MORE3 findings also support other EU policy agendas, such as the renewed agenda for higher education.

POLICY IMPLICATIONS

From the state of play and MORE3 findings, it is clear that increasing the attractiveness of the EU or of the ERA as a place to do research hinges on many factors. We have conceptualised these factors as **drivers and enablers of attractiveness**.

Enablers: Research funding and the availability of positions are perceived to be the two greatest barriers to mobility across the board in MORE3. Improving them would reduce barriers to mobility and make it easier to become mobile. We therefore call these two areas enablers of attractiveness: factors that, if improved, will no longer form a barrier to mobility and enable all those interested in an international move to do so. Researchers cannot join an otherwise attractive research system when they face insufficient numbers of suitable positions and/or research funding. Further enablers of attractiveness, in particular in an international context and when a new job involves changing countries, relate to pension portability or immigration rules. However these administrative barriers are not perceived to be the main barriers to international mobility.
Drivers: The quality of the working conditions influencing scientific productivity, such as e.g. working with leading scientists and long-term career perspectives (the tenure track model), research autonomy and the balance between teaching and research, are the main drivers of attractiveness of jobs in research: factors that drive the decision of researchers to become mobile. Previous evidence based on MORE2 shows that

researchers are "willing to pay", i.e. give up some salary, in exchange for higher quality-working conditions relevant for scientific productivity.

In sum: As a general takeaway, reducing administrative barriers to mobility, such as enabling pension portability or liberalising entry regulation are important but will not on their own make the EU more attractive. What is needed in addition are attractive working conditions for researchers which help them implement their research agenda. This implies a **stronger focus of policy at institutional and governmental level on boosting scientific productivity** to foster symmetric mobility of researchers (brain circulation) and the attractiveness of the EU as a place to do research.

This implication can be illustrated by a recent suggestion for policies for increasing cooperation and mobility flows between the EU and China[192]. Increasing bilateral cooperation programmes does not in itself increase the attractiveness of research institutions, and Chinese researchers go specifically to US universities because of their prestige – in fact, the Shanghai university ranking was set up precisely with the aim of guiding Chinese students in their choice of research location. Drawing Chinese researchers to European universities will on top of bilateral cooperation programmes require improved working conditions, including research funding, research autonomy and working with leading scientists.

Another illustration is provided by policies for return mobility. MORE3 shows that return mobility of researchers is high when they are in their early career stages – once they are established or tenured at a prestigious university, it is very difficult to get them back. Sending out talented researchers without a level playing field in terms of the attractiveness of research institutions, as suggested for increasing mobility flows, may hence be risky. This means that efforts aimed at recruiting the most promising researchers at early stages of their career rather than at later stages are likely to be more successful. In practice, this implies offering attractive career perspectives to early stage researchers in terms of e.g. a tenure track-career model. In this model, researchers join a HEI as assistant professors on a fixed-term contract, but turning this fixed-term contract into a permanent one only depends on the research performance of the researchers. Trying to recruit leading researchers at later career stages will be more costly by comparison. This is not to say that return mobility policies are necessarily ineffective, but that they cannot replace an attractive research system for early stage researchers. Both bilateral cooperation programmes and return mobility policies need therefore to be complemented by efforts to improve the conditions for scientific knowledge production.

Implications for use of policy instruments: In terms of overall instrument use, increasing the attractiveness of ERA in terms of conditions for knowledge production could follow a four-pronged strategy:

- **To further increase research funding**, which continues to be perceived as the working condition in the EU with the least satisfaction; low success rates in Horizon2020 have already been discussed, this concerns also specific initiatives such as the European Industrial Doctorates.

[192] Veugelers, R., The challenge of China's rise as a science and technology powerhouse, Bruegel Policy Contribution Issue N.19, July 2017.

- **To ensure that this money flows to the most talented**, particularly in systems with an overall limited amount of public research funding, in line with ERA priority 1. This is also a focus of the renewed EU agenda for higher education in terms of financially rewarding research and teaching performance. The ERC and also MSCA are funding schemes which are clearly successful in allocating money to highly promising researchers (cf. infra).
- **To attract the most talented researchers**, based on attractive career paths and working conditions for research as outlined above; satisfaction with career perspectives is third-lowest among all working conditions in the EU, and researchers perceive in particular career perspectives to be better outside the EU than inside; several EU instruments in terms of an open labour market (ERA) and Open, Transparent and Merit-based (OTM) recruitment are also important here, as well as MSCA and ERC.
- **To ensure that knowledge is shared among policy makers** on how the first three elements are done most effectively. Diffusing best practice as to how to structure recruitment policies, career paths and conditions for scientific knowledge production, to spread excellence from existing centres in the EU to wider areas of the EU needs to be tailor-made for the heterogeneous situation of the EU. It requires addressing country specific issues, such as the balance between teaching and research in some Eastern European countries, transparent and merit-based recruitment and career paths in some Southern European countries and the high share of fixed-term contracts in countries such as Germany. The evidence from comparative studies to do this is increasingly available, including from the MORE projects.

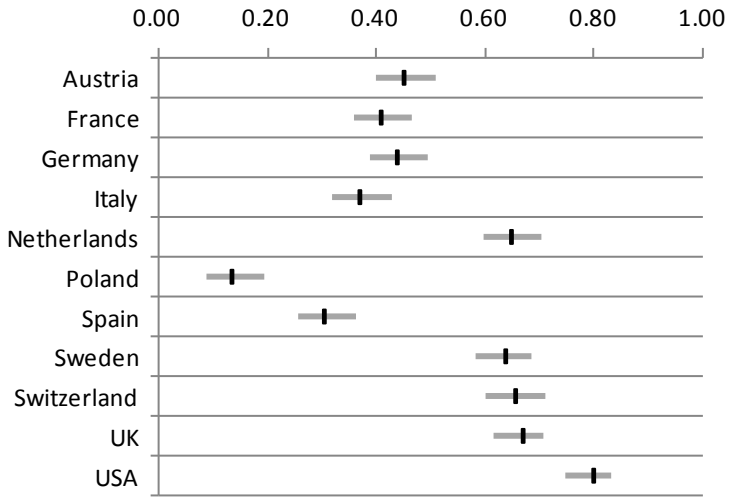
Some specific qualifications need to be added taking account of other literature:

- First, the satisfaction with the **balance between teaching and research** is second-lowest before funding and career perspectives. But what is an "optimal" balance between teaching and research? Research based on MORE2 data found that "research-only positions" are actually not a driver of attractiveness, and that some teaching is even preferred to no teaching at all. However, too much teaching clearly decreases the attractiveness of a job in research[193].
- Second, when a higher share of researchers is on a tenured position, care needs to be taken to **keep incentives for scientific productivity high over the life-cycle of researchers**. This can be done through allocation of funding (cf. above) or making time for research and for teaching in part dependent on research performance. Of course this needs careful independent evaluation over longer a time horizon, e.g. 10 years. Otherwise time horizons for research would be shortened, leading to risk aversion. But in principle such flexibility keeps not only positions open for early stage researchers, but also helps with the balance between teaching and research.
- An increased **emphasis on drivers of attractiveness does not mean that enabling conditions should be overlooked**. E.g. a general enabling prerequisite for international mobility, or people coming towards the EU, is also simply the ability to teach in English – not in terms of the researcher speaking English, but in terms of the university allowing the researcher to teach a course in English. This often limits international recruitment of researchers. Finally, several EU instruments are in place to improve social security/pensions portability (Euraxess, RESAVER).

[193] See Janger, J., & Nowotny, K. (2016). Job choice in academia. *Research Policy*, *45*(8), 1672-1683; the "optimal" share of teaching in combined teaching-research time (without administrative tasks) was found to be at roughly 27% for early stage researchers and somewhat higher for later stage researchers.

EU and national level initiatives are addressing many of these points (cf. sections 5-12). MORE3 cannot evaluate the effectiveness of these initiatives, but MORE3 findings clearly call for a renewed impetus to increase the attractiveness of the EU as a place to do research. This not just by comparison with strong research systems outside the EU, but also by further concentrating efforts on helping weaker EU research systems catch up with the top EU performers. Such efforts could benefit from regular monitoring of the attractiveness of research systems in terms of attractive job offers. The figure below shows an index of job attractiveness for selected countries, based on the findings of MORE2 and further work. Such a regular 'ranking' of research systems with respect to their attractiveness could provide reform incentives for policy-makers, similar to the rationale of the European Innovation Scoreboard (EIS), and is in line with EU aims at increasing the evidence base for reforms in higher education (cf. for example the renewed agenda for higher education).

Figure 27: Example of an indicator- and expert-based assessment of job attractiveness in academic research



Source: Janger, J., Strauss, A., Campbell, D., „Academic careers: a cross-country perspective". WWWforEurope Working Paper Series 37 (2013).

14.2. Lessons for an optimal knowledge exchange and circulation through researchers mobility

Next to the attractiveness of the ERA, also optimal exchange and circulation of knowledge within the EU and outside is a key dimension in the realisation of the ERA and in the setup of the MORE3 study (cf. conceptual framework in section 3). Under the concept of optimal exchange and circulation are understood: international, intersectoral and interdisciplinary mobility, as well as other forms of exchange through collaborations. Mobility both mirrors and affects attractiveness: as an example, international mobility drives international collaboration, which in turn is positive for individual research performance, so that mobility perspectives in a job affect its attractiveness. Many of the above mentioned ideas will thus also affect mobility. In the following section we will therefore not repeat these overarching points, but rather focus on the specific policy implications per type of mobility. Based on the comparative analysis of findings from the different MORE3 surveys and reports, a number of policy-relevant conclusions on how to foster each type of mobility are outlined.

INTERNATIONAL MOBILITY[194]

As stated before, international mobility is generally considered a key dimension of international networking and knowledge exchange and circulation with positive effects at system level in terms of creating a sufficiently large pool of researchers to develop innovative research, and at individual level in terms of career progression, collaboration and scientific productivity. From the analysis in the consequent MORE studies, it became clear that there are many different forms and motives for mobility and that not all forms of mobility are voluntary. Forced mobility points at a heterogeneity in terms of available research positions, funding, career progression and working conditions. Self-chosen mobility refers to a positive choice for exchange and networking.

One of the main questions arising in the policy context is how voluntary international mobility can be further fostered in the European context. Current perspectives on international mobility focus on the idea of "brain circulation". This is not only about attracting foreign researchers or retaining the researchers that are already in the country, it is also about facilitating the circulation of researchers. This has been shown to have positive benefits for individual researchers in terms of career progression, productivity and collaboration. It is the type of mobility that respondents to the MORE3 EU HE survey considered to be most appreciated for career progression and recruitment in their host institutions.

Most policy initiatives tend to focus on facilitating administrative processes (e.g. visa procedures), human resource practices or even social security and pension rights. However, the responses to the MORE3 EU HE survey indicate that, while these factors are important, the motives that are more frequently mentioned are those related to scientific production, such as the possibility of networking, working with leading scientists, research autonomy, or access to research facilities and equipment. A balance between both removing barriers and improving conditions that drive the mobility of researchers will be essential to both attract mobile researchers and enable them to undertake this step to or within Europe.

The promotion of the convergence across countries in terms of scientific excellence would be one of the factors that could have a direct impact in fostering brain circulation within the EU and in strengthening the attractiveness of the EU as destination for researchers at a global level. As stated by the Joint Research Centre in a report on international mobility[195], divergences between countries will persist as long as excellence in research is fragmented and dispersed. By contributing to the Member States´ research excellence and by harmonising existing best practices, the EU will not only foster 'internal' international circulation but also strengthen its attractiveness outside Europe. The policy aim here should thus be to optimise circulation and international mobility by both reducing barriers (enabling mobility) and improving the factors driving mobility at the same time, thereby encouraging knowledge circulation within Europe and attracting researchers from outside Europe.

Synergies between European funding for regional development and research excellence or innovation can be further explored with respect to what their role can be in terms of reducing the innovation gap. The effects of mobility can also be further optimised by encouraging instruments that allow researchers to return voluntarily to their home

[194] In the MORE3 EU HE survey, international mobility refers mainly to transnational mobility within the EU – and only to a lesser extent includes information on flows outside Europe.

[195] Fernández-Zubieta, A., & Guy, K. (2010). Developing the European Research Area: Improving knowledge flows via researcher mobility. JRC Scientific and Technical Report, JRC-IPTS.

country, maintaining their network from their mobility experience and benefiting from the knowledge exchange this entails, like the Member States are called to consider. As mentioned in the previous sections, this is to consider for early (less bound to permanent positions) and later career stages (highly positive effect in terms of bringing with them networks, knowledge, skills, etc.), but will only be effective when the research environment is sufficiently attractive to consider a return.

Finally, it is worthwhile to note that most of the existing instruments address mobility and open recruitment in general, compared to early stage researchers specifically. Even though the drivers of mobility in this group are generally the same as those of post-PhD researchers, they are at the same time more focused on their training, on the value of their experiences for their further career, and on how to combine their mobility with their family situation. In this respect, actions can be addressed more towards young researchers by taking these specific needs into account.

INTERDISCIPLINARY MOBILITY AND COLLABORATION

The MORE3 study measures interdisciplinary mobility as moves between fields and collaboration with other fields. Researchers indicate that they generally see this as a positive factor for recruitment and career progression. The extent to which interdisciplinarity is necessary or beneficial for researchers might depend on the career type and research topic. But in general, where policy supports interdisciplinarity, it also supports individual researchers in their careers.

However, one issue that arises in the interpretation of the data and contextualisation within existing literature is that there is no commonly accepted definition of interdisciplinary research, mobility or collaboration. This makes it difficult to compare or benchmark findings. A clear-cut definition would include a definition of the concept "discipline" and the differentiation between the ways through which research is carried out (i.e. the integration of theories, methods, data, etc.) and the ways through which researchers work and collaborate (i.e. with colleagues working in the same discipline or in a different one).

MORE3 data indicates that researchers having worked in projects funded by an MSCA or an ERC grant tend to display higher levels of interdisciplinary mobility and collaboration than the general population of researchers. It is therefore an opportunity for this kind of programmes and initiatives, aiming at fostering interdisciplinary research, to put forth a clear-cut definition and continue monitoring the numbers and effects of interdisciplinarity in research.

INTERSECTORAL MOBILITY

Intersectoral mobility is considered a key element of knowledge transfer, in all career stages and fields. Initiatives promoting intersectoral mobility can be one of the solutions to close the gap between academia and industry. However, MORE3 findings show that interest in intersectoral mobility among researchers currently working in EU HEI remains low, not just in terms of dual positions, or mobility stints, but also in terms of whether industry exposure or intersectoral mobility is perceived as important for PhD training, or whether entrepreneurship and IPR rights are important skills for a research career.

- The share of researchers working in the private sector in the EU (based on Eurostat data[196]) is low in comparison with other advanced economies (Japan or the US). Instead of converging, the MORE3 EU survey shows that the levels of intersectoral mobility have decreased since 2012, from 30% to 25%, mainly due to a decrease in the public sector.
- Also, researchers (that currently work in academia) generally do not attach great value to intersectoral mobility as a positive factor for recruitment or career progression. The initiatives promoting the positive recognition of intersectoral mobility in performance evaluations or recruitment in academic settings are still rare.
- The researchers that have experienced intersectoral mobility have different reasons to do so, also depending on the sector they have worked in. Contribution to society is more frequently mentioned among those that have worked in government and not-for-profit sectors. Gaining first-hand experience of industry, remuneration and bringing research to the market are more commonly cited motives for those with experience in the private industry[197]. Therefore, future initiatives promoting intersectoral mobility should take researchers´ motivations into account in order to trigger as much interest as possible from individual researchers.
- Differences across fields are also observed, and the motivations or expected benefits can differ for researchers from different fields. From the policy-making perspective, future initiatives would need to take into account the differences across fields of science and explicitly define the expected benefits. There are examples of current initiatives at EU level (e.g. bottom-up initiatives under MSCA like RISE, the recently introduced Society and Enterprise Panel in the Individual Fellowships and other academic fellowships encouraging to go on secondment to non-academia) that target all PhD researchers without distinction of field of science or types of SMEs.

Next to mobility to other sectors, more forms of exchange and collaboration should be fostered to exploit the potential of industry-science linkages and transfer of ideas. The MSCA co-funding of doctoral programmes already positively takes into account "collaboration with a wider set of partner organisations, including from the non-academic sector, which may provide hosting or secondment opportunities or training in research or transferable skills"[198]. Also the MSCA Research and Innovation Staff Exchange (RISE) (previously IAPP or Industry-Academia Pathways and Partnerships) is an example of exchange opportunities, offering support for short-term mobility of research and innovation staff at all career levels, from the most junior (post-graduate) to the most senior (management). They are based on flexible inter-sector (within Europe) and international (with third countries) exchanges of highly skilled research and innovation staff.

14.3. Gender

This third section on overarching policy implications reflects on the gender dimension as it was analysed in each of the sections of this final report. It brings together the findings and reflects on specific and comprehensive approaches to further improve gender equality in research.

---

[196] Based on Eurostat, Total R&D personnel (researchers) by sectors of performance, occupation and sex (rd_p_persocc). Cf. indicator 1.6 in the MORE3 Indicator report on researchers.
[197] Cf. Table 14 in section 12.1.1.
[198] Cf. https://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/msca-cofund-2017.html.

Competitiveness is affected by research and innovation activities and thus, international competition for talents has accelerated. Although women represent a major source of human capital, to a certain extent their talents are underexploited in various areas of social and economic life. Integration and incorporation of female researchers' skills could reduce inefficiencies in terms of unused, highly educated human resources and indicates considerable potential for expanding the pool of (young) researchers.

Although a quantitative catching-up of women in access to academic positions has been observed in recent decades, literature and statistics agree on ongoing gender inequalities in terms of recruitment and career advancement in higher education systems. Besides the omnipresent wage-gap between women and men, this is particularly true for more qualitative aspects of researchers' lives, such as status, satisfaction with teaching loads, the probability of having children and access to full-time positions[199]. The scope of gender inequality, of course, differs by career stage, field of science, and country. The findings of the MORE3 Global and EU HE surveys on gender inequalities in research jobs are consistent with the previous literature.

A wide spectrum of measures targeting different aspects of gender issues, national and EU-wide, has been implemented. EU funding programmes, such as Horizon2020 and the 'Science with and for Society' work programme, as well as (national) campaigns promoting gender equality in research careers, contribute to reaching the targets and objectives of the strategic engagement for gender equality. Overall, these initiatives can be clustered into measures supporting individuals at different career stages (short-term) and measures aiming for improvements of national education systems and the public perception of gender inequalities (long-term). Short-term measures focus on gender-related issues in terms of work-life balance, childcare, quotas, transparent recruitment procedures favouring women on equal qualification, etc. Long-term measures concentrate on changes of the education systems, like measures to increase the attractiveness of future careers in S&T for females already at an early stage or to provide targeted training to prepare young women for occupying a decision-making position in the future. The promotion of training and support programmes lead to increased awareness of potential gender biases among management and department heads, e.g. similar to Sweden (cf. ERA Progress Report 2016).

Although it is not possible to establish causal relationships between MORE3 and different policy measures designed to improve gender equality at the EU and at the national level, it is possible to summarise the present situation with respect to EU policy aims based on MORE3 findings.

First, the MORE3 EU HE survey suggests **gender differences in terms of recruitment, professional development and career progression in the higher education systems**, which results in lower numbers of female researchers in general, and particularly in later career stages and leading positions.

[199] E.g. Goastellec G. & Pekari N. Gender differences and Inequalities in Academia: Findings in Europe. In Teichler U. & Höhle E. (2013) The Work Situation of the Academic Profession in Europe: Findings of a Survey in Twelve Countries. Springer, Dordrecht, DOI 10.1007/978-94-007-5977-0; Monroe, K., Ozyurt, S., Wrigley, T., & Alexander, A. (2008). Gender equality in academia: Bad news from the trenches, and some possible solutions. Perspectives on Politics, 6(2), 215–233; and Toutkoushian, R. K., Bellas, M. L., & Moore, J. V. (2007). The interaction effects of gender, race, and marital status on faculty salaries. Journal of Higher Education, 78(5), 572–601.

- In most of the EU28 countries female researchers are still underrepresented. MORE3 data do not hint at considerable improvement compared to 2012. While only small differences can be observed in early career stages, women are outweighed by men in leading scientific positions. The implementation of mentorship programmes especially for young female researchers during and after their studies could improve the situation by providing guidance in terms of career progression. Targets and quotas can also positively affect the number of female researchers by increasing the importance of mixed research teams. In some ERA countries, for instance in Austria, Luxembourg and Finland, RFOs have already implemented mechanisms anchoring gender targets in form of requirements for research funding, e.g. quotas or targets in evaluation panels and research teams (cf. ERA Progress Report 2016).

- In general, female researchers are less satisfied with recruitment and career progression procedures and generally more pessimistic about their future career. Overall, the results corroborate the persistence of a glass ceiling effect in EU28 countries. Aside from the directly observable imbalance between women and men, a lack of women in decision-making positions may also affect the likelihood that gender-related topics can be addressed in future developments relevant to research careers. EU-wide implementation of legal provisions in place against direct discrimination, universities' gender equality plans as well as national incentive programmes might improve this situation over time. However, the existing measures vary strongly between countries and also between single universities and it remains unclear which initiatives bring about sustainable changes in recruitment and promotion procedures.

- The share of female researchers with children is higher than the share of male researchers with children, especially in case of researchers with full-time positions. To a certain extent, higher shares of part-time working mothers than part-time working fathers are rooted in unequally distributed time spent on care work. Some ERA countries provide supplementary funding for absences (e.g. maternity and sometime parental leave)[200] or have already implemented specific grant schemes considering family-related periods of absence, e.g. stop-the-clock policies or allowances for reducing administrative or teaching obligations after parental leave. In addition, EU programmes have been installed to facilitate the re-entry of researchers after periods of absence.[201] However, to establish sustainable equality between the sexes regarding research careers, further improvement of EU-wide care structures (e.g. 'Barcelona targets') is essential as it could not only improve the work-life balance particularly for women, but also improve their career advancements in terms of occupying decision-making (full-time) positions.

[200] For instance, Denmark and Poland offer grant extensions, Slovenia, Spain and Estonia offer the guarantee of returning to the same position and Sweden even introduced the obligation for both parents to share parental leave (including parental insurance) (cf. ERA progress report 2016).

[201] For instance, the Career Restart (CAR) Panel of the Individual Fellowships (IF) action concentrates on post-doctoral researchers, who have been absent from research for at least one year and are seeking to restart. For the work programme 2018-20 it has been endowed with a higher budget and an extended maximum duration of CAR fellowships (to 36 months).

- Female researchers are less often satisfied with their environment for scientific knowledge production compared to men, particularly in case of the balance between teaching and research and their possibilities to collaborate with leading experts. This hints at the need to further improve initiatives to facilitate female researchers focusing on their research, e.g. by teaching-free time periods awarding distinguished performance (also in teaching and assistance activities).

- PhD mobility is an important factor to improve education quality at the individual level, encourage brain circulation and early establishment of international networks. MORE3 findings show that considerably more female than male researchers mention that finding a suitable position and funding (for research and mobility) were factors that prevented them from being mobile during their PhD. Despite existing initiatives to support mobility during the PhD in general (e.g. ITN), MORE3 data suggest that further efforts particularly targeting female PhD candidates are needed in order to improve not only individual career perspectives of female researcher but also, in combination with suitable strategies to attract them back to Europe after finishing their studies, support international collaboration and knowledge spillovers. [202]

- The establishment of career paths which make it easier to balance work life demands, e.g. early selection including an early change of university after a PhD, as in tenure-track positions in the US, could positively affect female participation in research labour markets in the long run.

Second, **gender biases in terms of financial and social security as well as income,** reduce the attractiveness of research careers for women in general, further support potential imbalances regarding care duties and might be counteracted by efforts to attract the best talents worldwide available to Europe.

- Several (national) initiatives (e.g. equality plans) are focused on gender wage gaps, sometimes as a result of non-standard forms of employment (part-time and fixed-term contracts), which are also an issue in scientific research.[203] However, these measures strongly differ between Member States and sometimes even between higher education institutions within the same country.[204]

[202] Overall, the MSCA success rates decreased to 6.8% in 2014 (2007-2013: 19%) and previous studies have shown that female researchers are underrepresented: only between 26.4% and 40.5% of MSCA grantholders are women across the different types of grants. (PPMI, "FP7 Marie Curie Actions Interim Evaluation", Final report, 2013)

[203] Cf. She Figures 2015.

[204] Some European countries (e.g. Austria, Spain, Norway) motivate or obligate universities to explicitly create equality plans by specific legal provisions. In Denmark gender equality is included in the development contracts of universities with the ministries. For further examples see the report on Gender Equality Policies in Public Research (2013).

- Although researchers perceive the EU's strong points to relate to social and job security - which has even improved since 2012 - overall female researchers are far less satisfied than men. They also feel more often worse paid than their counterparts outside academia and more often report that they felt forced to move because there were no options for a research career in their home country. Of course, country heterogeneity is high, and national policy measures aimed specifically at monitoring and addressing researchers' gender wage gap have already been implemented in some countries (Austria, Cyprus and Finland) and others opted for unsolicitous measures like the voluntary implementation of advisory committees for monitoring wage differences (e.g. Slovenia). Increased monitoring and EU-wide initiatives (e.g. obligatory Gender Equality Plans) might reduce and balance gender differences also in terms of financial and social security between Member States.

At present it remains unclear which of these measures are the most effective and lead to persistent improvements. Gender monitoring is already in place in the large majority of ERA countries, making it easier to evaluate various initiatives aimed at increasing gender equality and in particular at increasing the share of female researchers in decision-making positions.[205] More evidence on what really works could then feed into mutual learning exercises. Even given better evidence, however, it is likely that there is no "silver bullet" which will reduce gender equality. Continuing and intensifying the broad range of both short-term as well as long-term initiatives available seems promising. There are many initiatives which are present only in selected countries, so that there is scope for rolling out more comprehensive gender equality policies.

14.4. Reflections on current policy instruments

From the analysis in this report, it is clear that several EU-level policy instruments address or integrate the general policy priorities of the ERA with respect to individual researchers' careers, working conditions and mobility. In particular the Marie Skłodowska-Curie actions (MSCA) and ERC programmes pay strong attention to these priorities, but the whole of Horizon2020 research funding is relevant for making progress towards ERA objectives. Based on the observations in this report, a number of reflections on these policy instruments arise on how they could be strengthened further in their role to support the ERA priorities:

- Horizon2020, MSCA and ERC strongly emphasise **gender equality**, in terms of human resource practices, and working conditions but also in their internal processes, decision making structures and in the content of the research. This practice is an example to which several national actions in the National Action Plans of the Member States refer and will thus also have an impact as 'good practice example'.

- To exploit the full potential of the European knowledge base, **young researchers** and their training are essential policy priorities. There are opportunities in the MSCA co-funding of structured PhD training support and through ESIF. Co-funding allows for coping with the fixed cost of establishing structured PhD training and at the same time to foster transparent recruitment policies in line with EU policy objectives, among others research excellence and gender equality. Given relatively low levels of structured training in many EU countries, increasing the budget for MSCA co-funding of doctoral programmes could be investigated.

[205] A screening of the ERA National Action Plans shows that gender is addressed through many measures.

- It is clear that the different funding programmes for individual researchers (ERC, MSCA) offer interesting **career development opportunities and working conditions** to researchers in all career stages. The current efforts in terms of recruitment, career progression and career paths should clearly be continued and intensified. The links to ERC and MSCA remain to be important in that respect. ERC and MSCA schemes offer several key working conditions such as access to research infrastructure and research autonomy, and pay strong attention to policy priorities in their human resource practices and internal processes. Evidence from the MSCA interim evaluation of the MSCA shows that the actions have a pronounced and positive structuring effect across Europe on institutional behaviour in terms of reforming or enhancing research systems, upgrading doctoral training programmes, offering good working conditions to researchers, etc.[206]

- As **international mobility** is important for recruitment and career progression, funding for mobility will also continue to be important in countries where there is a lack of funding for mobility stints. Moreover, funding and availability of research positions remain important barriers to international mobility in general. The MSCA explicitly aims at developing an open and accessible ERA and to foster the development of an EU labour market for researchers. International mobility is therefore a key component of the MSCA. Partial evidence of the success of the actions in this sense is shown by the data of the MORE3 EU HE survey. Although causality links cannot be established, researchers that have worked in a MSCA-funded project in the past display much larger shares of long-term international mobility in the last ten years (40%[207] compared to 27% in the general population of researchers). By facilitating the portability of grants, the ERC also aims at fostering researchers' international mobility, as well as their working conditions: HEI are incentivised to offer better working conditions to attract these top level researchers. As such, the ERC grants do not require international mobility, they only facilitate it. Interestingly, according to the MORE3 EU HE survey researchers that have worked in the framework of an ERC grant in the past display very similar levels of international mobility as the general population of researchers (24% versus 27%).

[206] FP7 ex post and H2020 interim evaluation of Marie Skłodowska-Curie actions (2017). Directorate-General for Education, Youth, Sport and Culture
See https://publications.europa.eu/en/publication-detail/-/publication/27e546f6-c847-11e7-9b01-01aa75ed71a1

[207] The item on international mobility used for this comparison only referred to mobility in the last ten years. This explains why this share is not even higher.

- With respect to **international collaboration**, those researchers that have worked in projects funded by an MSCA or ERC grant in the past, present much higher shares of international collaboration (49% and 50% respectively) than the overall population of researchers (36%). No causality links can be established on the basis of the available data, but nonetheless there seems to be an association between these grants and a higher level of collaboration with researchers working in other countries. Also other EU-level instruments, like MSCA-RISE and EU-ICI ECP (Education Cooperation Programme) activities pay attention to international collaboration and short stays abroad. The different aims and formats of these programmes hinder finding commonalities with respect to the ways through which they promote international exchanges through collaboration, short-term mobility, and virtual mobility. However in each of these instruments, the findings of the MORE3 EU HE survey can be further explored, e.g. in terms of links between short and long-term international experiences and forms of exchange, as well as on the benefits associated with each type of international exchange.

- **Interdisciplinary mobility or collaboration**[208] are not explicitly mentioned in the ERA priorities. They are however referred to – and positively valued - in the IDTP and some of the most important research programmes at EU level, such as the MSCA, the ERC grants or other Horizon2020 programmes. Although the figures should be taken with caution since the survey was not designed to offer representative data for these groups, there are indications that implementation of the interdisciplinarity idea in funding programmes has a positive influence: those researchers that have been involved in projects funded by an MSCA or an ERC grant display higher shares of interdisciplinary mobility (45% and 38% respectively) than the general population (34%). They also tend to collaborate more with researchers working in other disciplines (80% of those in the MSCA group and 82% of the ERC group), compared to 74% in the general population of researchers. It is thus considered a good practice example, in particular where excellent research is the goal and basic requirement, to include interdisciplinarity in the policy priorities of funding instruments.

- For **intersectoral mobility**, and in particular other forms of exchange that strengthen the industry-science linkages, an equal pattern is observed. Several EU instruments explicitly promote intersectoral mobility and collaboration, in particular the MSCA. A study on the impact of business participation in MSCA on researchers´ careers and job creation showed that the programme had very positive effects on the beneficiaries through the acquisition of new knowledge and industry-relevant skills[209]. The MORE3 EU HE survey, though not allowing to establish causality links, also suggests positive effects: 30% of the researchers having worked in projects funded by MSCA grants have been intersectorally mobile (compared to 25% in the general population of researchers), and 23% have previously worked in the private sector (compared to 18% in the general population of researchers).

[208] Interdisciplinary mobility refers to the situation in which a researcher has switched to another (sub)field of science during his or her research career. Interdisciplinary collaboration refers to the situation in which a researcher collaborates with other researchers working in a different discipline.

[209] PPMI Group et al (2017). Study of business participation and entrepreneurship in Marie Skłodowska-Curie actions (FP7 and Horizon 2020). Final report. Directorate-General for Education, Youth, Sport and Culture. European Commission.

- The ERC´s main objectives are focused on fostering excellent research in Europe through a bottom-up approach. Intersectoral mobility is not an explicit objective of these grants. However, the highest shares (to be interpreted with caution) of this type of mobility are found among those researchers that have worked in a project funded by an ERC grant (36%). Similar findings are found when looking into the types of sectors in which this intersectoral experience has taken place: researchers in the ERC group are more likely to have worked in the private sector (26%).
- However, the MORE3 findings also show that intersectoral mobility is not highly valued by researchers currently working in the Higher Education sector in terms of recruitment or career progression. Therefore, it seems that there are still untapped opportunities - particularly for young researchers and their training - to create a larger exposure already in those early stages to industry and its linkages with science. As there seem to be tensions between excelling in basic academic research and focusing on more applied problems, creating different training and career paths may be one way forward (cf. section 15 on further research). The European Industrial Doctorates have recently been evaluated. Applications for this funding scheme are characterised by low success rates so that increasing the budget could provide additional impetus. Also more experience-sharing from industry in teaching is one possibility to be examined for the future.

- One overarching element is however essential to consider in this respect: the observed **heterogeneity** in terms of quality and functioning of the research systems across Europe. Therefore, support for mutual learning, such as in the form of the Horizon2020 Policy Support Facility (PSF) which is specifically working to address danger of divergence in research and innovation and also works on higher education and science system, continues to be crucial. Mutual Learning Exercises within the PSF could look at the question of attractive career paths for early stage researchers and thus reduce heterogeneity in terms of quality in that respect. More industry-oriented PhD programmes may also make it easier for applications from universities, which are not at the frontier of basic research and are more likely to be in economically poorer EU countries, to be successful. Finally, synergies between European funding for regional development and research excellence or innovation can be further explored with respect to what their role can be in terms of reducing the innovation gap. This could boost equity in the ERA and contribute to convergence, rather than divergence in research excellence among EU countries.

15. Recommendations for further research

The MORE3 study is a major step forward in the large and relevant body of research on the different aspects of researchers' careers and mobility in European HEIs. This extensive research provides answers to today's policy makers, but also raises new questions on the implications and future evolution of our findings. In this section we identify a number of questions that are interesting for further research from a policy perspective.

Research to address the research and innovation divide across countries

Further research is needed to explore the ways through which the research and innovation divide between EU Member States and regions can be addressed through a mix of EU and national policy interventions. Although monitoring mechanisms for the performance of research systems and smart specialisation strategies have been developed to inform about the achievements of these strategies, it would be important to assess their contributions to the development of national and regional research and innovation systems, in particular in less developed countries, in order to make proposals for the next generation of programmes. Developing measurement frameworks for the attractiveness of national research systems on a regular basis – similar to the European Innovation Scoreboard – could provide a benchmark to stimulate the implementation of policies. Such frameworks could also include efforts to measure the extent to which mobility of researchers within the EU is symmetric (brain circulation) or asymmetric (brain drain).

Gender: comparative evidence is needed on the effectiveness of gender-related policies

More research efforts should be put on gaining a comprehensive insight into the effectiveness of the policies aiming at reducing the gender gap. There are a lot of initiatives at EU, national and institutional levels, however, the existing initiatives vary strongly at country- and sometimes even at university-level, and it remains unclear which initiatives bring about sustainable changes as there is relatively little comparative evidence of their effectiveness and efficiency. Special attention could be put on the difference between those initiatives that can potentially have an effect in the short-term (such as initiatives promoting work-life balance, contributing to childcare, introducing gender quotas, or promoting transparent recruitment procedures favouring women on equal qualification) and initiatives with a longer-term implementation and effect (initiatives implemented in education systems, promoting the presence of women in S&T, etc.).

PhD Studies: towards structured PhD training and a greater involvement of industry

Analysing cost-effective designs for structured PhD-training is one of the topics on which further research is most needed, especially if there is support for the idea of gradually replacing the predominant model of single researcher supervision in the EU with structured PhD programmes and reducing heterogeneity across European Member States in this respect.

Further research can also investigate how to more effectively integrate **transferable skills** into PhD training. This relates to the gap found between the increasing importance

of transferable skills in researchers´ careers and the relatively low shares of researchers having followed trainings in these skills during their PhD.

The different prevalence and assessment of intersectoral collaboration and industry funding during PhD stage across European countries is another important issue for further research. This type of collaboration is quite pronounced in some Eastern European countries, but this is far from being generalised at EU level. In general, PhD candidates consider intersectoral collaboration – in particular with industry – as less important.

Career paths: unveiling best practices to foster attractiveness

Research careers remain an interesting field for further research. Among many other potential topics, comparative analysis could further characterise the different countries' career and higher education systems. This would also make it easier for policy analysis to perform best practice and benchmarking studies, comparing like with like and choosing suitable policy avenues for country-specific problems.

Heterogeneous national career paths form a barrier to the single market for researchers (ERA), even if we recognise that a certain extent of heterogeneity and authenticity at institutional or country level is considered beneficial for the variety in research topics and training approaches across Europe.

Convergence in the framework conditions for career paths and structures could therefore lead to more mobility and exchange. This convergence should of course be driven by convergence towards best practice models. Such best practice models have been discussed in terms of "tenure track"-models, but further research is certainly necessary.

Moreover, international comparative research could look into the determinants of the different lengths of the early career stages, where a long period of contractual uncertainty and reduced research autonomy is unattractive for a research career. This point is also related to the relative scarcity of studies analysing the impact of different types of contracts (i.e. fixed-term versus tenure-track contracts) and their suitability for different research frameworks and objectives.

Further research should therefore focus on those conditions that are important to researchers. This would contribute to the design of effective policies that can help to improve the balance between incoming and outgoing mobility and, hence, maximising the benefits of brain circulation as opposite to brain drain and brain gain.

Working conditions: matching funding schemes to researchers´ motivations and expected benefits

Further research could look into how the working conditions offered by different higher education systems (including institutional heterogeneity within countries) foster the attractiveness of research careers and of ERA in general. In general, past research tended to have a more general approach and has shown that for research jobs to be attractive, both remuneration-related working conditions (salaries, social security etc.) and research-related working conditions (availability of funding, quality of peers, research autonomy, time horizons for research etc.) are important working conditions. Early-stage researchers are however particularly willing to move to other countries or institutions looking for better working conditions for research, even if the salary is not higher. The results of this type of research can also inform EU

research funding policies, as the availability of research funding is a clear policy lever of EU initiatives.

Further research on interactions and interdependencies between specific working conditions with a view to attractiveness and optimal scientific knowledge production is also needed. Examples of research questions that could be addressed are:

- How do different ways of research funding allocation (e.g., project-based vs. institutional block funding) interact with time horizons for research with a view to the riskiness of research paths chosen?
- How do different funding schemes foster organisational changes in the HEIs?
- How does funding shape the potential for intersectoral cooperation (cf. also below)?

International mobility: analysing its impact on career progression and unveiling the mechanisms fostering brain circulation

Long-term, consistent monitoring is of great importance for further research in the field of researchers´ international mobility. International mobility of researchers is analysed in great detail in the MORE1, 2 and 3 studies. These studies show that there is a stable mobility pattern among EU researchers even within an evolving policy framework. The longer term impact of policy changes such as the pension plan for researchers and expected changes in the VISA policy[210] will only become visible over time, and continued monitoring will provide the necessary benchmarks for these kind of considerations.

Further research is needed with regards to the relationship between short and long-term mobility and career progression: The results of MORE3 indicate that there is a strong interrelationship between short (< 3 months) mobility and long-term (> 3 months) mobility. The attention of future studies could focus on the analysis of the impact of different mobility patterns on career progression across career stages and disciplines, or on the extent to which short-term mobility can be equated to long-term mobility with respect to their impact on career progression or recruitment.

In the MORE3 study the extent to which researchers chose or felt forced to be mobile is analysed for the first time in detail, but further research will need to analyse the determinants and effects of these types of mobility. "Escape mobility" due to the absence of options for the researcher or because it is required for career progression are the most frequently cited motives for forced mobility among those researchers that are mobile towards EU countries. "Escape mobility" is lower for R4 researchers compared to R2 and R3 researchers but the frequency of this type of motivations is largely contingent upon the countries of origin. Large shares of researchers driven by "escape mobility" motivations are found among Irish and Bulgarian researchers while lower shares are found among Norwegian, Belgian and UK researchers.

The impact of economic crises, the openness of research systems and the underlying funding mechanisms warrant investigation as determinants behind this "Escape mobility". Analysing these determinants would allow identification of best practices and the design

[210] In this sense, it is important to note that Member States need to transpose the new rules of the "Recast researchers and students Directives" (Directive (EU) 2016/81) into national law by May 2018. The rationale for the reform of the Directive is to make the EU more attractive for talented/high-skilled third-country nationals by (1) facilitating their admission to the EU, (2) improving their rights during their stay and (3) increasing the retention rate.

of effective policies to foster brain circulation. The objective would therefore be to avoid brain drain related to this uneven distribution across EU countries.

Further research can provide useful insights into the extent to which improving collaboration with non-EU researchers can improve the EU´s attractiveness. This can entail analysing the consequences of EU researchers moving to non-EU countries or collaborating with non-EU researchers, but also the consequences of non-EU researchers being mobile to the EU. In this sense the MORE3 studies have provided evidence suggesting that non-EU researchers, having been mobile to the EU, maintain strong links with their EU network. The role of the EURAXESS networks can play in this can be further considered based on the outcomes of further research.

Intersectoral mobility and collaboration: analysing their impact, identifying best practices and promoting mechanisms to promote recognition for career progression

In general, open science and open innovation are becoming increasingly important in the research systems in Europe. These concepts are heavily supported by European policy makers and will determine the future of research approaches in Europe. **Openness to the scientific and industrial communities and even broader openness to regional policy makers and citizens will imply a change in the type of skills of researchers.** They will, for example, increasingly consult these groups in their research linked to societal questions and in translating their research into commercial applications. Although the MORE3 survey has provided first insights into the skills needed and the extent to which they are provided and valued today in research training, further research will be extremely interesting to follow up on this trend.

The MORE3 survey has provided evidence on the degree to which researchers engage in intersectoral mobility and collaboration. However, further research will allow us to shed light on several issues of importance for future policy making:

- **Further research should investigate whether there is a trade-off between i) focusing on intersectoral mobility or collaboration, ii) industry exposure at an early stage of researchers' training and iii) career and academic specialisation to achieve research excellence** (and obtain tenure, based on publication performance) This relates to the fact that researchers in MORE3 value intersectoral mobility and industry funding less as a principle of PhD training and as factors for recruitment and career progression. Intersectoral collaboration or mobility implies research on – generally - more applied problems. Solving applied problems is often less amenable to a journal publication. This should be analysed not only at PhD level as mentioned above, but also across career stages and in terms of the potential need for diverse career paths.
- **The MORE3 survey shows that researchers do not perceive intersectoral mobility as an asset for career progression.** Research into the determinants of this perception can help to address this gap, paying special attention to the differences across sectors and fields of science.
- The findings of such a study could be complemented by **research investigating the ways through which intersectoral moves could be more valued and recognised in academia**: e.g. shedding light on the mechanisms through which this experiences can be better valued and the types of experience and their impact. This can be achieved through identification of best practices where intersectoral mobility is valued (in industry and in academia) and dissemination of this information across the relevant stakeholders.

Tailored policy responses at EU, national and institutional level might be needed to achieve different aims related to intersectoral mobility and collaboration.

Interdisciplinary mobility and collaboration: defining the concept of "interdisciplinarity" can help to unveil its effects and its determinants

Although the MORE3 survey has shed light on the degree to which researchers working in Europe engage with other disciplines, further research can look into several questions related to interdisciplinary patterns of collaboration and mobility.

In this sense, it is interesting to note that we do not have a full picture of the effects of interdisciplinarity in terms of research quality and impact and how this can vary across different disciplines. Efforts to increase the evidence base on interdisciplinary mobility would help policy design, just as getting to know more in detail how interdisciplinarity is perceived by researchers and how it is developed in the different fields of science can enable the design of more targeted and effective policies.

At EU level, efforts should be invested in the promotion of the development of a clear definition of interdisciplinary research, mobility and collaboration. The integration of SSH (Social Science and Humanities) in research avenues and teams could be fostered on the basis of a clear conceptual framework. These efforts are currently being promoted in some Horizon2020 programmes (e.g. through GOVERNANCE CSA actions), but support for the development of robust definitions that could be applied across programmes would be beneficial.

Future studies should look into the determinants of the different perceptions of interdisciplinary experience. The results of the MORE3 survey have also shown that those researchers that have an interdisciplinary experience tend to have a less sanguine perception of the extent to which these experiences are positively taken into account for recruitment and career progression. The development of policies aiming at fostering these type of experiences among European researchers will greatly benefit of studies looking into the barriers for these types of mobility and collaboration.

Continued monitoring efforts: structural and non-structural indicators

The results of the MORE3 project and the evidence available from the comparison with the MORE2 project support the recommendation of the Council Conclusions on support to early stage researchers[211] to continue monitoring the indicators related to researchers' careers and mobility over time.

The MORE studies indicate the existence of more structural indicators that tend to be more stable over time and of indicators that are more volatile and need more frequent monitoring to efficiently assess whether objectives of instruments are met.

[211] Conclusions on 'Measures to support early stage researchers, raise the attractiveness of scientific careers and foster investment in human potential in research and development'. Available at: http://www.consilium.europa.eu/media/24214/st14301en16.pdf.

- Examples of structural indicators could be the shares of international, intersectorally or interdisciplinary mobile researchers. These indicators are likely to change slowly over time and would hence need to be monitored every three or four years.
- Researchers´ perceptions, e.g. on their career progression or on the degree of transparency in recruitment process, are examples of more volatile indicators that should be measured more frequently (e.g. every year) to capture progress towards the targets of policies.

As stated above, long-term, consistent monitoring is of great importance for further research and monitoring of policy effects in the field of researchers´ international mobility.

List of Tables

List of Figures

Annexes

1. Annex to the conceptual framework: definitions and policy-driven developments compared to MORE2

As presented in section 3 of this final report, the conceptual framework defines and structures a set of overarching concepts that are applied consistently in the four different tasks of the MORE3 study. It is as such a tool for guidance in structuring and interpreting the findings in each of the tasks and integrating them in this final report. The conceptual framework is also strongly based on the framework in the MORE2 study (2012) for reasons of consistency and comparability.[212]

The definitions of the mobility concepts further take into account the existing standards or secondary sources so that comparability with other studies and contexts is maximised. As an annex to the conceptual framework, we repeat in the following sections the definitions of a number of key concepts that were applied the same in MORE2: researchers, fields of science and research career stages. Section 1.1.4 elaborates on the key concept of mobility and how it is adapted based on the findings of MORE2. Finally, section 1.2 treats the refinements made to a number of concepts of career paths and working conditions, based on the identified evolutions in the policy context since 2012.

1.1. Definitions of concepts

1.1.1. Researchers

The main definitions on researchers in use derive from the Canberra Manual, covering Human Resources devoted to Science and Technology (HRST), and from the Frascati Manual, covering Research and experimental development and R&D personnel. These definitions have also been used in the previous MORE1 and MORE2 studies[213,214].

Definition from the Canberra Manual[215]:

- HRST: people who fulfil one or other of the following conditions:
  - Successfully completed education at the third level in an S&T field of study (HRSTE).
  - Not formally qualified as above, but employed in an S&T occupation where the above qualifications are normally required (HRSTO).

Definitions from the Frascati Manual[216]:

- Research and experimental development (R&D):
  - "Research and experimental development (R&D) comprise creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge."

[212] IDEA Consult et al. (2013) Support for continued data collection and analysis concerning mobility patterns and career paths of researchers. FINAL REPORT (deliverable 8).
[213] IDEA Consult et al. (2010) Study on mobility patterns and career paths of EU researchers. FINAL REPORT (deliverable 7).
[214] IDEA Consult et al. (2013) Support for continued data collection and analysis concerning mobility patterns and career paths of researchers. FINAL REPORT (deliverable 8).
[215] OECD (1995), The Measurement of Scientific and Technological Activities. Manual on the Measurement of Human Resources Devoted to S&T. "Canberra Manual", OECD, Paris. (Section 3.1.1.).
[216] OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264239012-en.

- R&D personnel:
  - "In broad terms, R&D personnel include highly trained researchers, specialists with high levels of technical experience and training, and other supporting staff who contribute directly to carrying out R&D projects and activities. […], the scope of this concept encompasses all knowledge domains."
  - "R&D personnel in a statistical unit include all persons engaged directly in R&D, whether they are employed by the statistical unit or are external contributors fully integrated into the statistical unit's R&D activities, as well as those providing direct services for the R&D activities (such as R&D managers, administrators, technicians and clerical staff). All persons employed directly on R&D should be counted, as well as those providing direct services such as R&D managers, administrators, and clerical staff."
- Researchers:
  - "Professionals engaged in the conception or creation of new knowledge. They conduct research and improve or develop concepts, theories, models, techniques instrumentation, software or operational methods."
  - "For practical reasons, doctoral candidates engaged in R&D should be counted as researchers."

For this study, a researcher is defined in accordance with the Frascati manual[217] as "professionals engaged in the conception or creation of new knowledge, conducting research and improving or developing concepts, theories, models, techniques instrumentation, software or operational methods". The European Charter for Researchers and Code of Conduct for the Recruitment of Researchers[218], which are key elements in the European Union's policy to make research an attractive career, as well as the European Commission's communication on "Towards a European framework for research careers"[219], also refer to the 2002 version of this definition of researchers[220]. The definition is furthermore applied in R&D surveys which are the source for Eurostat and OECD R&D statistics.

[217] OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264239012-en.
[218] http://ec.europa.eu/euraxess/pdf/brochure_rights/am509774CEE_EN_E4.pdf.
[219] "Towards a European Framework for Research Careers" (European Commission 2011, p. 2 http://ec.europa.eu/euraxess/pdf/research_policies/Towards_a_European_Framework_for_Research_Careers_final.pdf.
[220] In Proposed Standard Practice for Surveys on Research and Experimental Development, Frascati Manual, OECD, 2002: "Professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, and in the management of the projects concerned."

To guarantee that respondents meet the criteria to be considered a researcher according to this definition, the questionnaire of the MORE3 EU HE survey contained the following self-selection paragraph:

> We specifically target "researchers" within this survey, including people:
> - carrying out research OR
> - supervising research OR
> - improving or developing new products/processes/services OR
> - supervising the improvement or development of new products/processes/services.
>
> If you consider yourself to fall into one or more of the above categories, we kindly ask you to complete the questionnaire.

1.1.2. Fields of Science

Fields of science (FOS) are defined according to the Fields of Research and Development (FORD) classifications proposed by the OECD in the 2015 Frascati Manual[221]:

- Field 1: Natural Sciences;
- Field 2: Engineering and Technology;
- Field 3: Medical and health sciences;
- Field 4: Agricultural and veterinary sciences;
- Field 5: Social Sciences[222];
- Field 6: Humanities and the Arts.

Consistent with MORE1 and MORE2, three categories are derived from this for the purpose of the Task 1 survey sample stratification. The three categories are an aggregation of the six FOS as follows:

- NATURAL: Field 1 (Natural Sciences) and Field 2 (Engineering and Technology) ;
- HEALTH: Field 3 (Medical and health sciences) and Field 4 (Agricultural and veterinary sciences);
- SOCIAL: Field 5 (Social Sciences) and Field 6 (Humanities and the Arts).

1.1.3. Research careers

There is a wide but diverse range of literature on the definition and typology of research careers. An overview is given in the RISIS Research Paper on the 'Conceptual framework for the study of research careers'[223]. According to this overview, three theoretical approaches can be identified to research careers: that of the individual agency[224], of institutional and collectively produced processes[225] or in between[226]. Based on these,

---

[221] OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264239012-en.

[222] Including Economic Sciences.

[223] RISIS – WP24 – Task 1. Conceptual framework for the study of research careers. Research papper synthesizing the theoretical model for research careers. January 2016.

[224] The sociological model of the institutional processes that structure research careers (Gläser 2001; Laudel and Gläser 2008).

[225] Economics of sciences (Black and Stephan 2010; Fox and Stephan 2001; Sauermann and Stephan 2012; Stephan 2008).

careers are structured in stages. Four explicit models of career stages are identified, each focusing on different defining factors such as role sets/interdependence and authority (Laudel & Gläser, 2007); competences/independence and leadership (EC); positions/independence (ESF) and positions/ranks (LERU).

The MORE3 study, as with its predecessors, takes the perspective of the individual researcher within academic careers and applies the EC model for career stages. As such, it is situated in this context in the individual agency perspective, defined by competences/independence and leadership.

The choice to apply the career stage model defined in the European Commission's communication "Towards a European Framework for Research Careers" (European Commission 2011, p. 2)[227] is because, with its focus on competences and leadership, it best fits the purpose of the study whilst allowing for a high degree of standardisation across different related studies.

These four career stages are:

- R1: First Stage Researcher (up to the point of PhD);
- R2: Recognised Researcher (PhD holders or equivalent who are not yet fully independent);
- R3: Established Researcher (researchers who have developed a level of independence);
- R4: Leading Researcher (researchers leading their research area or field).

According to the definitions given in the European Commission's communication the different stages are sector-neutral (applicable to companies, NGO's, research institutes, research universities or universities of applied sciences) and are characterised as follows[228]:

A **first stage researcher (R1)** will:

- "Carry out research under supervision;
- Have the ambition to develop knowledge of research methodologies and discipline;
- Have demonstrated a good understanding of a field of study;
- Have demonstrated the ability to produce data under supervision;
- Be capable of critical analysis, evaluation and synthesis of new and complex ideas and
- Be able to explain the outcome of research and value thereof to research colleagues."

Recognised researchers (R2) are doctorate holders or researchers with an equivalent level of experience and competence who have not yet established a significant level of independence. In addition to the characteristics assigned to the profile of a first stage researcher a recognised researcher:

- "Has demonstrated a systematic understanding of a field of study and mastery of research associated with that field
- Has demonstrated the ability to conceive, design, implement and adapt a substantial program of research with integrity

[226] The scientific and technical human capital approach (Bozeman, Dietz, and Gaughan 2001; Bozeman and Rogers 2002).
[227] http://ec.europa.eu/euraxess/pdf/research_policies/Towards_a_European_Framework_for_Research_Careers_final.pdf.
[228] IDEA Consult et al. (2013) Support for continued data collection and analysis concerning mobility patterns and career paths of researchers. FINAL REPORT (deliverable 8).

- Has made a contribution through original research that extends the frontier of knowledge by developing a substantial body of work, innovation or application. This could merit national or international refereed publication or patent.
- Demonstrates critical analysis, evaluation and synthesis of new and complex ideas.
- Can communicate with his peers - be able to explain the outcome of his research and value thereof to the research community.
- Takes ownership for and manages own career progression, sets realistic and achievable career goals, identifies and develops ways to improve employability.
- Co-authors papers at workshop and conferences."

An **established Researcher (R3)** has developed a level of independence and, in addition to the characteristics assigned to the profile of a recognised researcher:

  - "Has an established reputation based on research excellence in his field.
- Makes a positive contribution to the development of knowledge, research and development through co-operations and collaborations.
- Identifies research problems and opportunities within his area of expertise Identifies appropriate research methodologies and approaches.
- Conducts research independently which advances a research agenda.
- Can take the lead in executing collaborative research projects in cooperation with colleagues and project partners.
- Publishes papers as lead author, organises workshops or conference sessions."

A **leading researcher (R4)** leads research in his area or field. He/she leads a team or a research group or is head of an industry R&D laboratory. "In particular disciplines as an exception, leading researchers may include individuals who operate as lone researchers." (European Commission 2011, p. 11). A leading researcher, in addition to the characteristics assigned to the profile of an established researcher:

- "Has an international reputation based on research excellence in their field.
- Demonstrates critical judgment in the identification and execution of research activities.
- Makes a substantial contribution (breakthroughs) to their research field or spanning multiple areas.
- Develops a strategic vision on the future of the research field.
- Recognises the broader implications and applications of their research.
- Publishes and presents influential papers and books, serves on workshop and conference organizing committees and delivers invited talks".

As this classification is not known from formal data sources on researchers, we introduce the classification by means of self-selection of the researchers in the surveys.

1.1.4. Mobility of researchers

Researcher 'mobility' refers to the movements researchers make during their career, which can be of varying lengths, with different goals, with different types of destinations and coming from different types of originating countries.

In MORE3 the definitions of mobility are strongly based on those applied in MORE2 for reasons of consistency. However, as new concepts of researcher mobility developed, and policies towards mobility and the evaluation of researchers' achievements had to be revisited[229], the definitions for this study also needed improvement and updating. In the following sections, we first resume the main definitions of (different types of) mobility and develop a new[230] approach for the concept of PhD mobility and the link with motives for mobility (escape, expected and exchange mobility).

1.1.4.1. Definitions of mobility

According to the expert group on the research profession[231] at least four types of mobility can be recognised:

- Geographical or international mobility;
- Intersectoral mobility;
- Virtual mobility (based on tangible cross-border research collaboration);
- Mobility related to change of topics or disciplines.

In MORE1, the analysis mainly focused on "geographical" and "sectoral mobility". As mobility could no longer be seen only in physical and geographical/international terms, "virtual mobility" was included for the first time in the MORE2 study. Mobility related to change of topics or disciplines was not explicitly included in the MORE2 study but is now elaborated in MORE3 so that this current study covers all four types of mobility.

The definitions of the first three types of mobility are based on those formulated in MORE2. In Table 15, they are structured along the dimensions of type of mobility, phase in which mobility takes place, duration and purpose of mobility. Each of the definitions in this table will be analysed in this report in the indicated sections.

[229] New concepts of researcher mobility – a comprehensive approach including combined/part-time positions. Science Policy Briefing, ESF, April 2013.
[230] Compared to MORE2.
[231] "Excellence, Equality and Entrepreneurialism building sustainable research careers in the European Research Area" (2012), by the Expert Group on the Research Profession.

Table 15: Definitions of mobility forms analysed in MORE3

<table>
<tr><th></th><th></th><th>PhD mobility</th><th colspan="2">Post-PhD mobility</th></tr>
<tr><td></td><td></td><td>Mobility of researchers enrolled in a PhD programme during their R1 career stage</td><td colspan="2">Mobility in any of the following research career stages and, even though the terminology selected for simplicity suggests otherwise, regardless of whether or not the researcher has obtained a PhD.</td></tr>
<tr><td rowspan="4">Geographical or international mobility</td><td rowspan="4">Moving to another country</td><td>PhD degree mobility: Mobility with the purpose of obtaining the PhD in another country</td><td rowspan="2">>3 month mobility: Mobility with duration of 3 months or more</td><td>Employer mobility: Mobility including a change of employer</td></tr>
<tr><td>>3 month mobility during PhD: Mobility of three months or more during the PhD while still obtaining the PhD in the home country</td><td>Mobility without employer change</td></tr>
<tr><td>PhD non-mobility: Having never been PhD degree or during PhD mobile to another country</td><td colspan="2">Non-mobility: Having never been mobile to another country for >3 months at a time</td></tr>
<tr><td></td><td colspan="2"><3 month mobility: Mobility with duration of less than 3 months</td></tr>
<tr><td>Intersectoral mobility</td><td colspan="4">Moving to another sector</td></tr>
<tr><td>Interdisciplinary mobility</td><td colspan="4">Having switched to another (sub)field during the academic research career[232]</td></tr>
<tr><td>Virtual mobility</td><td colspan="4">The use of web-based or virtual technology to collaborate internationally - based on tangible cross-border research collaboration</td></tr>
</table>

Source: IDEA Consult

1.1.4.2. A new approach to analysing PhD mobility

The analysis in the MORE2 study has exposed the need to simplify the presentation of PhD mobility to improve understanding and readability of the results.

An important point of discussion in PhD mobility concerned the reference country. Different reference countries were tested: country of citizenship and country of Master degree. The results were presented both in terms of destination (% of researchers that moved TO the country to obtain a PhD) and in terms of origin (% of researchers that moved AWAY FROM this country to obtain a PhD; either from country of citizenship or from country of Master degree). These different presentation forms in particular complicated the interpretation of the results. Therefore in MORE3 we will apply both an

[232] Which is to be distinguished from interdisciplinary research as such.

improved definition of PhD mobility, controlling for Master mobility, and a simplification of the presentation of the results.

First, we suggest making the following distinction (cf. Table 16 for an example):

- PhD mobility: Mobility with the purpose of obtaining the PhD in another country than the country of citizenship AND the country of Master degree. The case where the destination country of the PhD degree is equal to the destination of the Master degree, is classified as Master mobility.
- During PhD mobility: mobility of three months or more during the PhD while still obtaining the PhD in the home country.

Based on the graduation country for each degree, the distinction between PhD mobility, PhD return mobility and Master mobility is made. To grasp Master mobility more directly, we have also asked under PhD mobility whether one who has not obtained/will obtain the PhD in a country other than the one of the previous degree (the degree that gave access to the PhD), already moved during/for his/her Master degree anticipating on entering a PhD in this country. Master mobility will not be analysed as such in the MORE3 study (as it is not a form of researcher mobility but rather of education mobility), but it is necessary to control for it in the interpretation of the PhD mobility.

Table 16: Definition of PhD mobility - example

Country of citizenship	Country of Master degree	Country of PhD degree	Mobility
Country A	Country A	Country A	**Non-mobility for PhD**
Country A	Country A	Country B	**PhD mobility** to country B
Country A	Country B	Country A	**PhD return mobility** to country A *(after Master mobility to country B)*
Country A	Country B	Country B	**Non-mobility for PhD** *(after Master mobility to country B)*
Country A	Country B	Country C	**PhD mobility** to country C *(after Master mobility to country B)*

Source: IDEA Consult

For ease of interpretation, the analysis of PhD mobility focuses on the destination country (=country of PhD):

- **PhD mobility** (including indication of PhD mobility after Master mobility) per country (country moved to for the PhD):

  % of researchers who obtained a PhD in country X and who were mobile for this reason – of whom % after Master mobility;

- **Non-mobility for PhD** (including indication of non-mobility for PhD after Master mobility) per country (country stayed in for the PhD):

  % of researchers who obtained a PhD in country X and who were not mobile for this – of whom % after Master degree.

The latter case, non-mobility for PhD after Master degree, allows a better understanding of the mechanisms behind low PhD mobility to a country. It also enables us to test, for example, the assumption that mobility to this country takes place predominantly before PhD stage.

1.1.4.3. Link with motives: escape, expected and exchange mobility

In MORE2, a number of results indicated that international mobility can be driven by push factors more than by pull factors. In some cases the effects of mobility were even negative. To explore the explanations for these dynamics and outcomes in more detail, we have analysed international mobility from three different perspectives: escape mobility, expected mobility and exchange mobility.

Escape mobility is the case where a researcher is 'pushed' away from his or her environment because of lack of funding, positions, etc. – if they want to pursue a career as a researcher, they have to change countries. The hypothesis is that this kind of forced mobility may show a different pattern of effects, also including negative effects such as the loss of network at home or a deterioration of working conditions.

As a second perspective, we will also ask about situations where mobility may be 'natural' as a step in a research career, though not required. This is referred to as 'expected mobility' and is situated in between the two concepts of escape and exchange mobility. Moreover, this information can point to important differences between disciplines, related to the discussion on effects of mobility per discipline.

Finally, exchange mobility refers to the situation where a researcher chooses to move (positive motivation, self-chosen) with the aim of exchanging knowledge and work in an international network, or with the aim to use international experience as a way to boost one's career. The latter is expected to have more positive effects in terms of expanding a researcher's network and improving career progression opportunities. The latter also closely relates to the concept of Open Science, where global cooperation becomes increasingly important.

1.2. Policy-driven developments in concepts of career paths and working conditions

Recent developments in the R&D policy context in Europe have necessitated the revision of certain concepts about career paths and working conditions. In the following sections, we discuss the concepts of combined/part-time researcher positions, dual careers or career restarts, the measurement of researchers' achievements and open science in the 3Os framework. In the development of the questionnaire for the MORE3 EU HE survey, we have taken into account each of these concepts to the extent relevant and complementary to what is already being monitored in other studies (such as the DG EAC study "Research Careers in Europe", cf. infra). This also means that these concepts are new when compared to MORE2 and analysed for the first time in this context.

1.2.1. Combined/part-time researcher positions

One increasingly recognised means to transfer knowledge is **a combined, part-time research position**. The adjunct position can be made on time-bank terms i.e. *"a part-time position defined by a certain % of full position per year allowing the work-load to be flexibly distributed in short or long periods over the year according to the need"* (ESF, 2013). The combined/part-time research position has proven effective for knowledge transfer, networking and research collaboration. An example of this is the Norwegian 'professor 2' 20% combined/part-time positions scheme. The following suggestions were formulated by ESF (2013) concerning combined/part-time research positions:

- *"Should be introduced as part of ordinary employment conditions as well as in scholarships and grants (nationally and in EU-instruments);*
- *Could be established at all levels in the hierarchy;*

- *Might be suitable for implementation of the COM-proposed ERA-Chairs (attracting excellent researchers to build scientific quality in low-performing institutions);*
- *Might be suitable to counteract brain drain from less attractive areas by keeping them connected and cooperating."*

Given the growing importance of this concept, we have further elaborated the questionnaire for the MORE3 EU HE survey in this direction. Whereas the MORE2 study provided basic information on inter-sectoral dual positions, defined as a combined position between academia and another sector, we now allow for a more detailed approach to this concept. The MORE3 questionnaire also covers the share in each position, the possibility of accumulating multiple positions with academia and if so, the country of the academic positions (Q27-28-29).

1.2.2. Dual careers/restart of careers

Alternative career paths, including career breaks, restart of careers or implications of dual careers, have gained attention in studies on the topic as well as in the European policy context. In a study managed by the European Commission, DG Education and Culture, these three topic regarding "Research Careers in Europe" were addressed: restart of careers, perception (and promotion) of researcher's careers and dual careers[233].

- Dual careers are defined as living in couple where both life partners pursue a career or seek jobs which are highly demanding and strongly oriented at career progression, and at least one of them is a researcher.
- A career break is defined as a period away from what someone considers to be his/her main career, including a situation in which a researcher temporarily works in a non-research position either within or outside of an academic institution.

Concerning dual careers, the study measured for example the number of researchers who are in a "dual-career couple" relationship: almost 39% of respondents were in this situation. Around 66% of researchers being in this kind of dual-career relationship reported dual-career problems affecting their professional and/or personal lives. These outcomes point at a very important field of research to better understand career paths and career decisions of researchers.

In relation to career breaks, the study showed that around 35% of researchers experienced a career break or were planning to take one in the near future. For these researchers, childcare commitments were the major motivation (40%), followed by a lack of positions (34%) and end of contracts (32.5%).

Given this recent and detailed study on this topic, the MORE3 study did not explicitly focus on motives for and details regarding these concepts. The questionnaire did include a question (Q7) on whether or not the respondent's partner is also working as a researcher, thus allowing us to measure accurately (representative at country level) the share of researchers in a dual-career relationship.

[233] The final study report is available at http://bookshop.europa.eu/en/research-careers-in-europe-pbNC0614200/.

1.2.3. Measurement of researchers' achievements

Overall, new concepts of mobility bring with them the need for new evaluation measures for researchers' achievements. ESF (2013) has formulated some recommendations for international, inter-sectoral, interdisciplinary as well as virtual mobility. Their cross-cutting recommendations are:

- "Providing standardised CV in publically available information systems stating different forms of mobility;
- Recognising non-academic achievements in peer review;
- Normalising a researcher's achievements by normalizing the experience to the time actually spent in research."

In the MORE2 study, researchers' achievements were not taken into account. In MORE3 we have addressed the growing importance thereof by including questions on:

- The extent to which specific experiences or skills are appreciated for recruitment and career progression (e.g. interdisciplinary mobility or collaboration, transferable skills, etc.).
- Competitive funding at European or national level and the timing thereof.

1.2.4. Open Innovation, Open Science, Openness to the World

The policy context on the three O's of Open Innovation, Open Science and Openness to the World was given in section 2. To introduce the three O's in the MORE3 study, existing questions were elaborated and new questions developed. For example:

- Skills training: introduction of the categories 'innovative digital skills' and 'collaboration with citizens, government and broader society'
- Recruitment and career progress: introduction of a question on how 'alternative' skills and outputs are taken into account, namely 'alternative forms of research output' (e.g. project reports, grant writing, the development and maintenance of data infrastructure, organisation of research events/conferences, etc.), 'intersectoral mobility', 'interdisciplinary mobility', 'international mobility' and 'transferable skills'.
- Collaboration: introduction of 'non-researchers' in the list of potential collaboration partners

2. Survey methodology of the EU HE survey

2.1. Sampling strategy and implementation

The sampling strategy is at the core of the methodological approach of the MORE3 EU HE survey. The methodology is explained in detail in the MORE3 EU HE report, Annex 1. It is based on stratified random sampling, the best option for a survey of individuals that have to be classified according to a number of common characteristics (e.g. country, gender, age, field of science, career stage, etc.). It was as such defined at the start of the process with the aim of producing estimates with a minimum degree of accuracy (5% max error - p value of 5%) at both EU28 and individual country level for the EU28+3 countries, and in consistency with the MORE2 EU HE survey (2012).

In what follows, we briefly summarise the sampling strategy of the MORE3 EU HE survey in view of interpreting the indicators in this report correctly and to their full value.

Objective: The objective is to define a sampling methodology under the requirements of random selection of the units in order to define the necessary sample size in accordance with a predefined level of accuracy of the estimates. Estimates are to be produced at country level after stratification of researchers by field of science (FOS). The sampling strategy is therefore built from the start on information on researchers in Europe per country and field and the necessary sampling size is calculated for each combination of country and field.

Sampling frame: The 'optimal' sampling frame consists of an up-to-date nominal list of researchers including both contact details and the auxiliary information necessary for the definition of stratification variables (e.g. country, gender, age, field of science, career stage, etc.). If this kind of information is available, it is possible to define a random stratified sample of units that, after the survey, can be weighted for representing the total population with respect to the selected variable(s).

This sampling frame for researchers currently working in HEI in Europe is not given, but the study team developed a proxy frame in the early stages of the project based on available information on the HEI in Europe and followed a two-stage stratified sampling strategy.

Two-stage stratified sampling strategy:

- A proxy frame for HEI is available, so in the first stage HEI clusters were sampled from this (first stage or primary unit);
- In the second stage researchers (second stage or secondary unit) were then selected in these HEI and stratified by FOS.

The clustering of HEIs has the property to ensure that the sample of researchers is allocated proportionally to the FOS in each country so that estimates are consistent with the country number of researchers in each FOS. This also avoids that a too limited number of clusters cover all the sampled researchers which would in turn result in a bias of the estimates.

Survey implementation: Once the sample of researchers to address for the survey was finalised, the survey was implemented. As in MORE2, the raw data collection was organised through computer-assisted telephone interviews (CATI) and computer-assisted web interviews (CAWI). To further refine the information and in particular its statistical significance, a calibration and editing strategy was developed:

- First, a non-response survey was organised to collect data on why researchers did not participate in the main survey and on whether they would deviate from the general answering pattern in three key questions (>3 month mobility, <3 month mobility and intersectoral mobility).
- A second action in the refinement of the main data is the editing of partial responses by means of donor techniques so as to recycle information of researchers that have filled in a substantial part of the survey but did not reach the end.

The sampling strategy to collect sufficient information per country and field of science, combined with the calibration and editing strategy to refine the information and correct for non-response effects, results in the calibrated final sample on which all indicator development and measurement is based.

Ex-post stratification for gender and career stages: As mentioned before, the standard stratification that was already defined and integrated in the sampling strategy ex ante, is that based on field of science. However, we also looked into post-stratification based on gender and career stage. In the analysis phase, it is the available information in both the sampling frame and population that together determine the extent to with ex ante or post stratification is possible in the analysis.

For both gender and career stage, no information was available in the sampling frame, so only ex post stratification was an option. For gender, information was available for the population, allowing for an accurate ex post stratification. We point out however that ex-post weighting will result in less accurate estimates than the ex-ante defined country level estimates (the aim for accuracy of the country level estimates is 5% at a probability of 95%) because the response is not 'steered' for these variables and weighting is only done ex post.

For career stage, no information on the population was available, and only rough estimates based on combined information from national sources and Eurostat data for R1 could be analysed. This latter analysis is therefore not included in the main indicators in the MORE3 EU HE report. The ex post stratification based on career stages was only reported in annex in the form of a robustness check, suggesting that only very limited bias due to career stage distribution is present in the data (cf. Annex 2 in the MORE3 EU HE report).

2.2. Description of the sample

The survey has been administered in 31 European countries: the 28 Member States of the European Union and Iceland, Switzerland and Norway. It has been implemented through both CAWI (Computer-assisted web interviewing) and CATI (Computer-assisted telephone interviewing) techniques. One third (33.2%) was collected through CAWI and the remaining two thirds of the responses (66.8%) through CATI. The total number of respondents that answered the survey is 10,394. In the following sections we describe the MORE3 EU HE sample according to the main dimensions for the analysis.

2.2.1. Country level

The number of respondents per country and field of science are given in the table below.

Table 17: Sample per country and field of science

	Total	Natural	Health	Social
Austria	372	226	41	105
Belgium	375	158	108	109
Bulgaria	280	133	51	96
Croatia	361	186	53	122
Cyprus	277	122	12	143
Czech Republic	328	221	51	56
Denmark	346	150	69	127
Estonia	303	173	41	89
Finland	371	168	46	157
France	380	181	53	146
Germany	388	211	56	121
Greece	383	201	78	104
Hungary	262	128	11	123
Iceland	278	123	44	111
Ireland	364	163	74	127
Italy	381	155	77	149
Latvia	221	50	10	161
Lithuania	310	113	48	149
Luxembourg	260	136	12	112
Malta	218	90	40	88
Netherlands	369	153	78	138
Norway	345	133	65	147
Poland	355	172	90	93
Portugal	340	180	77	83
Romania	374	216	67	91
Slovakia	319	150	59	110
Slovenia	301	154	72	75
Spain	410	171	67	172
Sweden	384	157	90	137
Switzerland	359	170	68	121
United Kingdom	380	202	63	115
EU28	**9,421**	**4,520**	**1,594**	**3,298**
Total EU28+3	**10,394**	**4,946**	**1,771**	**3,677**

Source: MORE3 EU HE survey (2016)
(n=10,394)

2.2.2. Fields of science

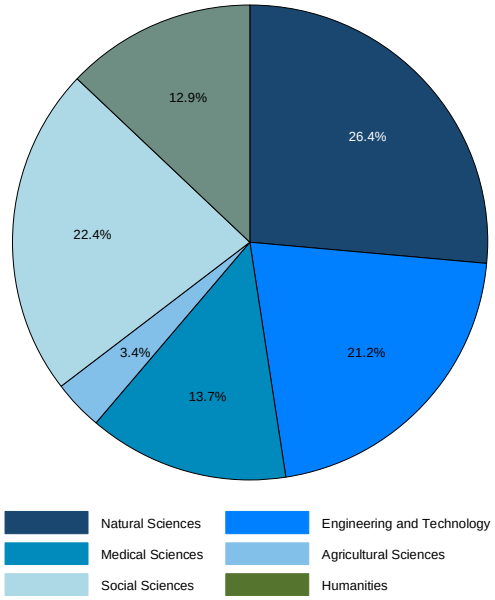
The MORE3 EU HE survey asked the respondents to self-select their field of science from a list of six fields, based on the Fields of Research and Development (FORD) classifications proposed by the OECD in the 2015 Frascati Manual[234]:

- Field 1 (Natural Sciences);
- Field 2 (Engineering and Technology);
- Field 3 (Medical and health sciences);
- Field 4 (Agricultural and veterinary sciences);
- Field 5 (Social Sciences);
- Field 6 (Humanities and the Arts).

[234] OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris. DOI: http://dx.doi.org/10.1787/9789264239012-en.

Figure 28 shows the overall distribution of respondents across the six fields of science. The largest share of respondents corresponds to the Natural Sciences and the smallest to Agricultural Sciences.

Figure 28: Distribution of fields of science in the sample



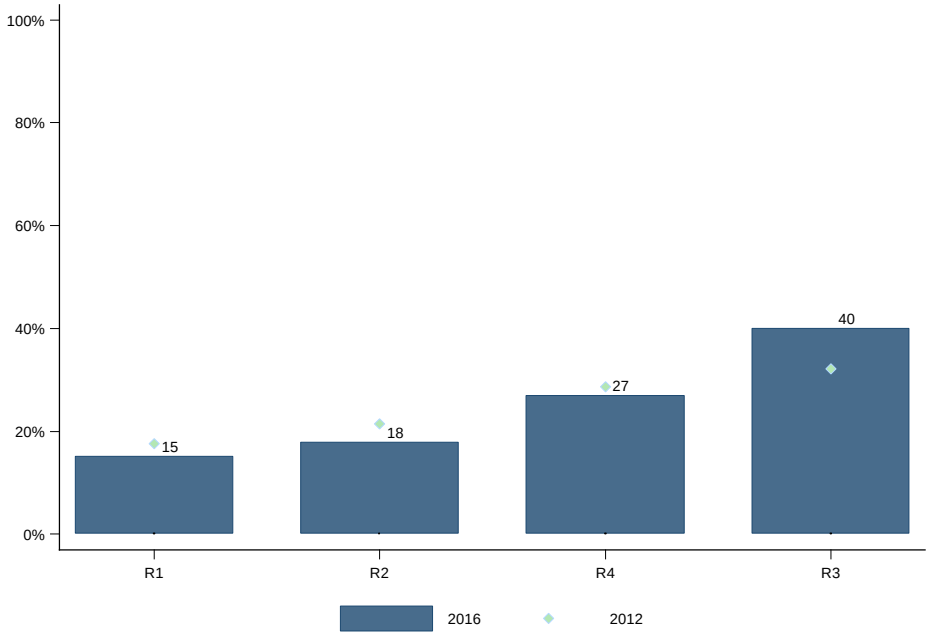
Source: MORE3 EU HE survey (2016)
Notes:
- Based on question 12: "What is your main field of research in your current position?"
- (n=10,394)

2.2.3. Career stage

Figure 29 shows the distribution per career stage of researchers in the sample of MORE3. As in MORE2 there is a strong emphasis on the later career stages in the sample (R3 in particular). The R1 researchers seem underrepresented to what we expect from Eurostat shares of R1 in the total.

In Table 18, we observe considerable differences in the distribution per country. The largest shares of R1 are found in Germany (34%), Luxembourg (34%) and Belgium (30%). R2 are more common in Poland (34%), Portugal (29%) and Switzerland (29%). The R3 are indeed highly represented in most countries. Particularly high values are observed in France (55%), Bulgaria (52%) and Malta (51%). Relatively lower values are found for Germany (19%), Luxembourg (24%) and Norway (24%), where R1 form the bigger group. The shares of R4 researchers are particularly high in Greece (44%), Spain (43%) and Romania (41%). In these countries also R3 reach more than 42%, so there is a clear inclination to the later career stages here.

Figure 29: Self-declared career stages



Source: MORE3 EU HE survey (2016)
Notes:
- Based on question 15: "In which career stage would you currently situate yourself?"
- (n=10,394)

Table 18: Number of respondents per career stage (self-declared in the survey)

Country	Total	R1	R2	R3	R4	*R1 %*	*R2 %*	*R3 %*	*R4 %*
Austria	372	53	88	124	107	*14%*	*24%*	*33%*	*29%*
Belgium	375	111	43	134	87	*30%*	*11%*	*36%*	*23%*
Bulgaria	280	25	41	145	69	*9%*	*15%*	*52%*	*25%*
Croatia	361	44	71	167	79	*12%*	*20%*	*46%*	*22%*
Cyprus	277	34	65	125	53	*12%*	*23%*	*45%*	*19%*
Czech Republic	328	17	57	135	119	*5%*	*17%*	*41%*	*36%*
Denmark	346	68	62	155	61	*20%*	*18%*	*45%*	*18%*
Estonia	303	82	42	111	68	*27%*	*14%*	*37%*	*22%*
Finland	371	69	73	114	115	*19%*	*20%*	*31%*	*31%*
France	380	25	54	209	92	*7%*	*14%*	*55%*	*24%*
Germany	388	130	97	74	87	*34%*	*25%*	*19%*	*22%*
Greece	383	18	26	170	169	*5%*	*7%*	*44%*	*44%*
Hungary	262	51	33	120	58	*19%*	*13%*	*46%*	*22%*
Iceland	278	45	28	121	84	*16%*	*10%*	*44%*	*30%*
Ireland	364	43	85	173	63	*12%*	*23%*	*48%*	*17%*
Italy	381	15	103	158	105	*4%*	*27%*	*41%*	*28%*
Latvia	221	53	13	73	82	*24%*	*6%*	*33%*	*37%*
Lithuania	310	40	47	122	101	*13%*	*15%*	*39%*	*33%*
Luxembourg	260	89	71	62	38	*34%*	*27%*	*24%*	*15%*
Malta	218	20	43	112	43	*9%*	*20%*	*51%*	*20%*
Norway	345	83	45	82	135	*24%*	*13%*	*24%*	*39%*
Poland	355	25	119	129	82	*7%*	*34%*	*36%*	*23%*
Portugal	340	23	98	168	51	*7%*	*29%*	*49%*	*15%*
Romania	374	18	43	160	153	*5%*	*11%*	*43%*	*41%*
Slovakia	319	38	76	149	56	*12%*	*24%*	*47%*	*18%*
Slovenia	301	38	48	146	69	*13%*	*16%*	*49%*	*23%*
Spain	410	20	40	173	177	*5%*	*10%*	*42%*	*43%*
Sweden	384	74	54	150	106	*19%*	*14%*	*39%*	*28%*
Switzerland	359	103	103	94	59	*29%*	*29%*	*26%*	*16%*
The Netherlands	369	86	48	141	94	*23%*	*13%*	*38%*	*25%*
United Kingdom	380	30	43	166	141	*8%*	*11%*	*44%*	*37%*
EU28	**9,412**	**1,339**	**1,683**	**3,865**	**2,525**	**14%**	**18%**	**41%**	**27%**
Total EU28+3	**10,394**	**1,570**	**1,859**	**4,162**	**2,803**	**15%**	**18%**	**40%**	**27%**

Source: MORE3 EU HE survey (2016)
Notes:
- Based on question 15: "In which career stage would you currently situate yourself?"
- (n=10,394)

2.2.4. Gender

In total, 41% of the respondents in the sample are female. This is the same share as found in Eurostat for the entire population of researchers. Also at country level the distributions of sample and population are similar (see Table 19). The main differences are found in Croatia and Latvia (with respectively 13pp and 10pp difference between sample and population). On the other hand, female researchers are less represented in the sample in the United Kingdom (-15pp), Greece (-12pp) and Austria (-10pp). When gender-based weights are applied in the analysis, we will see that in countries with a lower share of female researchers than in the population, the responses of the female researchers receive higher weight than those of their male counterparts. As the overall balance between sample and population is good, this will have only limited effect on the values for the indicators.

Table 19: Gender distribution in the sample and in the population

	Share of Female researchers in the **sample**	Share of Female researchers in the **population**
Austria	30%	40%
Belgium	36%	41%
Bulgaria	55%	48%
Croatia	61%	48%
Cyprus	35%	39%
Czech Republic	29%	36%
Denmark	36%	43%
Estonia	48%	47%
Finland	37%	47%
France	38%	33%
Germany	36%	38%
Greece	27%	39%
Hungary	36%	39%
Iceland	45%	51%
Ireland	41%	44%
Italy	46%	40%
Latvia	63%	54%
Lithuania	51%	55%
Luxembourg	36%	38%
Malta	29%	33%
Netherlands	37%	41%
Norway	39%	47%
Poland	44%	43%
Portugal	51%	48%
Romania	51%	47%
Slovakia	40%	46%
Slovenia	48%	42%
Spain	40%	41%
Sweden	37%	44%
Switzerland	43%	36%
United Kingdom	29%	45%
EU28	**41%**	**41%**
Total EU28+3	**41%**	**41%**

Source: MORE3 EU HE survey (2016)
Notes:
- Based on question 2: "What is your gender?"
- (n=10,394)

2.3. Interpretation of the results

2.3.1. Potential and limitations of the resulting sample

The MORE3 Higher Education (HE) survey in Europe was implemented to provide estimates on researchers in the EU28+3 HE sector with maximum accuracy at both EU and individual country level (5% max error -p value of 0.05) and including a stratification by fields of science (FOS). Our methodology thus leads to accurate indicators at the European and country level: if the survey was to be repeated a hundred times, in 95 cases the outcomes at country level would be deviating no more than +/-5% from the outcomes of the MORE3 survey (5% max error -p value of 0.05). In most countries the number of validated questionnaires achieved a margin of error of 5.5%; in four countries a margin of error between 5.5% and 6% was achieved and for one country a 6.5% error was achieved. Overall, the response rates are more equally distributed across countries than in MORE2.

The indicators at other levels of analysis than the European and country level (field of science, gender, career stages, FTE) are not guaranteed to have the same accuracy. Nevertheless, at EU level, the number of observations is sufficiently high to guarantee consistent and accurate results here as well. It is at lower level of subpopulations that the outcomes are to be interpreted with more care (e.g. R1 researchers' opinions in a particular country). Sample size is therefore key to obtaining accurate estimates. For this reason, we do not show subpopulation estimates in the report when the n-value of this subpopulation is below 30. Applying this threshold of 30 observations - the standard used in international reference like the OECD - avoids the publication of non-robust indicators due to low n-values. Moreover, it also ensures that the privacy of the respondents in this small subpopulation is not compromised.

2.3.2. Comparability with MORE2

Comparability with MORE2 estimates was one of the main goals when designing the approach and developing the questionnaire in MORE3. For this reason, the sampling approach and data editing approach is the same as in MORE2. Only the implementation was improved based on the lessons learned in MORE2. This means the methodology is the same, but better results in terms of accuracy are obtained.

It is important to stress the fact that the two studies do not follow a panel design. This entails that MORE2 and MORE3 are independent from each other in the sense that the two surveys do not include responses from the same individuals. MORE2 and MORE3 offer solid ground for the study of the evolution of indicators at aggregate level between the two points in time, but cannot serve to analyse the evolution of small subgroups (e.g. the abovementioned threshold of 30 observations).

Also the questionnaire was based strongly on the MORE2 questionnaire. The evolving policy context did require a shift in focus towards, for example, skills development, intersectoral and interdisciplinary mobility, open science, etc. For this reason, a number of questions were deleted, replaced or added. Apart from this natural evolution, the key questions were not changed in any way and for questions where a change was needed, the team still took into account maximum comparability.

These general principles in the development of the approach and questionnaire have resulted in strongly comparable indicators between MORE2 and MORE3, in particular in terms of what concerns the key indicators on working conditions and mobility of researchers in Europe. However, we need to point out that comparability is in a limited number of cases affected by the following:

- Changes in the question which may have led to alternative interpretation (e.g. the questions on collaboration partners, recruitment and dual positions);
- Changes in the order of the questions which may have led to another position towards the question (1 case: the question on open, transparent and merit-based recruitment);
- Small changes in routing (but always including more target groups than in MORE2 so that comparability is still possible);
- Different sample composition (e.g. slightly different distribution in career stages with more senior researchers in MORE3 and the share of R1 researchers who are not enrolled in PhD programme is larger in MORE3 than in MORE2)
- The introduction of new questions; i.e. that were not included in MORE2 (e.g. on skills training, dual careers and funding).

Finally, also in the analysis phase, the same principles are applied in MORE3 as in MORE2. In a limited number of cases, we agreed upon a new approach and applied this new approach also to MORE2 data in order to again obtain comparable results. This is,

for example, the case in the calculation of composite indicators, when grouping types of working conditions or mobility motives together.

Further points of attention or limitations on the interpretation of specific indicators are explicitly mentioned in the relevant sections on analysis and results.

3. Survey methodology of the Global survey

The Global survey focuses on mobility patterns, career paths, employment and working conditions of researchers currently working outside Europe. The topics are similar to those in the Task 1 EU HE survey, but the focus is different:

	Task 1 EU HE survey	Task 2 Global survey[235]
Target region of employment	Researchers currently working IN the EU	Researchers currently working OUTSIDE the EU
Target sector[236]	Researchers at higher education institutes	No specific sectoral focus (both researchers from higher education institutes and other organisations can participate)
Career stage focus	Differentiates between PhD-mobility (R1) and post-PhD mobility (R2-R4)	Does not differentiate between PhD mobility (R1) and post-PhD mobility (R2-R4)
Representative data	Provides representative data at the EU28 and country level	Does not provide representative data at the EU28 and country level

The target population of the Global survey consists of the following subgroups (in line with the analysis in MORE2[237]):

- TG1: European researchers currently working outside the EU[238];
- TG2: Non-EU researchers who have worked in the EU in the past;
- TG3: Non-EU researchers who have worked abroad but not in the EU;
- TG4: Non-EU researchers who have never worked abroad.

The following sections first present the main characteristics of the sampling methodology and the country focus followed for the Global survey. Then, an overview is given for the distribution strategy, the composition of the sample and the interpretation of the results.

3.1. Sampling strategy and country focus

The sampling approach for the Global survey is characterised as 'convenience' sampling (similar to the MORE2 Extra-EU survey[239]). A multichannel approach was applied:

[235] Consistent with the MORE2 approach.
[236] A broad definition of 'sector' is used here: it is based on the difference between Higher Education Institutions; private-not-for-profit organisations; public sector and government; large companies; and SMEs.
[237] IDEA Consult et al, 2013. MORE2 - Support for continued data collection and analysis concerning mobility patterns and career paths of researchers, Extra-EU report (WP2). European Commission, DG Research and Innovation.
[238] EU28 + 3 Associated Countries (Switzerland, Norway and Iceland).
[239] IDEA Consult et al. (2013) Support for continued data collection and analysis concerning mobility patterns and career paths of researchers. EXTRA-EU report.

- Via a web-based contact collection approach, email addresses of researchers currently working outside the EU were obtained. These researchers were contacted via email, including a personalised link to the online survey (more detailed information is provided in section 3.2);
- Via the Euraxess Links (Officers), email addresses of researchers were obtained. These researchers were contacted via email, including a personalised link to the online survey;
- Via an open communication strategy, a non-personalised link to the online survey was distributed on the MORE3 website, EC websites and via intermediary organisations.

The Global survey had a global outlook: it was directed towards researchers currently working outside the EU. A special emphasis was put on the (larger) countries that have an S&T agreement with the EU, on some countries associated to Horizon2020 such as Turkey and Israel and on the ASEAN countries. Below an overview is provided of these countries. Researchers who are currently working in countries that are not included in this list were not excluded from the survey, but they were not specifically targeted by the communication strategy.

- (Large) countries with an S&T agreement[240]: Argentina, Australia, Brazil, Canada, Chile, China, Colombia, India, Japan, Mexico, New Zealand, (Russia), South Africa, (South Korea), United States;
- ASEAN: Singapore, Malaysia, Indonesia and Thailand;
- Other Associated Countries with Horizon2020 (FP7): Turkey and Israel.

3.2. Distribution strategy

Different communication channels were used in order to reach out to as many researchers outside the EU as possible. The multi-channel strategy includes a direct contact approach and an indirect contact approach:

- In the direct contact approach, researchers received a personalised email with a link to the Global survey.
- In the indirect contact approach, a link to the Global survey was included on the website of MORE3 and the EC. Intermediary organisations were contacted with the request to distribute the link to the Global survey via their own communication channels (website, newsletter, social media etc.).

Below, more details are provided on these different contacting and communication approaches (Table 20).

Table 20: Overview table communication strategy

Communication strategy	Panel versus non-panel	Focus
Targeted email approach towards researchers (contacts obtained via web-based approach)	"panel" responses": the researchers received an email including a personalised link to the Global survey.	Focus on HE researchers.
Targeted email approach towards researchers (contacts obtained via	"panel" responses": the researchers received an email including a	No focus on HE researchers. Euraxess is open to HE and non-HE researchers, but

[240] http://ec.europa.eu/research/iscp/index.cfm?pg=countries.

Euraxess Links officers)	personalised link to the Global survey.	there is a high bias towards HE researchers.
Communication via websites, intermediary organisations, etc.	"non-panel response": there was a non-personalised open link to the Global survey.	No focus on HE researchers. Due to the open approach, it is possible that non-HE researchers responded to the survey.

Source: The consortium

Email to researchers using the web-based contact collection approach

Email addresses of HE researchers (working outside Europe) were collected using a web-based contact collection approach (similar to MORE2). In MORE2, the main focus of this approach was on US researchers. The aim of the MORE3 study is broader and therefore the strategy entailed a broader outreach (cf. also section 3.1).

Email to researchers via Euraxess Links officers

Euraxess Links is a networking tool for the community of European Researchers abroad[241]. As a part of the networking purpose, it also focuses on disseminating information and fostering collaboration with researchers in Europe and helping the expatriate researchers to return to Europe[242]. Euraxess Links was launched in 2006 in the US. Now there are Euraxess links officers in North America, Japan, China, India, ASEAN (Singapore, Malaysia, Indonesia and Thailand) and Brazil. Via the Euraxess Links officers, the contact details (email) of researchers who are connected with Euraxess Links countries were obtained and the researchers received an email invitation to participate to the survey.

Open communication strategy

Aside from contacting researchers directly via email including a personalised web link, there was also an "open" web link to the online survey. This allowed all those interested to participate in the survey. A drawback of the approach is that there was no control over who participated to the study and it was therefore not possible to address/remind them personally. It was thus not possible to support or steer the response rate for specific countries through this channel. In addition, a certain self-selection bias is possible: researchers that participated in the study might present some characteristics that distinguish them from the general population. This type of bias is, however, difficult to measure in the absence of population data (i.e. the population of researchers in the world).

There are different channels through which the open web link was distributed:

- A dedicated website on the MORE3 project with information on the context and set-up of the study was developed and launched as part of the first phase of the MORE3 project: http://www.more3.eu. The link to the online Global survey was placed visibly on the main page of the website so that all website visitors could easily access the survey.
- The open web link has been communicated via the EC's own communication channels, more specifically Euraxess Worldwide and the Marie Skłodowska-Curie website.

- Aiming at a broad outreach, the online Global survey link was disseminated as widely as possible. Therefore relevant intermediary organisations were asked to distribute the link.
  - Euraxess Worldwide;
  - National research funding agencies;
  - The EU centres of excellence around the world.

Snowballing

In addition to the different approaches explained above, also "snowballing" was used as a source to increase the survey sample. All respondents to the survey had the opportunity to forward the survey link to other researchers (these were then included in the non-panel responses).

3.3. Sample description

Researchers were ex-post classified in four subgroups based on the information provided in the questionnaire. An overview of the number of responses by researcher/target group is provided in Table 21 below[243].

An overview of country of citizenship per target group is provided in Table 22. The respondents of the Global survey consist of 417 EU citizens and 1,310 non-EU citizens. The majority of responses were obtained from researchers originating from Anglo-Saxon countries.

[243] 213 responses were obtained from EU researchers who have been mobile more than 10 years ago or who have not been mobile. To remain focused on the topics of mobility and career paths in the past ten years, these responses were not considered for further analysis (this is also consistent with the approach of the MORE2 Extra-EU survey and the MORE3 EU HE survey).

Table 21: Survey response rate per target group (completed responses)

Target groups	Who were mobile for more than 3 months in the past ten years	Who were mobile for more than 3 months but more than 10 years ago	Who have never been mobile	Total (n)	Share (%)
TG1: EU researchers currently working abroad	417	(81)	(132)*	630	32.5%
TG2: Non-EU researchers who have worked abroad in the EU in the last ten years	263			263	13.6%
TG3: Non-EU researchers who have worked abroad but not in the EU	178			178	10%
TG4: Non-EU researchers who have never worked abroad		211	658	869	44.8%
Total	**858**	**292**	**790**	**1,940**	
Responses outside the scope				213 (81+132)	
Total sample				**1,727**	

Source: MORE3 Global survey (2017)
Note:

- There were 132 researchers currently working abroad who have never been mobile that have an EU nationality. These cases can refer to very diverse circumstances. People with double citizenship (EU and non-EU) but who have never been to the EU. People who moved to another country to do their Master degree are not considered mobile in this study. People who were born outside Europe or that moved as a child but retained EU nationality would also be included in this group. Due to the heterogeneity of this group, these researchers are not taken into account for the analysis.

Table 22: Distribution of respondents by countries of citizenship and target groups

Country of current citizenship	European researchers currently working outside the EU	Non-European researchers who have worked in the EU in the past	Non-European researchers who have worked abroad, but not in the EU	Non-European researchers who have never worked abroad	Total
Total					
	417	**263**	**178**	**869**	**1,727**
European citizenship					
	417	**0**	**0**	**0**	**417**
Austria	14	0	0	0	14
Belgium	19	0	0	0	19
Bulgaria	2	0	0	0	2
Cyprus	2	0	0	0	2
Czech Republic	1	0	0	0	1
Denmark	4	0	0	0	4

Finland	2	0	0	0	2
France	52	0	0	0	52
Germany	55	0	0	0	55
Greece	11	0	0	0	11
Hungary	2	0	0	0	2
Iceland	1	0	0	0	1
Ireland	15	0	0	0	15
Italy	55	0	0	0	55
Malta	1	0	0	0	1
Netherlands	23	0	0	0	23
Norway	3	0	0	0	3
Poland	13	0	0	0	13
Portugal	11	0	0	0	11
Romania	5	0	0	0	5
Slovakia	2	0	0	0	2
Slovenia	1	0	0	0	1
Spain	34	0	0	0	34
Sweden	2	0	0	0	2
Switzerland	13	0	0	0	13
United Kingdom	74	0	0	0	74
Non-European citizenship					
	0	**263**	**178**	**869**	**1,310**
Argentina	0	8	7	19	34
Australia	0	40	18	128	186
Brazil	0	27	16	66	109
Canada	0	40	21	114	175
Chile	0	7	9	30	46
China	0	8	3	11	22
Colombia	0	18	7	49	74
India	0	14	2	28	44
Indonesia	0	3	3	3	9
Israel	0	6	9	12	27
Japan	0	5	1	11	17
Malaysia	0	0	1	6	7
Mexico	0	13	7	32	52
New Zealand	0	20	11	47	78
Russia	0	8	5	42	55
Singapore	0	0	2	2	4
South Africa	0	6	7	42	55
South Korea	0	0	3	5	8
Thailand	0	3	0	8	11
Turkey	0	8	7	39	54
United States	0	14	26	110	150
Other	0	15	13	65	93

Source: MORE3 Global survey (2017)

3.4. Interpretation of the results

3.4.1. Potential and limitations of the resulting sample

The Global survey did not provide representative data at the level of the countries covered. As there are no weights applied, this means that the dataset does not provide representative data on the number of researchers and their mobility patterns from and to specific countries. This sample does not reflect the proportion of researchers currently working outside the EU within the overall population of researchers currently working outside the EU. Therefore, results need to be interpreted with care and no generalisations/extrapolations can be made in this regard.

3.4.2. Comparability with MORE2

For Task 1 of the study, the MORE3 EU HE report, a comparison was made between the results of the MORE2 EU HE survey and the MORE3 EU HE survey. This was possible as the results of both surveys are based on a representative sample of researchers currently working in the EU.

Such a comparison between the two surveys is not possible for the Global survey, primarily because this survey is not based on a representative sample of researchers currently working outside the EU. In addition, the scope of the MORE3 Global survey is much broader than it was in MORE2. While in the MORE2 extra-EU survey the main focus was on US researchers, the scope now is broadened with (large) countries with which the EU has an S&T agreement, ASEAN countries, as well as other Associated Countries with Horizon2020 and FP7.

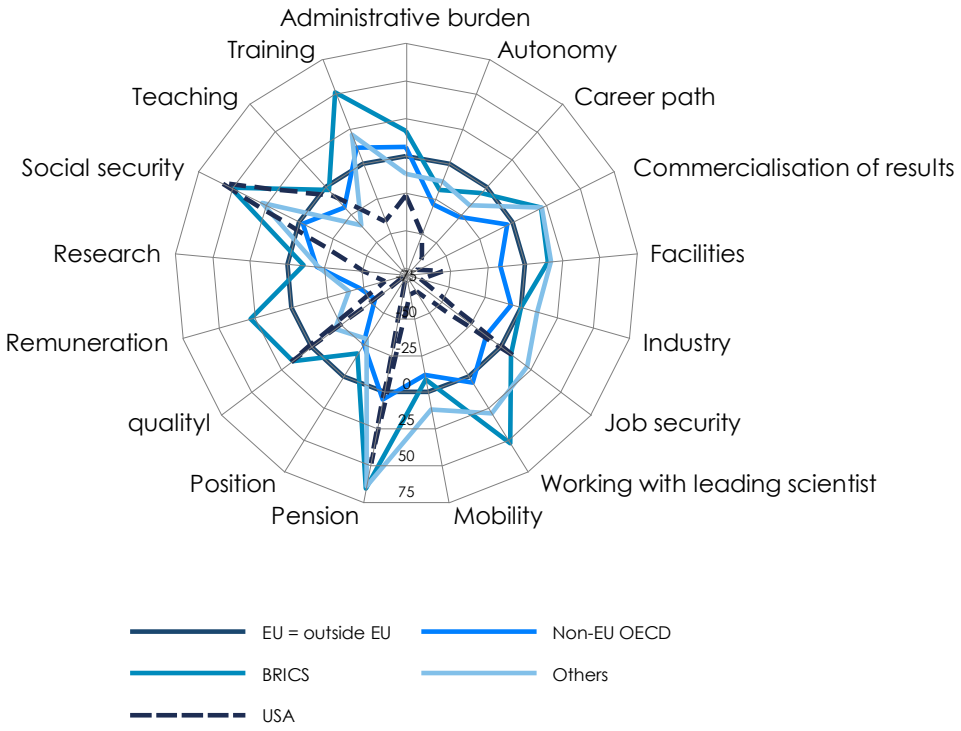
4. Questionnaires

Cf. separate documents:

- Questionnaire EU HE survey
- Questionnaire Global survey

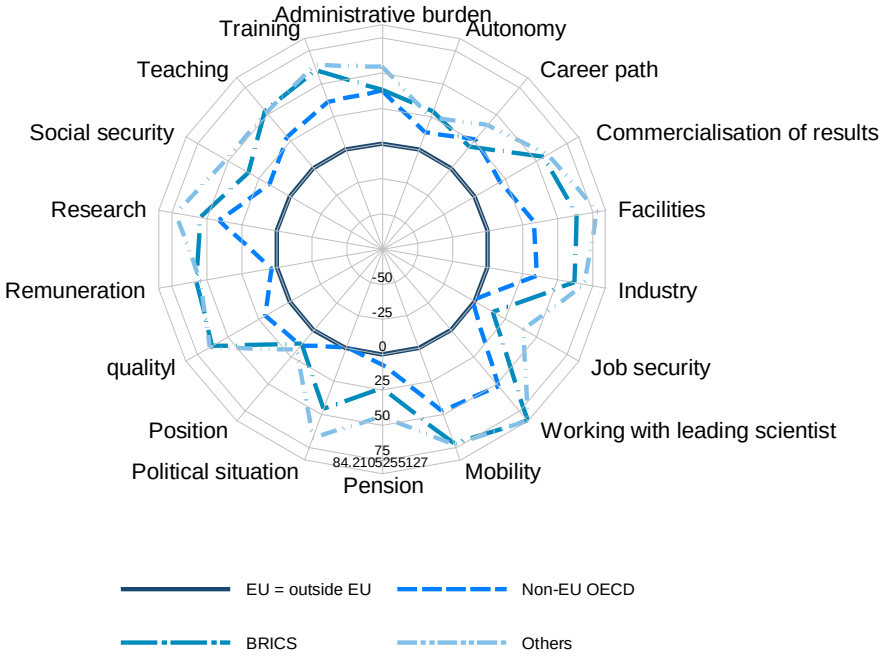
5. Additional tables and figures

Figure 30: Perception of EU attractiveness by EU researchers abroad grouped by their current country of employment



Source: MORE3 Global survey (2017) – Figure 131 in Global survey
Notes:
- Only EU researchers who work outside the EU, grouped by their current country of employment.
- Based on question 50: "How does working in … compare to working as a researcher in Europe? Please indicate if something is worse, similar or better in … than in Europe."
- (n= 415)

Figure 31: Perception of EU attractiveness by non-EU researchers who have been mobile to the EU grouped by their current country of employment



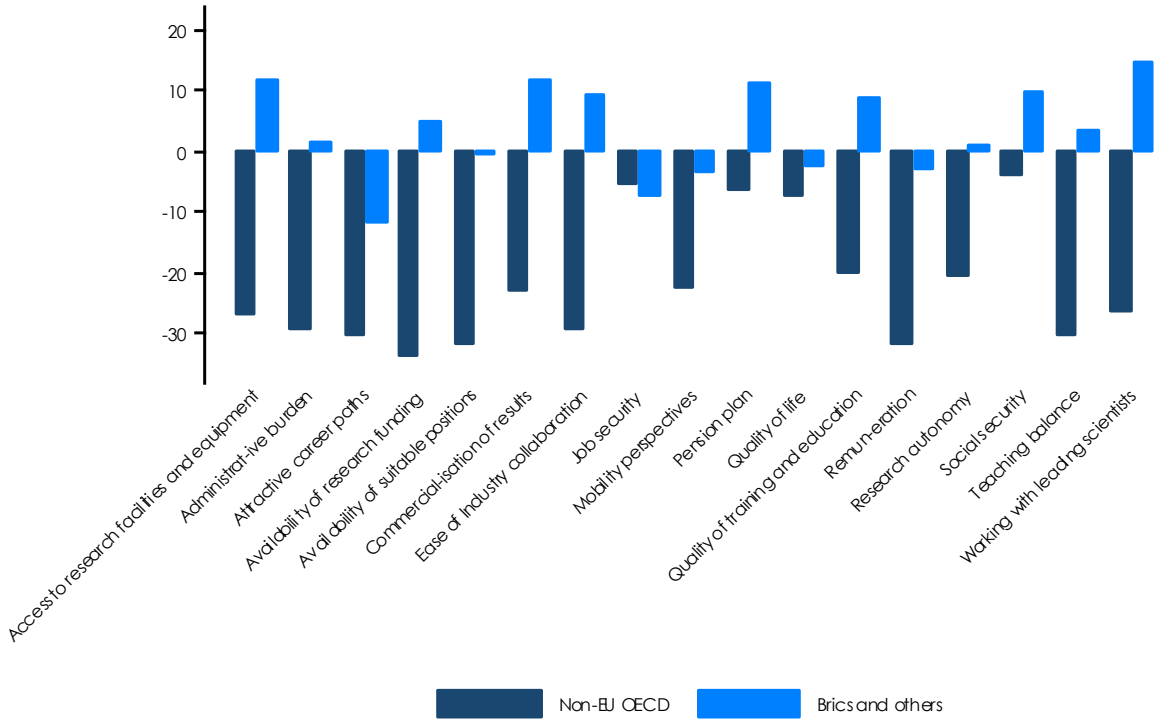
Source: MORE3 Global survey (2017)
Notes:
- Only non-EU researchers who have been mobile to the EU, grouped by their current country of employment.
- Based on question 60: "How does working as a researcher in Europe compare to your current employment in …? Please indicate if something is worse, similar or better in Europe than in ..."
- (n= 261)

Table 23: Comparison between working outside the EU and working inside the EU as a researcher: full set of data of the figures above

	EU researchers abroad				Non-EU researchers mobile to the EU		
	USA	Non-EU OECD	BRICS	Others	Non-EU OECD	BRICS	Others
Career path	-63.6	-27.2	-5.4	-16.7	26.7	20.0	40.0
Condition for scientific knowledge production	-42.9	-12.1	8.8	-5.6	34.5	53.8	60.9
Administrative burden	-26.2	6.1	16.7	-12.0	37.6	38.0	54.5
Autonomy	-50.0	-29.2	-18.4	-12.5	13.2	29.3	24.3
Facilities	-55.1	-16.3	15.4	17.4	33.6	63.8	78.4
Working with leading scientists	-66.7	4.9	52.6	29.2	52.1	83.9	84.2
Research funding	-51.2	-19.6	-10.8	-20.8	41.5	54.9	72.2
Teaching	-8.1	-18.6	-2.9	-34.8	28.8	53.1	51.5
Engagement with industry	-70.6	-5.5	10.5	16.3	27.9	59.0	64.2
Commercialisation of results	-71.4	-4.3	21.1	21.4	20.6	56.1	59.3
Industry	-69.8	-6.7	0.0	11.1	35.2	61.9	69.2
Mobility	-66.3	-11.6	-8.6	12.0	47.3	72.0	72.7
Position	-79.5	-26.0	-17.9	-29.2	14.4	12.8	18.2
Remuneration	13.9	-22.2	33.8	10.7	9.0	38.4	50.9
Remuneration	-64.8	-47.4	28.2	-40.0	3.9	57.4	54.8
Social security	57.8	-2.5	51.4	28.0	16.7	33.3	51.7
Pension	48.2	4.9	65.7	64.0	6.8	23.7	44.0
Job security	11.6	-12.7	8.3	21.7	-2.1	14.6	39.3
Quality of life	16.7	-53.4	15.4	-20.0	19.9	63.0	64.9
Training	-41.2	11.4	51.4	20.8	36.2	60.4	63.9
Political situation	-	-	-	-	-0.8	45.8	67.7

Source: MORE3 Global survey (2017)
Notes:
- See Figures 30 and 31
- Negative numbers indicate higher share of researchers who think that it is better outside the EU than inside.

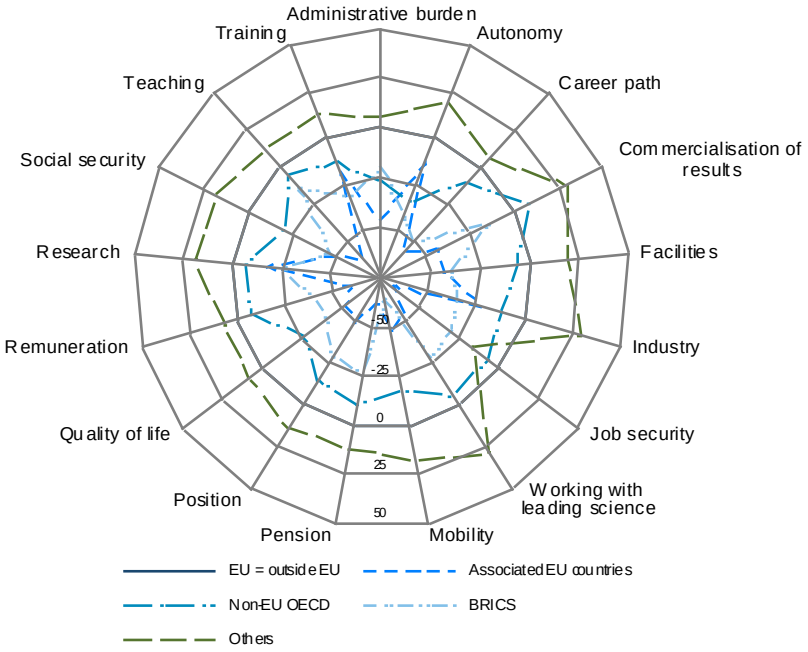
Figure 32: Balance of researchers perceiving the EU as better or worse than other research areas, in %



Source: MORE3 EU HE Survey (2016) and MORE3 Global survey (2017)
Notes:

- Based on weighted averages of the questions 47 and 76 of the EU survey, and on questions 50 and 60 of the Global survey (see Figure 30 and Figure 31 above); n=1820.
- Negative values indicate that working inside the EU is perceived as worse than outside the EU.

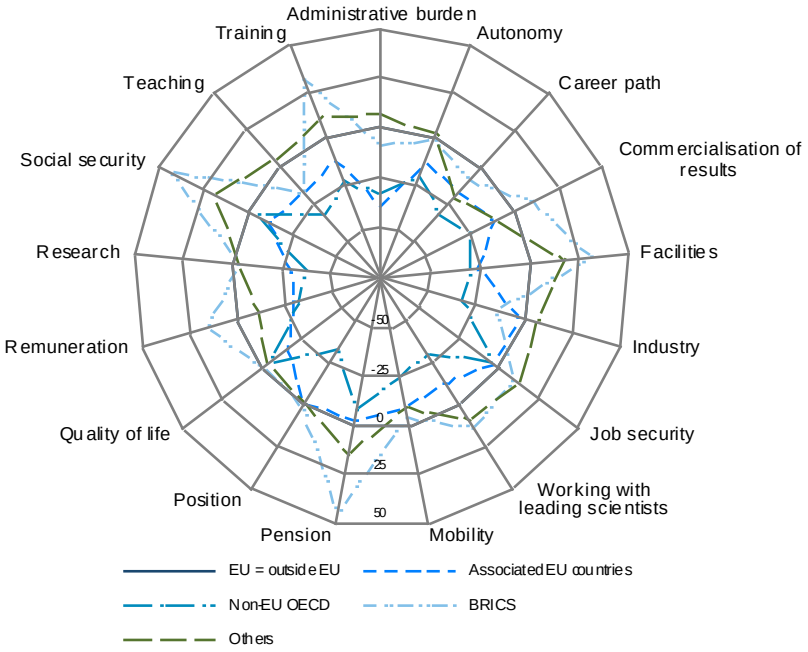
Figure 33: Comparison between working outside the EU and working inside the EU as a researcher by region of citizenship, detailed indicators



Source: MORE3 EU HE Survey (2016) - Figure 166 in EU HE Report
Notes:

- Based on question 47: "How does working as a researcher outside the EU compare to inside the EU? Please indicate if something was worse, similar or better outside the EU than in the EU."
- (n=339)

Figure 34: Comparison between working outside the EU and working inside the EU as a researcher by mobility experience, detailed indicators



Source: MORE3 EU HE Survey (2016) – Figure 167 in EU HE Report
Notes:
- Based on question 76: "How does working as a researcher outside the EU compare to inside the EU? Please indicate if something was worse, similar or better than in the EU."
- (n=805)

Getting in touch with the EU

IN PERSON
All over the European Union there are hundreds of Europe Direct Information Centres.
You can find the address of the centre nearest you at: http://europa.eu/contact

ON THE PHONE OR BY E-MAIL
Europe Direct is a service that answers your questions about the European Union.
You can contact this service
– by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),
– at the following standard number: +32 22999696 or
– by electronic mail via: http://europa.eu/contact

Finding information about the EU

ONLINE
Information about the European Union in all the official languages of the EU is available on the Europa website at: http://europa.eu

EU PUBLICATIONS
You can download or order free and priced EU publications from EU Bookshop at: http://bookshop.europa.eu. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see http://europa.eu/contact)

EU LAW AND RELATED DOCUMENTS
For access to legal information from the EU, including all EU law since 1951 in all the official language versions, go to EUR-Lex at: http://eur-lex.europa.eu

OPEN DATA FROM THE EU
The EU Open Data Portal (http://data.europa.eu/euodp/en/data) provides access to datasets from the EU. Data can be downloaded and reused for free, both for commercial and non-commercial purposes.

The MORE III study aims at updating, improving and further develop the set of indicators of the MORE2 study in order to meet the need for indicators over time and assess the impact on researchers of policy measures introduced for the development of an open labour market for researchers. This study gathers data to highlight emerging policy needs and priorities regarding mobility patterns, career paths and working conditions of researchers.

The study carries out two surveys: the first one addressed to researchers currently working in the EU (and EFTA) in higher education institutions (HEI) and the second one to researchers currently working outside Europe.

Studies and reports

Publications Office