

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

Deliverable 8 – Final report MORE2

Prepared for:

**European Commission
Research Directorate-General
Directorate B – European Research Area**

IDEA Consult

in consortium with:

- **Austrian Institute of Economic Research, WIFO**
- **iFQ, Institute for Research Information and Quality Assurance**
- **CHEPS, Center for Higher Education Policy Studies, University of Twente**
- **LaSapienza - University of Rome**
- **CFA, Danish Center for Research and Research Policy, Aarhus University**

and its subcontractors:

- **University of Wolverhampton**
- **Loft33**
- **CheckMarket**
- **Interago**

Brussels, August 2013



TABLE OF CONTENTS

0	EXECUTIVE SUMMARY	6
0.1.	Introduction _____	6
0.2.	Human resources of researchers: stock and evolution _____	7
0.3.	Career paths and working conditions of researchers _____	9
0.4.	Remuneration of researchers _____	14
0.5.	Stock of internationally mobile researchers _____	16
0.6.	Mobility flows of researchers _____	23
0.7.	Motives for international mobility _____	25
0.8.	Barriers to international mobility _____	27
0.9.	Effects of international mobility _____	29
0.10.	Attractiveness of the research environment _____	31
0.11.	Overall conclusions and potential policy implications _____	33
PART 1	OBJECTIVES AND METHODOLOGY OF THE MORE2 PROJECT	36
1	INTRODUCTION	37
2	GENERAL BACKGROUND	38
2.1	EU2020 Strategy and the European Research Area _____	38
2.2	Innovation Union Flagship initiative _____	39
2.3	Important initiatives: a selection _____	40
3	OBJECTIVES AND DELIVERABLES	43
3.1	Objectives _____	43
3.2	Deliverables _____	44
3.3	Scope _____	45
3.4	Contribution of the MORE2 study _____	46
3.5	Conceptual framework and outline of the Final Report _____	49
4	METHODOLOGY AND APPROACH	50
4.1	Introduction _____	50
4.2	The different work packages _____	50
4.3	Data collection methods _____	51
4.4	Analytical approach _____	55
5	CONCEPTUAL BASIS	56
5.1	Introduction _____	56
5.2	Definition of 'researcher' _____	56
5.3	Selected 'fields of science' (FOS) _____	57
5.4	Defined 'career stages' _____	58
5.5	Definitions and forms of 'mobility' _____	61

PART 2	MAIN FINDINGS	63
1	INTRODUCTION	64
2	EUROPEAN RESEARCHER POPULATION	65
2.1	Researcher indicators _____	66
2.2	Researcher demographics: estimates from the EU HEI _____	71
2.3	Social demographics: estimates from the EU HEI _____	72
3	CAREER PATHS AND WORKING CONDITIONS OF RESEARCHERS	73
3.1	Career path _____	74
3.2	Country comparison and attractiveness _____	90
3.3	Satisfaction and career progression _____	95
4	REMUNERATION OF RESEARCHERS	100
4.1	Remuneration of researchers in Europe _____	101
4.2	Remuneration factors _____	103
4.3	Country comparison and attractiveness _____	107
4.4	Sector comparison and attractiveness _____	114
5	STOCKS OF MOBILITY OF RESEARCHERS	118
5.1	Measurement of mobility _____	120
5.2	Stock of mobility _____	121
5.3	Mobility and collaboration profiles _____	145
6	MOBILITY FLOWS OF RESEARCHERS	148
6.1	Pull: destination _____	149
6.2	Push: departure/origin _____	152
6.3	Extra-EU flows _____	154
7	MOTIVES FOR INTERNATIONAL MOBILITY	155
7.1	Motives _____	156
7.2	Factors determining motives _____	162
8	BARRIERS TO INTERNATIONAL MOBILITY	166
8.1	Barriers _____	167
8.2	Factors determining perception of barriers _____	171
9	EFFECTS OF INTERNATIONAL MOBILITY	176
9.1	Effects _____	177
9.2	Factors determining effects _____	181
10	ATTRACTIVENESS OF THE RESEARCH ENVIRONMENT	186
10.1	How attractive is the EU as a research environment? _____	187
10.2	Which aspects of the EU research environment are particularly appreciated by researchers? _____	189
10.3	How can the attractiveness of Europe as a destination for researchers be improved? _____	192

10.4	How does this compare to the non-EU research environment? _____	194
PART 3	OVERALL CONCLUSIONS AND POTENTIAL POLICY IMPLICATIONS	195
1	INTRODUCTION	196
2	METHODOLOGICAL CONSIDERATIONS	197
2.1	Related to the EU HEI survey _____	197
2.2	Related to the Extra-EU survey _____	199
2.3	Related to the case studies on career paths, working conditions and remuneration _____	200
2.4	Related to the Researcher Indicators _____	201
2.5	In summary _____	201
3	KEY FINDINGS IN A THEORETICAL CONTEXT	202
3.1	Career paths of researchers _____	202
3.2	Working conditions for researchers _____	204
3.3	International research collaboration, visits and virtual technology _____	206
3.4	Motives for researcher mobility _____	207
3.5	Barriers to researcher mobility _____	209
3.6	The effects of researcher mobility _____	211
3.7	Flows of mobility of researchers and attractiveness _____	214
4	POLICY IMPLICATIONS	216
5	TOPICS FOR FUTURE RESEARCH	219
	LIST OF FIGURES	220
	LIST OF TABLES	223

0 EXECUTIVE SUMMARY

0.1. Introduction

The objective of the MORE2 study was to “provide internationally comparable data, indicators and analysis in order to support further evidence-based policy development on the research profession at European and national level.”

This final report provides a comparative, policy-focussed analysis concerning mobility patterns and career paths of researchers.

As part of the study, two large-scale surveys and two case studies were carried out between November 2011 and May 2013:

- I. A survey of more than 10,000 individual researchers currently working in the EU (27 Member States +6 Associated and Candidate Countries¹) in higher education institutions (HEI). The survey addressed researchers with both EU and non-EU citizenship. It also includes researchers who have been mobile outside the EU but have returned to work now in the EU. It does not include EU and non-EU researchers who are currently working outside the EU. Data are representative at country level.
- II. A survey of more than 4,000 individual researchers currently working outside the EU (27 Member States plus EFTA countries²). The majority (but not all) of the researchers in the sample work in higher education institutes. The survey includes i) EU researchers currently working outside the EU, ii) non-EU researchers who have worked in the EU in the past, iii) non-EU researchers who have not worked in the EU but who have been internationally mobile elsewhere and iv) non-EU researchers who have not been mobile at all.
- III. A case study on the working conditions and career paths of early career researchers in around 45 countries: the EU Member States plus the countries associated to FP7 and the USA, Canada, Japan, China, India, South Korea, Singapore, Australia, Brazil and Russia.
- IV. A case study on the remuneration of researchers in around 45 countries (same as above). This has resulted in a comparative analysis together with a set of detailed country profiles.

A comprehensive report on each of the surveys and case studies is available on the Commission’s website:

<http://ec.europa.eu/euraxess/index.cfm/services/researchPolicies>

In addition, the study included the development of a set of internationally-comparable indicators on stocks, flows, working conditions and career paths of researchers both in Europe and beyond.

A dedicated website www.more-2.eu has also been developed. This includes an online database containing around 150 indicators.

¹ Norway, Switzerland, Iceland, Croatia, Turkey, and the former Yugoslav Republic of Macedonia.

² Norway, Switzerland, Iceland and Liechtenstein

13% researchers have a dual position in academia and non-academia

13% of post-PhD researchers in the EU HEI survey indicated they had a dual position, i.e. they were working in both a university and in another sector outside academia.

On average, researchers are more likely than other employees to live in a couple and have children

74% of EU27 researchers live in a couple and around 69% have children. This compares to respectively 52% and 46% of all those employed in the EU27. The age structure of the researchers generally reflects that of the employed population in EU27, according to Eurostat.

stages. The major dividing line within all career stages is the provision of temporary versus permanent contracts and tenure-track options.

Typical for career stage R1 are the following characteristics: young researchers aged 30 years or even younger with somewhat low autonomy and for whom tenure-track options hardly exist. Differences among countries can be found in relation to the tasks researchers fulfil and also the type of contract offered.

R2 positions are typically researchers in their early 30s, engaged more in teaching than R1, having a low level of autonomy. There are country differences with respect to the age, the funding regime and the division of tasks.

The R3 career stage is the most diverse career stage. The picture is rather scattered with regard to combinations of the characteristics and thus, there are no main features characterizing this career stage. However, in a large number of countries there appears to be a transition towards more stable working conditions, which we define by the availability of permanent contracts.

Career stage R4 is characterized by researchers who obtain these positions in their late 40s, are employed on permanent contracts and engage in both research and teaching. Differentiating factors between groups are, again, whether or not tenure track options are available and the researcher's level of autonomy.

Career progress is country-specific with averages at 30 (R1), 36 (R2), 41 (R3) and 46-51 (R4) years old. In the majority of countries, career progression depends on the researcher's merits and performance and thus not only on seniority. International mobility is also a prerequisite for 'climbing the ladder' in more than one third of the countries.

Increasing job security in positions at later career stages

The share of permanent positions increases significantly when moving to the R3 stage. At this point, the majority of positions already offer permanent contracts. This share increases significantly again when moving from R3 to R4 and suggests that researchers typically find stable positions relatively late on in their career.

Common practice of basic/block funding

In most countries, funding for the majority of researchers at all career stages comes from block funding (57% of countries for R2 to 77% of countries for R4). The share of positions funded by competitive funding is highest at the R2 stage (11% majority competitive funding in the country and 13% balance of competitive and block funding), and lowest at the R4 stage (resp. 2% and 6%).

Academic autonomy relatively high; financial autonomy significantly lower

The conditions across the various career stages vary with regard to the autonomy granted to researchers. The degree of freedom is generally highest with regard to academic autonomy and lowest when it comes to financial aspects. Autonomy increases along the career path.

High teaching load in Eastern European countries

In the EU HEI survey, Eastern European countries show the highest proportions of teaching load versus other (research) activities: between 10 and 30% of researchers fall under the category '76-100% working time', versus an 8% EU27 average. In these instances, the time available for research is limited, making those positions less attractive for those who are pursuing a research career.

0.3.2. Focus on early stage researchers

PhD funding: Primarily funded by own institute

The majority of doctoral candidates or recent doctorate holders are primarily funded by their 'own institute'⁶ (42% as primary and 19% as secondary source of funding), followed by 'own funds' (17% as primary source of funding and 31% as secondary source). National government funding comprises the third source of funding, with 31% of doctoral candidates identifying this as their primary source and 10% as their secondary source. 4% of researchers receive funding from a European funding body as their primary source, with another 3% as their secondary source.

For post-doctoral researchers (R2), job insecurity appears to be the most important barrier to pursuing a research career.

The EU HEI survey shows a pronounced difference in satisfaction regarding job security between the career stages. During the early career stages, satisfaction is lower, and those in the post-doctoral stage (R2) feel particularly dissatisfied given the uncertainty about their positions. Up to 43% of R2 researchers are dissatisfied with job security in their current post, compared to 38% in R1, 25% in R3 and 11% in R4. Linked to this is the fact that these post-docs (R2) are less satisfied with opportunities for advancement (45% dissatisfied in R2 versus 40% in R3 and 33% in R4).

Contractual situation: Precarious contractual situation for 31% of doctoral candidates

In general, the share of stable contracts increases over the career stages. Many researchers work on a fixed-term contract or may have no contract at all. This is most pronounced during early career stages R1 and R2. Those with no contracts, 'others' (often student status) and researchers with fixed term contracts of one year maximum, amount to 31% of the R1 doctoral candidates, 10% of R2, 4% of R3 and 3% of R4. Moreover, 55% of researchers in R1 with a PhD and 47% in R2 also have fixed-term contracts, albeit of a slightly longer duration than 12 months.

0.3.3. Skills of doctoral candidates

'Structured' doctoral training: more than 50% half of doctoral candidates report receiving specific training

High quality, industry-relevant doctoral training is instrumental in meeting the increased demand for knowledge workers. In this regard, a set of best practice-based Principles for Innovative Doctoral Training has been identified and endorsed in recent EU Council conclusions⁷.

The country case studies show that while 'structured training' is not necessarily mandatory, it is the predominant way to gain a PhD in the majority of countries.

Respondents to the EU HEI survey were also asked about the type of doctoral training they receive. 57% of doctoral candidates and 47% of R2 doctorate holders reported that they received 'structured training' during their PhD. Of those

⁶ This can comprise both block funding and competitive funding. This observation on funding sources is based on the MORE2 HEI survey (2012) data and is thus not directly related to the observation from the country cases (WP3) that the majority of R1 researchers in the 61% of the countries are funded through basic/block funding.

⁷ Report of Mapping Exercise on Doctoral Training in Europe: Towards a common approach (European Commission, 2011)

that received such training, the vast majority (around 85%) received up to two weeks training per year while about 15% received more than two weeks. Even though there is a 'leakage' between the R1 and R2 stages to other employment types or jobs outside the higher education sector, an increasing number of researchers appear to be receiving 'structured training' modules.

Scandinavian countries appear to provide relatively more early stage researchers with 'structured training' modules, as do the Netherlands, the United Kingdom, Bulgaria and the Baltic countries Estonia and Latvia. In contrast, researchers in Germany, France, Romania, Poland and Italy appear less likely to receive such training.

Focus on communication and presentation skills, less on entrepreneurial skills

Content-wise, training modules in 'communication and presentation skills' are the most common (reported by 40% of PhDs). Skills which are more directly related to non-academic positions, such as people management, intellectual property rights and entrepreneurship, are less common features of training programmes in HEI (11%, 10% 8% respectively). Ethics training is provided to over 30% of researchers in Scandinavian countries and the United Kingdom.

Doctoral candidates and recent doctorate holders who have received 'structured training' are generally satisfied with its relevance, especially in the Scandinavian countries, Portugal, Estonia, Ireland and Hungary: over 85% are (very) satisfied.

0.3.4. Determinants of attractiveness of research position or working environment

Career prospects and research autonomy motivate researchers to accept a research position on condition that their 'quality of life' is not negatively impacted

Based on a stated choice experiment, the determining factors for a researcher to accept a new position (not necessarily in another country) are "career perspectives" and "research autonomy". The one proviso is that their "quality of life" is not adversely affected.

R3 and R4 researchers put more emphasis on the material component of a position

Researchers at a later career stage are more likely than those at the early career stage to value the material aspects of a job: salary, attractive grant systems, minimal administrative burden and the ease of starting new lines of research. Both early and late stage research positions are more attractive when accommodating a fair balance between teaching and research.

0.3.5. Satisfaction levels with current position

High degree of satisfaction with academic aspects of post; lower degree of satisfaction as regards remuneration and job security

The majority of PhDs are satisfied with the academic aspects of their PhD work, such as intellectual challenge (94%), the reputation of the employer (91%), their level of responsibility (89%) and degree of independence (89%). On the other hand, only 54% are satisfied with benefits, 59% with salary and 62% with job security. Post-docs (R2) are more dissatisfied than other researchers with their degree of independence, opportunities for advancement and salary. A similar pattern is observed for researchers in post-PhD career stages.

Opportunities for advancement: Female researchers are less satisfied than their male counterparts

Females are less satisfied with opportunities for advancement than are their male colleagues (7 pp⁸ difference with male researchers; mobility perspectives (6 pp difference); job security (6 pp difference) and salary (5 pp difference). This opinion-based data appears to match other fact-based data in the survey which show that females are less likely to be mobile, and also less 'present' in more senior positions.

⁸ Percentage Points.

Correlation between the innovation profile of a country and the wage setting mechanisms and level of institutional autonomy

Major differences in setting academics' salary levels and increases exist between countries with different innovation capacities. Countries which are innovation leaders¹⁰ pay slightly higher wages, but more importantly, also allow more wage dispersion within positions than countries that show a lower innovation performance.

In countries that are innovation leaders, the salaries for academic positions are more often determined by the research institutions themselves rather than by law. They also put a lower emphasis on seniority and a larger one on performance for pay increases as well as emphasizing individual negotiations more strongly than pre-determined wage scales for wage increases.

Research institutions in the EU27 as a rule grant fewer provisions and bonuses to their staff than research institutions outside the EU27, and the value of these provisions and bonuses as a percentage of the salary is smaller.

Research performing organizations have more autonomy in wage setting and tend to pay higher wages

Research performing organizations (RPOs) more often negotiate salaries individually, are less bound to remuneration schemes by law and have a greater tendency to provide performance related salary increases than universities.

RPOs also generally pay higher salaries and allow substantially fewer additional jobs than universities, and among universities wages are lower in physics and economics than in engineering with researchers in engineering also earning more in additional jobs than in other disciplines.

0.4.2. Remuneration at junior and senior research level

Research institutions were given two standardised CVs, one for a senior and another for a junior researcher and asked about the typical type of contract provided to these two theoretical employees as well as about salaries, fringe benefits and holiday regulations.

Lower wages, higher insurance and social security for both junior and senior researchers in EU27

In terms of net salaries (also including mandatory deductions), both the junior and the senior researcher defined in the standardized CV would earn less at both the typical EU15 and EU12 university than at universities located outside the EU27. Although these differences diminish when taking into account mandatory contributions, they remain sizeable even after this adjustment.

The lower net wages in the EU countries are associated with much higher coverage by compulsory insurance and a more generous health insurance system. This suggests that - at least in part - researchers in the EU27 countries are compensated for the fact that their net wages are lower than those of their peers in non-EU27 countries through a more generous compulsory social security system. Although we cannot quantify the value of this better social security system to the researchers with the data at hand, this implies that comparing researcher salaries on the basis of net wages may overestimate the salary disadvantage of the EU27 countries relative to the non EU27-countries.

¹⁰ Countries are divided into four groups based on their innovation performance, cf. European Commission (2013), "Innovation Union Scoreboard 2013"

0.5.2.1. PhD mobility

Two types of PhD mobility are measured: mobility in order to obtain a PhD in a country other than the country of highest previous degree (PhD degree mobility); and mobility during the PhD of at least three months to another country but with a return 'home' to obtain their PhD.

14% of current or recent doctoral candidates in EU HEI moved to another country to obtain their PhD

14% of doctoral candidates and recent doctorate holders indicate that they are/were internationally PhD degree mobile, i.e. they obtained or will obtain their PhD in another country than the one in which they obtained their previous degree (i.e. the degree giving access to the PhD). The current doctoral candidates will be more PhD degree mobile than the R2 doctorate holders (19% versus 12%).

18% of current or recent doctoral candidates in EU HEI were >3 month mobile during their PhD (returning 'home' to obtain their PhD)

Around 18% of doctoral candidates and recent doctorate holders move for three months or more to another country (not restricted to the EU) during their doctoral research, returning 'home' to obtain their PhD.

0.5.2.2. >3 month mobility in post-PhD career stages

Around 30% of EU HEI researchers were mobile for three months or more during the last ten years of their post-PhD career

31% of post-PhD researchers in the EU27 have worked abroad (EU or worldwide) as researchers for more than three months at least once during the last ten years.

Another 17% have been >3 month mobile but more than ten years ago. This means that around 48% of the researcher population has been mobile at least once in their career following their PhD.

Based on a comparison of mobility in the last three years (instead of last ten years), R2 researchers are more likely to be mobile than their counterparts in later career stages.

0.5.2.3. Employer mobility¹¹

Researchers are more likely to change employer when moving outside the EU than moving within the EU

According to the EU HEI survey, 12% of researchers have worked abroad for a new employer (for 3 months or more and at least once in the last ten years). This represents around 40% of all mobile researchers and provides an indication of 'employer' mobility.

Among HEI researchers currently working in the United Kingdom, Austria, Cyprus, Estonia, Ireland, Finland and Switzerland, the majority of >3 month mobile respondents¹² have undertaken at least one move which involved changing

¹¹ See Part 1 - section 0 on definitions of mobility.

¹² The data include all researchers currently working in Europe and who were mobile in the last ten years. The entire mobility experience may concern a move to the country of current employment from abroad (inflow); a move abroad and back to the country of current employment (return mobility); or a multiplicity of moves, ending in the country of current employment. There is thus a mixture of inflow and outflow possible in the mobility indicators on employer mobility and effects (as these concern the entire mobility experience).

employer. In contrast, in Croatia, Slovenia and Norway less than one quarter changed employer in one of their moves.

Of the EU researchers currently working outside the EU, about 90% have changed employer (at least once) when moving abroad. The remaining researchers are still employed by their home institution while residing abroad. This suggests that when EU researchers move outside the EU, they are much more likely to change employer and stay for longer.

0.5.2.4. <3 month mobility in post-PhD career stages

41% of the EU HEI researchers were <3 month mobile in the last ten years during their post-PhD career

41% of post-PhD researchers in the EU27 have worked abroad for a period of less than 3 months at least once in the last ten years. Another 13% have been <3 month mobile only more than 10 years ago. This means that more than half (54%) of researchers have worked abroad for a period of under 3 months, regardless of whether or not they have been mobile for >3 months.

At country level, a number of East-European countries rank higher in terms of <3 month mobile researchers: Hungary and Romania, followed by Iceland, Belgium, Denmark and Austria.

0.5.2.5. Non-mobility in post-PhD career stages

31% of EU HEI researchers have never been internationally mobile in post-PhD career stages

EU-wide, 31% of all researchers in the post-PhD career stages have never been internationally mobile (neither <3 months nor >3 months). In Poland, almost two thirds of researchers have never been mobile while in Latvia the proportion is almost half. On the other hand, in countries such as Iceland, Luxembourg and Switzerland less than 15% of researchers have never been mobile.

0.5.3. Focusing on gender and the field of science

Gender perspective: Female researchers are less likely to be mobile than their male counterparts

For all types of international mobility, there is an indication that female researchers are, to some extent, less mobile than their male counterparts. For current mobility and PhD mobility the differences are limited but in >3 month international mobility during the post-PhD career stage, the gender gap is larger. For male researchers, the share for mobility amounts to 28% compared to 21% for female researchers. The gap is also larger in higher career stages: 5 pp difference in R2, 8 in R3 and 9 in R4.

Differences also occur across countries. Male researchers are significantly more >3 month mobile in Cyprus, Germany, Finland, Sweden, Slovenia and Czech Republic (11 to 25 pp difference). On the other hand, female researchers are more >3 month mobile than their male counterparts in Macedonia (FYROM), Belgium, Switzerland, Denmark and Malta. In contrast, it is interesting to note that female researchers are more likely to be internationally mobile when it involves a change in employer.

Also in terms of the <3 month internationally mobile researchers, there is a difference of 6 pp between men and women.

Field of science: higher levels of PhD mobility among researchers in Humanities and Social Sciences; higher levels of post-PhD mobility in Natural Sciences and Engineering

>3 month mobility during the PhD is most common in the fields of Humanities and Social sciences (25% and 22%) compared with around 16 % in the other fields.

In post-PhD career stages, the Natural Sciences, Humanities and Engineering and Technology are the fields with relatively high rates of both short and >3 month mobility whereas Medical Sciences have relatively low rates of mobility.

0.5.4. EU researchers abroad

An estimated 34,000 EU-born researchers working abroad in five large countries, of which 15,000 in the USA

Given the lack of (comparable) data on foreign researchers across non-EU countries, it is very difficult to estimate the total number of EU researchers abroad. Based on the more detailed data available in the US and a number of basic assumptions on researchers' careers and mobility, estimates are provided for three scenarios. Referring to the "baseline" scenario, the stock of EU researchers in the US is estimated to have increased from around 9,000 in 2000 to around 15,000 in 2011, with a steady annual increase. This would correspond to a total of around 34,000 EU-born individuals working as researchers in 2011 in US, Australia, New Zealand, Canada and Mexico.

Overall, OECD and Open Doors data show that the US is an important destination for EU27 researchers and that this flow is quite substantial. The number of EU born citizens who were awarded a doctoral degree in the US increased from 1,882 in 2000 to 2,021 in 2011. This figure represents around 2% of all EU citizens who earned a doctoral degree in 2011. On average, an increasing share of EU-born individuals attaining a doctoral degree in the US remains to work there (28.1% in 2000 and over 40% in 2005 and 2011).

0.5.5. Non-EU researchers in the EU

An estimated 70,000 non-EU researchers working in the EU

Based on the sample of 495 researchers with non-EU citizenship in the HEI survey, the total number of non-EU researchers is estimated at 70,000 in EU27. This is 5.6% of the total amount of researchers working in the EU.

These non-EU researchers in the EU are concentrated in a small group of countries with UK and Germany accounting for more than 50%.

Concentration in terms of origin

There is also concentration in terms of origin: 78.8% of all the non-EU researchers come from 20 countries with the largest share coming from China (13%), India (12%) and the US (11%).

20% non-EU doctoral candidates in the EU27

In 2010, about 20% of EU27 doctoral candidates came from non-EU countries. Almost 7,500 (around 7% of the total inflow) come from China and 3,400 from Brazil. The share of students coming from China and India substantially increased in the period 2005-2010. Almost two-thirds of the doctoral candidates coming from non-EU countries go to France or the UK.

0.5.6. Return mobility and retention

Return mobility of EU researchers currently in the EU HEI: 11% of researchers return to their country of 'origin' (either citizenship or highest previous education)

The EU HEI survey provides one type of estimate for 'return mobility', namely that of researchers who, during their post-PhD career, return to work in either their country of citizenship or in the country where they received their most recent and highest education.

According to this definition, 11% of mobile researchers return at least once to their country of 'origin' (regardless of definition used). The highest shares for this type of return mobility are observed in Ireland (39% according to citizenship and 25% according to highest education) and Denmark (28% and 30%). Of the researchers who obtained their highest education in the Netherlands, 22% return at least once in their post-PhD career while only 11% of mobile Dutch citizens return. A similar relation between both indicators is observed in France, Estonia, Switzerland, Belgium and Norway.

Return potential: 23% of the EU researchers currently outside the EU consider returning to the EU

23% of the EU researchers currently working outside the EU are actively considering moving back in the coming 12 months. Of this 23%, around 4 out of 5 had taken concrete steps to 'return'. The main difficulties faced when returning to the EU were finding a suitable research position (72%), maintaining their current level of remuneration (56%), obtaining funding (53%), and finding a job for their spouse (50%).

Potential for retention of non-EU researchers in the EU appears high

72% of the non-EU researchers who had previously been to the EU would like to have stayed on. The main reason for leaving the EU was, paradoxically, that they never intended to stay longer. However, career opportunities and personal/family life were also important motives for leaving the EU. 93% would recommend working as a researcher in Europe to other colleagues, which suggests that they really valued their stay in the EU.

Mobility perspectives of non-EU researchers: Major interest in the EU

In general, non-EU researchers who had never worked in the EU before are interested (approx. 90%) in moving to the EU¹³. More than half of the sample of non-EU researchers who had never been to the EU had already investigated the possibility of doing so. Although the interest in EU mobility is high, some barriers are still expected: finding a job for one's spouse (64%); finding a suitable research position (53%); and funding for research (51%) are clear examples.

0.5.7. Links with home during mobility period

Vast majority of EU researchers outside the EU and non-EU researchers who previously worked in the EU continue to maintain connections with Europe

More than 90% of EU researchers working abroad maintained connections with their fellow researchers in Europe mainly through informal networks (91%) and by participating in conferences organized in Europe (74%).

¹³ One has to bear in mind that this result might be biased, as respondents to this 'international' survey are more likely to be interested in research outside their own country.

Among the non-EU researchers who had worked previously in the EU, 94% continue to maintain connections with research institutions and researchers in Europe, most frequently through informal networks (91%) and conferences organized in Europe (77%). They are also actively engaged in research collaboration with researchers affiliated with institutions in Europe (79%).

0.5.8. Collaboration profiles

77% of EU HEI researchers collaborate internationally

EU-wide, 77% of HEI researchers collaborate internationally: 67% indicate that they collaborate with colleagues from other EU universities or research institutes, and 52% with colleagues from universities or institutes outside the EU.

More collaboration with academic partners than with non-academic partners

Researchers in EU HEI tend to collaborate less with the non-academic sector outside their country (19% collaborate with private industry in Europe and 11% outside Europe) than the academic sector abroad. Differences occur across countries, with higher degrees of collaboration with the non-academic sector undertaken by researchers from Ireland, the United Kingdom and Cyprus.

More collaboration in later career stages

Researchers' career stage is also an important factor: those further advanced in their career tend to collaborate more so than those at an earlier stage. For example, 88% of the R4 researchers in EU HEI collaborate internationally compared to 83% in R3, 70% in R2 and 55% in R1.

Impact of mobility on exchanging knowledge and enhancing collaboration

In line with general expectations, >3 month mobility is interlinked with other forms of mobility and collaboration. Long term (>3 months) and short term (< 3 months) mobility profiles are strongly interrelated. Moreover, long term international mobility is positively related to international collaboration: researchers who have been >3 month mobile have also collaborated more frequently with research partners abroad and outside the EU. This is the case for both academic and non-academic partners.

Mobility is positively correlated with collaboration activities. Around three quarters of the mobile researchers who collaborate internationally indicate that these relationships are the result of a mobility experience. Intersectoral mobility to private industry is also positively correlated with collaboration with the private sector (10 to 25 pp higher collaboration rate than among researchers who have never worked in private industry).

Virtual mobility partly substitutes short term mobility of EU researchers

The development of virtual communication/interaction technology appears to be an important aspect of research mobility. For the majority of EU HEI respondents who indicated that they have been involved in international collaboration, virtual technology helps to reduce international visits (50% for short term and 9% for long term). This can be seen as a growth sector which has an enormous potential impact, and which could add a new dimension to international research mobility. A complete replacement of physical mobility is not anticipated, but it may also advance international collaboration for those who, for whatever reasons (such as family, personal reasons or other barriers), might not be able to engage in international research collaboration or mobility.

0.5.9. Intersectoral mobility

Intersectoral mobility is defined as being mobile to a sector outside academia, in the researcher's own country or abroad. This not only relates to private industry but also to the private not-for-profit sector as well as the public and government sectors.

PhD stage: 23% of researchers have been intersectorally mobile

Intersectoral >3 month mobility during the PhD is observed for 23% of researchers: 4% were mobile in the private industry; 9% in private not-for profit and 10% in the public or government sector.

Post-PhD stage: 30% of researchers have been intersectorally mobile, 13% in a dual position

During post-doctoral career stages, 30% of EU HEI researchers have been intersectorally mobile: 12% to private industry, 7% to private not-for-profit sector and 15% to public or government sector¹⁴. Currently, 13% of HEI researchers work in a dual position in academia and non-academia. For the most part, their primary position is in academia and their secondary position in the public or government sector. 3% worked in a dual position in HEI and private industry in the last ten years. This represents just under half of all those researchers who have worked in private industry in the last ten years.

Gender perspective: Differences at country level

EU-wide, females (28%) are slightly less likely than males (31%) to have experienced intersectoral mobility. They are particularly less likely to be intersectorally mobile in Macedonia (FYROM), Hungary, Germany, Denmark and Bulgaria, with the proportion of women being between 10 and 17 pp below that of men. On the other hand, women are more likely to be intersectorally mobile in Cyprus (17pp), Turkey (10pp) and the United Kingdom (5pp).

Over the last ten years, having a dual position in private industry is more common in men than women (7pp difference).

Researchers who are currently in a dual position (academia and private industry) indicate that they are relatively more satisfied with opportunities for advancement, remuneration, social status, mobility perspectives, dynamism and independence in their current industry post than in their current academic one. On the other hand, the academic position is evaluated more favourably with respect to job security, job location, employer, intellectual challenge and degree of independence.

Researchers tend to value the type of work more than the level of remuneration when choosing a position; moves to non-academia tend to take place early in a career

University researchers are less likely to move to non-academic research positions the older they are or - more precisely - the longer they have been working at the university. Those researchers who have worked their way up to senior university researchers (e.g., full professors) are often unwilling to give up their positions. If R4 researchers do move they most often take up management positions or become members of an advisory board, etc.

¹⁴ Multiple destinations are possible per researcher.

Mobility during the PhD (lasting 3 months or more and returning to obtain the PhD) ranges from just over 10% in Luxembourg to more than 55% in Italy. Next to Italy, only Denmark and Spain have a share of over 40%. Relatively low rates are observed in Luxembourg, Ireland, United Kingdom, Austria, Germany, Poland, Belgium and Sweden (all 11-12%), which are in some cases countries with high levels of PhD degree mobility (Luxembourg, Ireland, Sweden) or are popular destinations for PhD mobility (United Kingdom, Germany).

Mobility outflows of researchers reflect the current economic crisis as well as historical, linguistic or cultural links

When analysing countries of departure - defined as the country of citizenship - we can note that it appears to be largely those countries which are suffering significantly amidst the current economic crisis (Greece, Spain, and Italy¹⁵) which stand out. 7% of all moves are by Greek citizens (compared to 3% of the researchers in the sample being Greek citizens); another 7% by Italians (compared to 5% Italian citizens in the sample) and 6% by Spanish researchers (compared to 4% Spanish citizens in the sample). It is also worth noting that 11% of moves are made by German citizens (compared to 4% of the researchers in the sample being German citizens). The identified mobility flows thus clearly reflect the influence of historical, cultural or linguistic links with the reporting country. These observations confirm the main findings on destinations in the Careers of Doctorate Holders (CDH) Survey 2009 data (OECD, 2012).

More than one third of the sample of European researchers currently working outside the EU originate from Germany

In the Extra-EU survey, more than one third of the sample of (reached) European researchers currently working outside the EU originate from Germany (36%), followed by the UK (16%), Italy (9%), France (8%), the Netherlands (5%) and Austria (5%).

¹⁵ However, there may be other country-specific reasons alongside to the impact of the economic crisis which should be taken into account, such as lack of attractive working conditions or career prospects.

0.7. Motives for international mobility

Main results in a snapshot:



0.7.1. PhD mobility

Primary motives at the PhD stage are 'intrinsic'

For PhD degree mobility, virtually all the intrinsic motives are deemed important by EU HEI researchers, particularly the availability of a PhD position (84% of the R1 and R2 researchers find this important); quality of training and education (76%), and career progression (75%). The extrinsic factors of social security, pensions, and job security are considered to be less important motives although they are 12 percentage points higher among R1 researchers than for and R2 researchers. This could imply that job security is becoming more of an issue now than previously, or that priorities have changed after researchers have moved to the post-PhD stage.

Mobility during PhD training is also largely motivated by intrinsic factors such as career progression (83%); working with leading experts (82%); and facilities and equipment (78%).

0.7.2. >3 month post-PhD mobility

Primary motive in post-PhD stage is career progression

Motives are similar for researchers during their post-PhD career phase: the most important factors are career progression (83%); followed by working with leading experts (75%); available funds (70%); facilities & equipment (69%) and positions (69%).

Motives reflect different priorities across career stages and gender

The importance attached to the different motives during different career stages reveals changing priorities. R4 researchers appear to be more secure about their position and are motivated by other factors: they find research autonomy, personal or family reasons and quality of training and culture more important than the average researcher. R2 and R3 researchers primarily seek availability of funds and positions to increase job security. For R2 researchers, career progression and remuneration are also important motives for post-PhD mobility.

Females consider most of the motivational aspects to be more important than do males, especially those in the R3 and R4 career stages.

Career progression is also the main reason for employer mobility of EU HEI researchers. It is selected as the single most important motive in one quarter of the moves including a change in employer (24% compared to 16% for overall >3 month mobility).

remuneration is cited more by US researchers (45%) than by non-US researchers (38%). This coincides with the higher salary levels in the US compared to the EU, as discussed above.

Leading researchers believe mobility has become easier over time

Leading researchers (R4) with long-term mobility experience believe that it has become easier over time for researchers to become internationally mobile during their career, with women being more positive in this regard. Overall, 71% of R4 researchers think that this is the case. Given the large majority, this may well be an indication of gradually decreasing barriers for mobility in the EU.

Non-mobile researchers: personal and family reasons are more important

When asked for explicit reasons for non-mobility, researchers rank personal and family reasons as being the most important. Funding and logistical problems again appear among the top 3 barriers.

Not surprisingly, researchers with children find logistical problems and personal/family reasons more important, whereas those without children indicate the potential loss of professional network, but also cite quality of training and finding a suitable position as reasons which discourage mobility.

the home country (push) may benefit less from the international research environment and collaboration than other so 'choose' their destination for the benefit of their career (pull).

Highly mobile researchers tend to report more positive effects of their mobility experience

The effects on job options and overall career progression are considerably higher for EU HEI researchers who have worked both in and outside the EU (as compared to those who were only mobile inside the EU or only outside the EU).

Female researchers report more positive effects

Concerning gender differences, women in the EU HEI survey are generally much more positive when appreciating the mobility effects than men. Most notably, women score higher on network effects such as 'recognition' in the research community, international and national contacts/networks.

Non-EU researchers report very positive effects of their mobility experience in the EU

Among non-EU researchers who had been mobile to the EU, a large majority (92%) indicated that their stay in Europe had increased their recognition in the research community. More than half the sample of non-EU researchers indicated that the following factors (strongly) increased as a result of their stay in Europe: contact and networks (92%); recognition in the research community (80%); overall career progression (73%); advanced researcher skills (73%); number of co-authored publications (64%); quality of family life (60%); citation impact of their publications (53%); and the ability to obtain research funding (50%).

0.10.2. Recruitment process in EU HEI

More than one-third of EU HEI researchers is dissatisfied with the recruitment process at their HEI but the level of satisfaction is very country-specific

When asked their opinion about recruitment policies at their institution, around 34-40% of EU HEI researchers indicated that they were 'dissatisfied' with levels of openness, transparency and the degree of merit-based recruitment.

Satisfaction between the three aspects is correlated per country. The United Kingdom has the highest share of satisfied researchers (around 80%) for all three aspects whereas Italy has the lowest (between 30 and 45%) for open and transparent recruitment and the one-but-lowest for merit-based recruitment. In Croatia, Bulgaria and Slovenia shares are also low.

Lower satisfaction with recruitment process in early career stages and among female researchers

Those at an early stage of their career are the least satisfied: R2 researchers are the least satisfied with their experiences of transparency and merit-based recruitment; R1 researchers are the least satisfied with levels of openness. Female researchers are similarly less satisfied with the recruitment process (between 6 and 9 pp difference to male researchers).

0.11. Overall conclusions and potential policy implications

1. Towards a common and widely accepted set of definitions of 'mobility'

The underlying study, a follow-up to the MORE1 study¹⁶, has led to an enormous wealth of (new) data and insights on mobility patterns, flows, motives and effects, working conditions and remuneration. It has been confirmed that mobility is not a homogenous concept, but, rather, has many sides depending on the conventions and definitions used. It is the same lack of globally accepted concepts that makes comparison with MORE1, and also other studies on mobility, difficult, if not impossible. As a result, longitudinal monitoring of policy effects in this important area is also problematic.

Looking to the future, it seems advisable to come to a common and widely set of definitions of 'mobility' in order to increase comparability and to monitor evolutions and longitudinal policy effects. A good place to introduce such a set of definitions can be sought among or linked with existing initiatives such as the Frascati manual (OECD), the UOE definition of student mobility (Eurostat, UIS-UNESCO and OECD), the EC DG EAC learning mobility concepts or the ESF paper on concepts of mobility¹⁷.

2. Continuation of efforts to raise awareness about gender issues

Concerning the composition of the overall researcher population in Europe, we note that there are more male than female researchers, particularly in the higher career stages of the research profession. Female researchers are also less satisfied with the opportunities offered for advancement than their male colleagues.

Efforts at national and EU level to create awareness about these issues, and facilitate 'more women at the top' with equal wage conditions, need to be continued to increase the number of female researchers in higher career stages and remove barriers to mobility.

3. Intensifying tailored policy towards early stage researchers

The characteristics of researchers at the various career stages (R1-R4) differ significantly. Researchers tend to find stable positions at later stages of their careers (R3 to R4). Post-doc researchers (R2) who form an important pool of future researchers, feel particularly less satisfied with their current opportunities for advancement and development. At the same time, doctoral candidates are in a precarious contractual situation, as many of them work on a fixed-term contract or do not have a contract at all.

This all suggests that a more 'tailored' policy towards the specific groups of early stage researchers is required in order to increase their job security and the attractiveness of further pursuing a research career.

4. Encourage exposure to industry and transferable skills training

It is increasingly accepted that today's doctoral candidates are trained not only for an academic career but will increasingly build a career outside academia. This requires the ability to adapt to another environment, the development of new skills as well as receiving the right training. Essential skills such as people management, intellectual property rights and entrepreneurship, remain less common forms of 'structured' training for PhDs: around one in ten report

¹⁶ <http://www.researchersmobility.eu/>

¹⁷ European Science Foundation (2013). New Concepts of Researcher Mobility – A comprehensive approach including combined/part-time positions. ESF Science Policy Briefing, 49, April 2013.

receiving such training. When looking at intersectoral mobility (>3 months) during the PhD, 23% of researchers have had a non-academic research experience (in public, non-for-profit or private industry); a subgroup of only 4% have experience with private industry.

More attention should be given to skills development during PhD training and continuous professional development. 'Transferable' skills and experience outside academia are, for example, embedded in the existing Principles for Innovative Doctoral Training.

5. Observations on salary, funding and wage setting autonomy

The MORE1 study, with its focus on EU-US mobility, already indicated that, in general, researchers earn less in Europe than in the US. MORE2 confirms this finding through more detailed evidence. On average, across all career stages, non-EU countries pay 9-14 pp higher salaries than European countries (PPP adjusted).

While salaries are lower on average, salary setting/flexibility/autonomy is also rather low in many EU27 countries (particularly in universities), due to the fact that wage levels are often set at national level. This double 'wage' disadvantage therefore makes it difficult for Europe to compete for the best researchers on the international stage. On the other hand, caution is needed when generalising across Europe because there are important country differences. The analysis shows that innovation leader countries have more autonomy at the institutional level and that wage increases are granted more for performance (versus seniority for example) than in other countries.

From the perspective of international competition for leading talent, Member States have a large role to play with respect to funding and wage setting autonomy.

6. Observations on the attractiveness of the EU research environment

When asked to compare the research environment in the EU with that outside the EU, the majority of researchers report that conditions such as remuneration and career progression are generally better outside the EU. 'Quality of life' is a notable exception.

On the other hand, non-EU researchers who have been mobile to the EU report very positive effects from their mobility experience. Moreover, 93% of non-EU researchers with experience in Europe would recommend that other colleagues work in Europe. These observations show that the European research environment has left a positive impression on those researchers who have experienced it and that there is arguably some potential to attract researchers (back) to Europe.

7. Guidance, support and funding for return mobility and collaboration with researchers abroad

Most EU researchers currently working outside Europe still have strong ties with Europe (91%). Around 23% have actively considered moving back to Europe and 18% have taken concrete steps to do so. The problems they face in moving back: they find it difficult to find a suitable research position, keep their salary and/or obtain funding and find a job for their spouse.

Advertising positions, career guidance, close support and mobilisation of funding are essential in order to facilitate the return mobility to Europe for those interested in doing so. A priority should be to alleviate barriers for their return. On the other hand, collaboration of researchers who have been abroad for a long period with researchers in their home country or the rest of Europe is also beneficial for European research and innovation.

8. Mobility paradox: positive effects versus decrease in job opportunities

The majority of the >3 months internationally mobile researchers feel that mobility has had positive effects on several aspects of their career as a researcher. The output effects (quality of output, citation impact, patents, number of co-authored publications) are indicated as having increased the most as a result of their mobility experience. Acquiring new skills and network building are also notable effects.

On the other hand, there is still a significant minority for whom these aspects have decreased. One would expect that mobile researchers would become more 'attractive' to employers, but paradoxically enough, job options in academia as well as progression in remuneration and reputation have tended to decrease for more researchers rather than increasing.

Is this a new 'mobility paradox' that perhaps relates to the fact that mobility is becoming more 'common' and 'easier', or as a result of the fact that non-mobile researchers 'remain in the system' and build up a career track together with the associated remuneration?

One plausible explanation of the negative perception of the effects of mobility by this subgroup could be that they were 'forced' into mobility due to lack of available positions or career prospects. In this case, the researcher may benefit less from the international research environment and collaboration than others who 'choose' their destination for the benefit of their career.

This paradox triggers new research questions, specifically the observation on issues such as recognition, career progression, and access to attractive/stable positions. These are all very interesting angles for future research to shed light on the dynamics and causes thereof.

Part 1 OBJECTIVES AND METHODOLOGY OF THE MORE2 PROJECT

1 INTRODUCTION

The first part of this final report of the MORE2 project serves as introduction and provides a context to the second part which presents the results of the project. First, the project's policy context is briefly outlined. Second, the project's objectives and deliverables are listed and we point specifically to the value added the MORE2 project offers, compared to the existing information on researchers, their careers and mobility. Next, the methodology of data collection and analysis in the different work packages are presented and the definitions applied in these processes are also explained. With this policy and methodological background, the results presented in the next part are interpreted within their relevant context and focus.

2 GENERAL BACKGROUND

The MORE2 HEI report aims to produce accurate evidence for further evidence-based policy making. The topics selected for the survey are based on recent policy developments and perspectives. In this chapter, we outline this recent policy context. Next to the general policy context within which the MORE2 HEI survey is situated, a number of observations on the research profession and mobility are important as background information, when interpreting the key indicators. For the state of the art research on academic studies and their main findings, we refer to Annex 1.

2.1 EU2020 Strategy and the European Research Area

The number of researchers in Europe as a share of the population is visibly below that of the United States and Japan. In the context of reaching the 3% R&D target, the number of researchers required is significantly higher than the current pool and even more newcomers are needed to take the place of those who will retire over the next decade. If there is going to be a serious effort in R&D in the EU, there will need to be 1m new researchers, on top of the current 1.5m researcher population. These new researchers need not only to be in existing disciplines and fields, but also in new and increasingly important interdisciplinary fields related to the grand challenges (demographic ageing, food security etc.).

The EU2020 Strategy builds on Europe's strongest (knowledge) asset, human capital and, more precisely, Europe's researcher population. Creation of a European Research Area (ERA), is one of the cornerstones of the EU 2020 strategy¹⁸ (and the Innovation Union initiative in particular) and future economic competitiveness of Europe. In 2007 the ERA concept was put high on the European policy agenda through the publication of the 'ERA Green Paper'¹⁹ and the launch of various related policy initiatives. The European Commission has indicated that the Framework Programme is one of the principal instruments which can make the ERA to become reality.

ERA concerns a European "internal market" for research where researchers, technology and knowledge circulate freely, where there is effective European level co-ordination of national and regional research activities, programmes and policies, and initiatives implemented and funded at European level. There should be a single labour market with attractive working conditions for both men and women, involving – notably - the absence of financial or administrative obstacles to trans-national mobility. Moreover, the full opening of academic research positions and national research programmes across Europe, with a strong drive to recruit researchers internationally, and easy movement between disciplines and between the public and private sectors, should also become a reality.

The MORE2 HEI survey collects evidence on the geographical, intersectoral and virtual mobility steps of researchers, but also probes the opinion of researchers on fair, open and transparent recruitment at their HEI.

The promotion of ERA has taken place through various instruments and programmes implemented at the EU level, the national level and the regional

¹⁸ European Commission, "Europe 2020 Flagship Initiative – Innovation Union, SEC(2010) 1161 final, Brussels, 6 October 2010.

¹⁹ European Commission (2007), The European Research Area: New Perspectives - Green Paper: 04.04.2007, Luxembourg (+ results public consultation).

level. At the EU level, the European Commission has taken the lead by introducing new and adapting existing R&D support schemes such as: the Framework Programmes and the Marie Curie Actions, the adoption and implementation of the European Charter for Researchers, and the Code of Conduct for the Recruitment of Researchers, the 'scientific visa' package, and the integrated European Research Partnership.

2.2 Innovation Union Flagship initiative

The "Innovation Union" is one of the seven flagships announced in the Europe 2020 Strategy²⁰. Endorsed by the European Council meeting of 4 February 2011²¹, it has called for completion of the ERA by 2014 and development of supporting measures to remove obstacles to mobility and cross-border co-operation. Based on the outcome of several targeted initiatives (cf. infra), the EC Communication of July 17, 2012²² proposes "A Reinforced European Research Area Partnership for Excellence and Growth" to realise the ERA by 2014. It focuses on:

- More effective national research system;
- Optimal transnational cooperation and competition (common research agendas, Europe-wide open competition and infrastructure for key research);
- An open labour market for researchers (removal of barriers to research mobility, training and attractive careers);
- Gender equality and gender mainstreaming in research and
- Optimal circulation, access to and transfer of scientific knowledge including through digital means.

Concerning these goals, the MORE2 HEI survey enables further insight into the working conditions and satisfaction of researchers. Further, information on fair, open and transparent recruitment as well as on structured doctoral training is collected. The additional benefits are also covered in several questions of the survey (e.g. is funding or transferring thereof a barrier or motive to mobility, is there evidence on job (in)security and career progression for early-stage researchers, collaboration with private industry and intersectoral mobility...).

The Innovation Union flagship initiative sets out several major commitments in the area of researchers' mobility and career development:

1. By the end of 2011, Member States should have **strategies** in place to **train** enough researchers to meet their national R&D targets and to promote attractive employment conditions in public research institutions (including gender and dual career considerations).
2. In 2011, further steps were to be proposed in a Communication²³ on the **reform and modernisation of higher education** including support of business-academia collaboration through the creation of "Knowledge Alliances" between education and business. Efforts were to be made to develop new curricula addressing innovation skill gaps and to help universities to develop towards inter-disciplinarity, entrepreneurship and stronger business partnerships.

²⁰ European Commission, "EUROPE 2020 A strategy for smart, sustainable and inclusive growth", Brussels, 3.3.2010, COM(2010); adopted by the European Council in European Council Conclusions 17 June 2010

²¹ European Council 4 February 2011 Conclusions, Brussels, 8 March 2011, http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/119175.pdf.

²² http://ec.europa.eu/euraxess/pdf/research_policies/era-communication_en.pdf

²³ http://ec.europa.eu/education/higher-education/doc/com0911_en.pdf

3. In 2011, the Commission presented an **integrated framework for the development and promotion of e-skills**²⁴ for innovation and competitiveness. This framework should take into consideration supply and demand factors, pan-European guidelines for new curricula, quality labels for industry-based training, and the need for awareness raising activities.

From this, the focus towards gender, dual careers, intersectoral collaboration and the use of virtual and web-based technologies emerge as highly relevant research topics. Each of these topics is part of the MORE2 HEI survey to collect evidence of the state of play and evolution therein.

2.3 Important initiatives: a selection

Since the launching of the European Commission's initiative for the creation of the European Research Area (ERA) in 2000, researchers' mobility has become an important element in many EU initiatives. One example is the European career of researchers project or E*CARE, which was launched in August 2008 with a total duration of three years. Within the E*CARE project, a survey was carried out on the careers and mobility of researchers in Europe and on their awareness about EU initiatives for building the ERA²⁵. Special emphasis is given to the attractiveness of researchers' careers, the remaining problems of researchers' mobility and its impact on further career development.

The ERA Steering Group on human resources and mobility (SGHRM) and, more particularly, its working group on skills, developed a European Framework for Research Careers in consultation with stakeholders. In May 2011, this framework was adopted by the SGHRM, "Towards a European Framework for Research Careers" (European Commission 2011, p. 2)²⁶. The framework describes four research profiles: 'first stage researcher', 'recognised researcher', 'established researcher' and 'leading researcher'.

These career stages are also implemented in the survey and report at hand.

Furthermore, in support of the ERA Communication of July 2012, an expert group on the Research Profession was established by DG Research and Innovation. Their report was published in July 2012²⁷ and recommends:

- A European Monitoring System
- Harmonising career structures
- Harmonising working conditions
- Realising the 5th freedom: essential role of mobility (geographical, intersectoral, virtual and disciplinary)
- Conditions for career development: transparency & open recruitment
- Individual oriented research funding
- More use of awards and prizes

²⁴ European Commission (2007), "e-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs", COM(2007) 496

²⁵ E*CARE project 2009, Comparative survey analysis on researchers' mobility and career obstacles. Deliverable 1.2. in: Ivancheva L. and Gourova E., 2011, Challenges for career and mobility of researchers in Europe.

²⁶ http://ec.europa.eu/euraxess/pdf/research_policies/Towards_a_European_Framework_for_Research_Careers_final.pdf

²⁷ ERA Expert Group on the Research Profession (2012), Excellence, Equality and Entrepreneurialism. Building Sustainable Research Careers in the European Research Area. Final report prepared for the EC DG Research and Innovation. July 20, 2012.

An important public consultation took place which aimed at gathering the views and evidence of stakeholders on the key obstacles which have to be tackled to achieve a well-functioning ERA²⁸. It was observed that 80% of respondents believe that research careers in the public sector are comparatively unattractive because of the current uncompetitive working conditions and the lack of career prospects. The reasons for this unattractiveness are: the underfunding of universities and research institutions; the limited availability of research positions in academia; the relatively low salaries in academia and the insufficient cooperation between academia and the private sector. Respondents also report a lack of recognition of the research profession more generally. Yet there is major support among respondents to strengthen the ERA and for closer involvement of stakeholders therein.

To monitor the ERA and its implementation in the Member States, the Commission launched a call for tender for a study on monitoring human resources policies and practices in research and assessment of the impact of the "Scientific Visa" package' (2010). This is to provide support for a monitoring system on national policies on human resources in research and on their effects at the level of research organisations, foreseen in the 2009 People Specific Programme of the 7th Framework Programme. The first lot within this call is currently being carried out by Deloitte Consulting and is known as the Researchers Report²⁹. Their study addresses the creation of a monitoring system for the implementation of the European Partnership for Researchers and subsequently Innovation Union commitments, as well as for the related uptake of the Charter and Code principles including the development and use of mobility and career indicators and data collections. The resulting Researchers Report was published in November 2012 and will be updated annually in the coming two years.

The second lot within this call focuses on the assessment of the implementation and impact of the "Scientific Visa" package. In 2005, the European Commission adopted the "Scientific Visa" package in order to make scientific careers more attractive and open up the Community to third-country nationals who might be admitted for the purposes of research. The package includes Directive 2005/71/EC on a specific procedure for admitting third-country nationals for the purposes of scientific research and Recommendation 2005/761/EC aiming to facilitate the issue by the Member States of uniform short-stay visas for researchers from third countries travelling within the Community for the purpose of carrying out scientific research. The assessment was carried out by the International Centre for Migration Policy Development (ICMPD).

Important to mention in the context of this report is, of course, the MORE1 study, the first study on "mobility patterns and career paths of EU Researchers" commissioned by the EC DG Research and Innovation. MORE1 intended to provide a detailed study on the mobility patterns and career paths of EU researchers. The finale report was published in June 2010 and provided the first full and detailed overview of the mobility patterns of EU researchers and their career paths.

Other important on-going or recent surveys on the mobility of researchers are the following:

- Survey of mobility of researchers by the Institute for Prospective Technology Studies (IPTS) of the EU's Joint Research Centre (JRC) under

²⁸ EC DG Research and Innovation (2012). Areas of untapped potential for the development of the European REsarch Area (ERA). Analysis of the response to the ERA Framework public consultation.

²⁹ Deloitte (2012). Researchers' report 2012, European Commission, DG Research and Innovation.

the FP6 ERAWATCH contract. This survey was launched in 10 countries in Spring 2012.

- The international 'Survey on the careers of doctorate holders (CDH)³⁰, jointly carried out by Eurostat, the Organisation for Economic Co-operation and Development and UNESCO's Institute for Statistics (UIS). The survey covers most of the Member States of the European Union, of EFTA as well as some of the most important other members of the OECD, such as the United States and Australia. The latest survey was held in 2009 and results were analysed in an OECD paper (2012)³¹.
- The EURODOC Survey I was conducted in 2008 and 2009 throughout Europe. The final report analyses the current situation of more than 7,500 doctoral candidates in twelve countries (Austria, Belgium, Croatia, Finland, France, Germany, the Netherlands, Norway, Portugal, Slovenia, Spain and Sweden). This study intends to respond to two main questions: a) what is the actual situation concerning funding, social benefits and working conditions of doctoral candidates; b) what are the differences regarding the different types of doctoral education models across Europe? The findings of this study were published in September 2011, at the Eurodoc General Meeting in Strasbourg³². This presentation focused on three main topics: funding, working conditions and mobility of doctoral candidates and junior researchers. These themes are all directly linked to the European Charter of Researchers and to the Code of Conduct for the Recruitment of Researchers published by the European Commission.
- The MAUNIMO (MApping UNiversity MObility)³³ project, which aims to present a university perspective on mobility and the related data collection at institutional level. The project was coordinated by the European University Association and ran from October 2010 to September 2012.
- The ESF-funded EUROAC project³⁴ "The Academic Profession in Europe: Responses to Societal Challenges", a Research Project within the EuroHESC Programme, which aims at establishing how the academic profession perceives, interprets and "digests" recent changes in its societal environment and the organizational fabric of higher education systems. One of the four main research questions is on internationalization: How do academics deal with growing international cooperation and competition? How does the individual (national) project see itself being affected by these changes beyond a mere increase in international activities?

³⁰ CDH survey, Auriol L., B. Felix, M. Schaaper (2010) Mapping careers and mobility of doctorate holders: draft guidelines, model questionnaire and indicators – second edition – the OECD/UNESCO institute for statistics/Eurostat careers of doctorate holders project, STI working paper 2010/1.

³¹ OECD (2012) Doctoral graduates in times of economic downturn: labour market participation and mobility. OECD: Auriol L., M. Misu & R. Freeman, 11(1).

³² Eurodoc Survey I (2010) The first Eurodoc survey on doctoral candidates in twelve European countries. Descriptive report.

³³ www.maunimo.eu

³⁴ http://www.uni-kassel.de/einrichtungen/fileadmin/datas/einrichtungen/incher/110615_EUROAC-Flyer-1_final_version_aktuell.pdf

3 OBJECTIVES AND DELIVERABLES

3.1 Objectives

As Cañibano et al. (2008)³⁵ states, “despite numerous recent attempts to measure and assess researcher mobility, there seems to be agreement among scholars and policy makers that the lack of progress in developing innovative empirical approaches is due to inadequate or lack of data”.

The objective of the study “support for continued data collection and analysis concerning mobility patterns and career paths of researchers” (MORE2), as foreseen under the 2010 People Work Programme of the 7th Framework Programme³⁶ was:

“To provide internationally comparable data, indicators and analysis in order to support further evidence-based policy development on the research profession at European and national level.”

The project was set up around the following work packages:

- I. Survey of researchers currently working in Europe in higher education institutions (HEI) regarding their mobility patterns, career paths and working conditions (WP1).
- II. Survey of researchers currently working outside Europe regarding their mobility patterns, career paths and working conditions (WP2).
- III. Case study on the working conditions and career paths of early career researchers in selected countries (WP3).
- IV. Case study on the remuneration of researchers in selected countries (WP4).
- V. Development of a set of internationally-comparable indicators on stocks, flows, working conditions and career paths of European researchers (WP5).
- VI. Final report that provides a comparative, policy-relevant analysis of the mobility patterns, working conditions and career paths of European researchers (WP6).

The entire study was implemented between **November 2011** and **May 2013** and organised in **6 work packages**. In support of the research activities and the dissemination of the results, a dedicated website has been designed: www.more-2.eu. This includes an online database containing around 150 indicators.

³⁵ Cañibano C., F. Javier Otamendi and F. Solís (2011):International temporary mobility of researchers: cross-discipline study. *Scientometrics*, 89, 653-675.

³⁶ http://cordis.europa.eu/fp7/wp-2010_en.html#people

3.2 Deliverables

The deliverables resulting from the MORE2 project are listed below with reference to their numbering in the project and the work package they result from. The deliverables indicated in bold text are made publicly available through the MORE2 website.

Work package	Deliverables
Preparatory stage	<p>D1 • Roadmap of the project.</p> <p>D2 • Interim report providing an overview of progress made to date and detailed proposals for the case studies and surveys.</p> <p>D3 • Interim WP3/4 report presenting the set-up, progress and preliminary findings of the case studies in the specific work packages WP3 and 4 on researchers' career paths, working conditions and remuneration.</p>
1 EU Higher Education Survey of individual researchers currently working in the EU	<p>D5 • HEI Report (WP1): <i>Report presenting the results of the survey of researchers currently working in Europe in higher education institutions.</i></p> <p>• Methodological report on the HEI survey (WP1): <i>Report on the methodological set-up, implementation and results of the HEI survey.</i></p> <p>• Dataset: MORE2 HEI survey (2012)</p> <p>• Indicator set: MORE2 HEI survey (2012) <i>Available for download in dynamic online database tool (www.more-2.eu)</i></p>
2 Extra-EU survey of individual researchers currently working outside the EU	<p>D6 • Extra-EU Report (WP2): <i>Report presenting the results of the survey of researchers currently working outside Europe.</i></p>
3 Case study on working conditions and career paths of early stage researchers	<p>D4 • Working Conditions Cross-Country Report (WP3): <i>Report presenting the comparative analysis of the main findings from the country reports.</i></p> <p>• MORE2 country profiles Working Conditions (WP3): <i>Country reports of the case study on early career researchers.</i></p>
4 Case study on remuneration	<p>D4 • Remuneration Cross-Country Report (WP4): <i>Report presenting the comparative analysis of the main findings from the country reports.</i></p> <p>• MORE2 country profiles Remuneration (WP4): <i>Country reports of the case study on the remuneration of researchers.</i></p>
5 Researcher Indicators	<p>D7 • Researcher Indicators Report (WP5): <i>Report presenting the set of internationally-comparable indicators on stocks, flows, working conditions and career paths of researchers.</i></p>
6 Synthesis and final report	<p>D8 • Final report (WP6): <i>Report presenting and integrating the main results of the study across the different work packages.</i></p>

3.3 Scope

In order to define the scope applied in the different data collection processes, we outline the target groups and geographical reference for each work package.

Work package	Scope
1 EU Higher Education Survey	<p>Individual researchers currently working in the EU (27+6 Associated and Candidate Countries)³⁷.</p> <p>This includes:</p> <ul style="list-style-type: none"> • Researchers with both EU and non-EU citizenship • Researchers in both EU and non-EU higher education • Researchers who have been mobile outside the EU but have returned to work now in the EU <p>This does not include:</p> <ul style="list-style-type: none"> • EU and non-EU researchers who are currently working outside the EU
2 Extra-EU survey	<p>Individual researchers currently working outside the EU (27+3 Associated Countries). The majority (but not all) of the researchers in the sample work in higher education institutes.</p> <p>This includes :</p> <ul style="list-style-type: none"> • EU researchers currently working outside the EU • Non-EU researchers who have worked in the EU in the past • Non-EU researchers who have not worked in the EU but who have worked in non-EU countries • Non-EU researchers who have not been mobile at all <p>This does not include:</p> <p>EU and non-EU researchers who are currently working in the EU27+3</p>
3 Case study on working conditions and career paths of early stage researchers	<p>Country-level, university and RPO information on early stage researchers</p> <p>50 countries are included:</p> <ul style="list-style-type: none"> • 40 European countries: The 27 EU Member States plus the countries associated to the Seventh Framework Programme for research and technological development: Norway, Iceland, Liechtenstein, Switzerland, Israel, Turkey, Croatia, Macedonia (FYROM), Serbia, Albania, Montenegro, Bosnia & Herzegovina, Faroe Islands • the USA, Canada, Japan, China, India, South Korea, Singapore, Australia, Brazil and Russia
4 Case study on remuneration	<p>Country-level, university and RPO information</p> <p>50 countries are in the scope:</p> <ul style="list-style-type: none"> • 40 European countries: The 27 EU Member States plus the countries associated to the Seventh Framework Programme for research and technological development: Norway, Iceland, Liechtenstein, Switzerland, Israel, Turkey, Croatia, Macedonia (FYROM), Serbia, Albania, Montenegro, Bosnia & Herzegovina, Faroe Islands • the USA, Canada, Japan, China, India, South Korea, Singapore, Australia, Brazil and Russia <p>Additional interviews with business sector in Austria, Denmark and Germany</p>

³⁷ Throughout the rest of the report, we refer to 'EU HEI' as all researchers (EU and non-EU citizens) who currently work in the EU27 or one of the Associated or Candidate countries.

3.4 Contribution of the MORE2 study

Whereas the MORE1 study (www.researchersmobility.eu) played a pioneering role as a first attempt to systematically collect and analyse data on researcher career paths and mobility (through an EU-level representative HEI survey, the EU-US researcher's mobility case study, and the extensive IISER update), the MORE2 study consolidated these findings and experiences, and introduced more detail and a better understanding of a number of aspects. The MORE2 study pushed the frontier of knowledge on career paths, mobility and associated aspects further, through:

- Conceptual refinement of the concept of 'mobility' and 'mobile researcher', hence a higher accuracy of measurement.
- Broadening the geographical scope and the introduction of a global perspective.
- Representativity of data and results at the individual country level, making it possible to draw conclusions on the country level (EU27).
- Systematic collection and analysis of EU 'policies' with respect to early stage researcher working conditions, and the confrontation of these policies with researcher opinions.
- Revealing decision-making factors of researchers when choosing between positions (through a first-in-a-kind stated choice experiment).
- Introduction of a whole range of new topics of major importance to future policy making in this area (among others on remuneration).
- Estimation of the number of EU researchers currently working abroad, and the number of non-EU researchers working in Europe.

3.4.1 Conceptual refinement and more precise measurement

Researcher 'mobility' refers to the movements researcher make during their career, which can be of varying lengths, having different goals, with different types of destinations and from several originating countries. In order to know what is being measured, a more accurate and sharper conceptual framework has been designed (see section 0) that could potentially be the basis for a terminological standardisation.

The concept of mobility was approached from the perspective of duration (more versus less than 3 months, with or without change of employer, intersectoral moves, virtual moves) and to the types of origin (citizenship, highest education, self-selection) or destination (geographical, sector). The study provides insights into how the measurement is affected by these different parameters; volatility of outcomes, depending on definition chosen, is rather limited however.

3.4.2 A global perspective

The MORE2 project is the only (known) study taking a global perspective on the topics of mobility and researchers' careers. Through the EU HEI survey, accurate data are collected for all Member States, Associated and Candidate Countries. The cases on working conditions, career paths and remuneration cover these countries, plus third countries with an EU S&T agreement: Australia, Brazil, Canada, China, India, Japan, South Korea, Singapore, the United States of America and the Russian Federation. In the Extra-EU survey, a global perspective is taken and information covers researchers all over the world. This broad geographical coverage results in detailed country-level information and a particularly relevant reference framework to compare the EU indicators against.

3.4.3 EU27 and country level representativity

The EU HEI survey was designed in such a way as to provide accurate indicators on the research profession and researchers' mobility at EU27 level, as well as at country level. The latter, in particular, results in unique indicators by country, allowing Member States to take action where needed.

Representativity at country level for 33 countries (EU27+6) has been achieved. This means that the general indicators, building on the entire sample and expressed per country in the panel, are representative for the researchers' population in that country instead of only for the sample of respondents (an extensive weighting and calibration procedure has been applied, thereby also correcting for non-response bias, related to self-selection and/or seasonal effects). For subgroups where a logical routing is also applied, the indicators are representative for the population (i.e. indicators on post-PhD mobility are, logically, not asked of PhD researchers). Unless otherwise indicated, all general indicators reflect the EU27 researcher population. The 3 Candidate and 3 Associate Countries are included systematically as part of the analyses at country level.

3.4.4 Focus on early stage working conditions

An EU-wide review of existing and new policies on working conditions and career paths of early stage researchers has been implemented. The EU HEI survey further collects data on the working conditions, satisfaction, training and mobility in these early stages, making it possible to compare the policy context with the perception of the researcher.

The analysis focuses on the specific situation of early stage researchers to identify whether and to what extent it is precarious. The working conditions of early stage researchers are compared to those at later career stages to assess whether doctoral candidates are considered to be, and treated, as research professionals or to what extent their situation deviates from the general researcher experience. In particular, characteristics such as the contract type and tenure track options per career stage can give an indication. The career stage at which a stable position is on average reached, relates to this as well.

3.4.5 Insight into the real decision-making factors

A stated choice experiment formed the last part of the two MORE2 surveys – HEI and extra-EU mobility surveys of individual researchers. Respondents were asked to choose between three different jobs proposed to them. Each job consists of the same characteristics which take different values for each job. From the job finally chosen (the researchers' stated choice) we hence learn about which job characteristics make researchers decide between different job offers and, as a result, about the importance of a range of job characteristics for the attractiveness of researcher jobs³⁸.

This first-in-a-kind experiment thus contributes to the evidence-based policy development on the research profession at European and national level as outlined in the overall objective of the MORE 2 project. More precisely, it informs commitment #1 of the Innovation Union ("promote attractive employment

³⁸ The research leading to these results has received funding not only from the MORE2 project but also from the European Commission's Seventh Framework Programme FP7/2007-2013 under grant agreement no. 290647 (WwwforEurope). Basically, all the development and analytical work related to the survey was done with the www for Europe funding, while the MORE2 survey implementation itself was funded by MORE2.

conditions in public research institutions”) and commitment #30 (“integrated policies to ensure that leading academics, researchers ... reside and work in Europe and to attract a sufficient number of highly skilled third country nationals to stay in Europe”).

3.4.6 Topics and data on new/updated issues

Building on the work of MORE1 (and other existing studies), a whole range of new topics has been approached under MORE2.

New/updated topics include:

- Self-selection of researchers into career stages and breakdown of information per career stage;
- Systematic measurement of the effects of mobility;
- Short mobility;
- Virtual mobility;
- Collaboration in relation to mobility;
- Satisfaction with open, transparent and merit-based recruitment;
- Awareness of EU policy instruments among researchers;
- Structured doctoral training and training modules

3.4.7 Estimation of the number of EU researchers currently working outside the EU, and non-EU researchers working in the EU

Existing sources provide a number of indicators on the mobility of graduate students and doctoral candidates. However, in the current MORE2 project, one of the aims was to estimate the number of non-EU researchers currently working in the EU and vice versa, the number of EU researchers currently working outside the EU.

The first question - to estimate the number of non-EU researchers currently working in the EU - is answered through the MORE2 HEI Survey. The citizenship and country of current employment is registered for all individual researchers who participated in the survey and comparison of the two is provided by this particularly relevant indicator. The indicator is furthermore very reliable at EU-level, thanks to the statistical strategy to provide accurate estimates at country level for the EU27 and the high number of observations for the EU27 altogether.

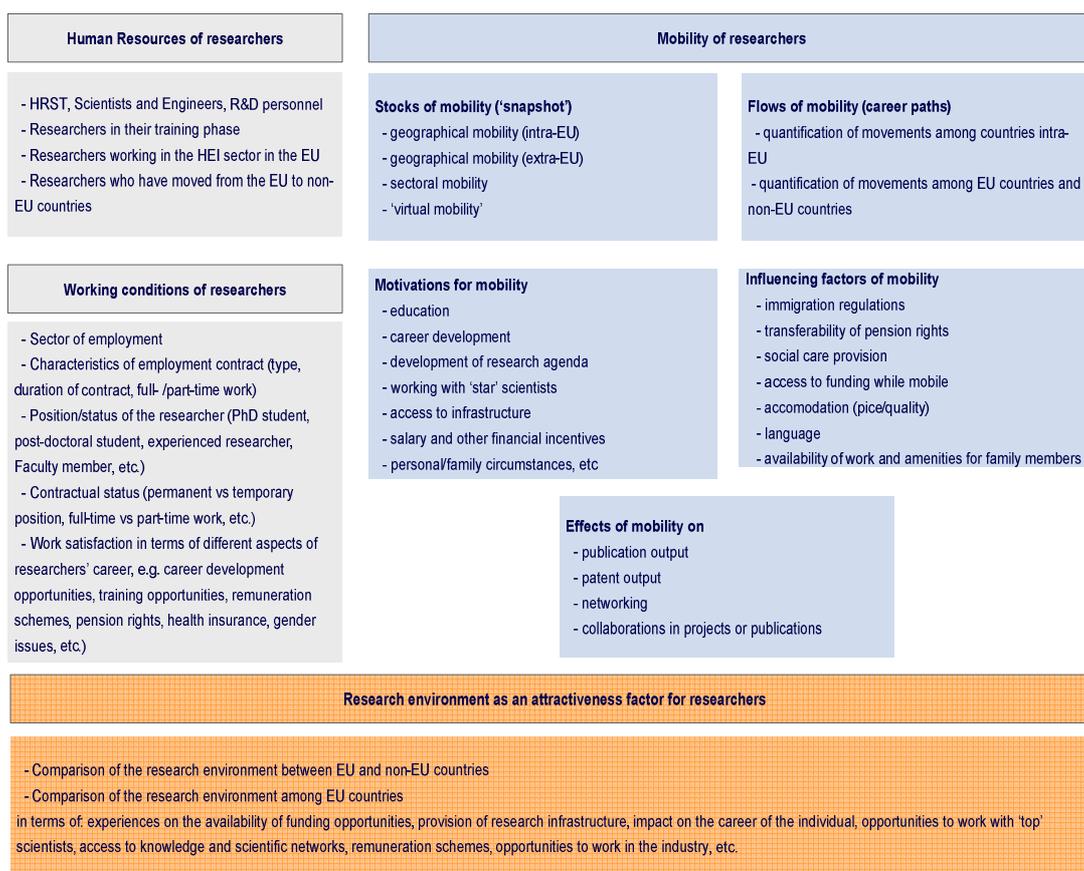
The second question, to estimate the number of EU researchers currently working outside the EU, should not be constructed from the MORE2 surveys. The Extra-EU survey does not provide the same level of accuracy and representation of the researchers’ population outside the EU and it is thus not appropriate to base conclusions on it in terms of absolute numbers. On the other hand, this indicator is of major policy relevance as it relates to the issues of international mobility flows, return mobility of EU researchers and brain drain/gain/exchange. This question has been approached through existing data from the OECD and Open Doors databases.

3.5 Conceptual framework and outline of the Final Report

The conceptual framework in Figure 1 forms the backbone of the MORE2 project. The framework was used as a guide during the set-up and analysis for each of the work packages and even more so in the integration of findings cross-work-package.

The synthesis of the data and information collected throughout the different phases of the project in the Final Report therefore follows the structure of this conceptual framework.

Figure 1: Conceptual framework for the synthesis of the MORE2 data



Source: IDEA Consult in the study proposal and based on MORE1

Part 1 of the Final Report introduces the project. After the contextual and conceptual introductions in chapters 1 to 3, the methodology and definitions of the project are presented in chapters 4 and 5.

Part 2 subsequently synthesizes the main findings from the MORE2 project according to the blocks in the conceptual framework. Chapter 2 of Part 2 starts with the section on human resources of researchers. Chapter 3 continues with the information on career paths and working conditions of researchers and Chapter 4 focuses on remuneration. Chapters 5 to 9 relate to the mobility of researchers, namely respectively on the stocks, flows, motives, barriers and effects of mobility. Finally, Chapter 10 reflects on the research environment as attractiveness factor for researchers. The interaction between work packages to provide input for each of the chapters is further elaborated in Part 1 - section 4.2 (p. 50).

Part 3 of the Final Report concludes and develops a number of policy-relevant and methodological recommendations.

4 METHODOLOGY AND APPROACH

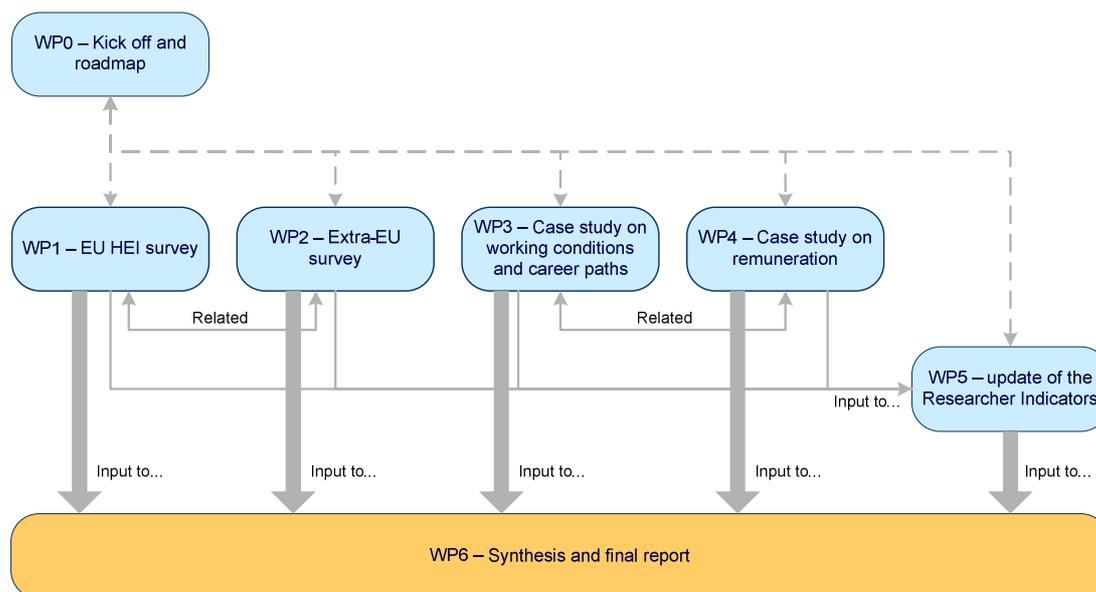
4.1 Introduction

In the following sections we introduce the structure and methodological approach of the MORE2 project as a whole and outline the approach in the different work packages separately. For a detailed explanation of the methodologies applied in each of the work packages, we refer to the work package reports.

4.2 The different work packages

The MORE2 project consists of 6 closely interrelated work packages, as shown in Figure 2.

Figure 2: Overview of the work packages and their interrelation



After the initiation phase, the project work packages 1 to 5 are implemented.

Work package 1 contains the EU Higher Education Survey on mobility patterns and behaviour and barriers and motives related to mobility. This work package is related to work package 2, where the focus shifts from Europe to the rest of the world. Even though the methodology is substantially different in terms of scope and sampling, both work package surveys are based on a common basis to optimize comparability of results.

Work package 3 looks into the career paths and working conditions of early career researchers, whereas work package 4 focuses on remuneration of researchers. In both work packages, a network of national expert-correspondents in 50

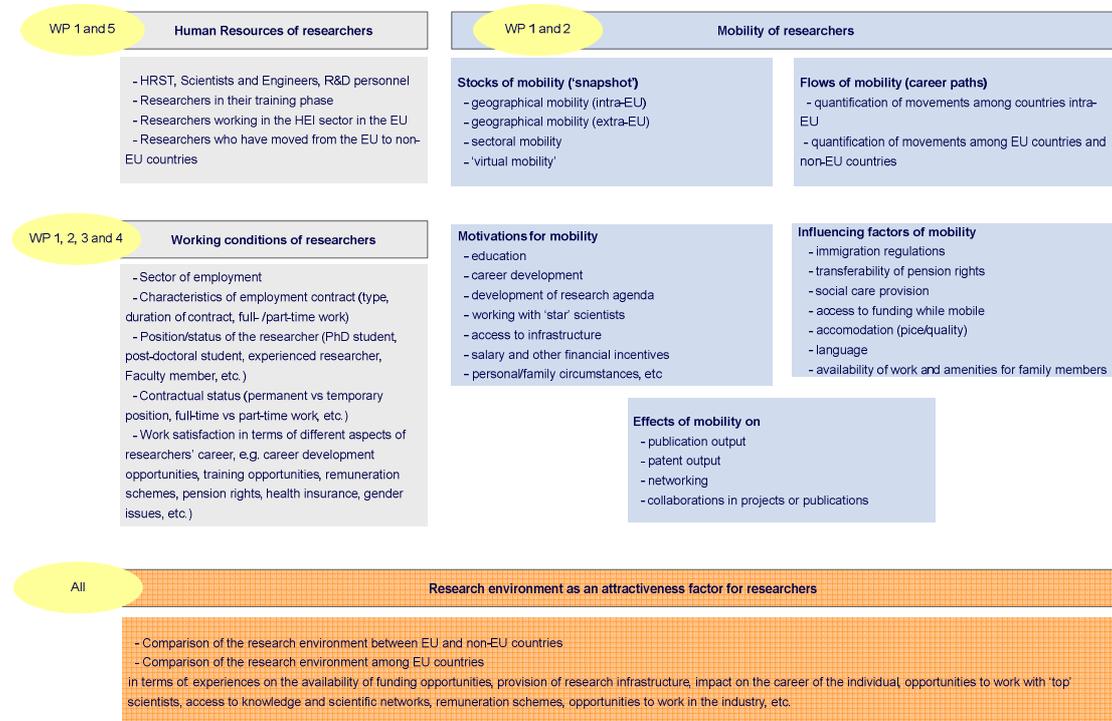
countries³⁹ provided detailed information through a common ICT support system specifically designed for this task. The fourth work package further includes 10 interviews with business sector in 3 countries (Austria, Denmark and Germany) and a stated choice experiment.

Work package 5 deals with the update of the IISER indicators. The results from MORE1 are updated and improved where needed to develop a complete set of key indicators on researchers and their careers, among which indicators from the first and second work package surveys.

Finally, the 6th work package summarizes and integrates all results from the other work packages into the final report at hand. The discussion focuses on specific policy-relevant questions within the conceptual framework, bringing together and analysing all information from the different work packages that relates to the specific question.

According to their thematic focus, the different work packages provide input in different blocks of the conceptual framework as depicted in Figure 2.

Figure 3: Interrelation of the work packages with the conceptual framework



Source: MORE2 Final Report

4.3 Data collection methods

As indicated in the previous section, each of the work packages has its own scope and focus and therefore requires a tailor-made method to collect information. We present an overview in the table below.

³⁹ 40 European countries, the USA, Canada, Japan, China, India, South Korea, Singapore, Australia, Brazil and Russia.

Table 1: Scope, topics and information collection method per work package

Work package	Scope	Focus on topics	Data collection method
1 EU Higher Education Survey	<p>Individual researchers currently working in the EU (27+6 Associated and Candidate Countries)⁴⁰.</p> <p>This includes:</p> <ul style="list-style-type: none"> • Researchers with both EU and non-EU citizenships • Researchers with both EU and non-EU higher education • Researchers who have been mobile outside the EU but have returned to now work in the EU <p>This does not include:</p> <ul style="list-style-type: none"> • EU and non-EU researchers who are currently working outside the EU 	All	Combined CATI and CAWI survey based on two-stage stratified random sampling strategy
2 Extra-EU survey	<p>Individual researchers currently working outside the EU (27+3 Associated Countries). The majority (but not all) researchers in the sample work in higher education institutes.</p> <p>This includes :</p> <ul style="list-style-type: none"> • EU researchers currently working outside the EU • Non-EU researchers who have worked in the EU in the past • Non-EU researchers who have not worked in the EU but who have worked in non-EU countries • Non-EU researchers who have not been mobile at all <p>This does not include:</p> <p>EU and non-EU researchers who are currently working in the EU27+3</p>	All	CAWI survey based on 'convenience' sampling

⁴⁰ In the rest of the report, we refer to 'EU HEI' as all researchers (EU and non-EU citizens) who currently work in the EU27 or one of the Associated or Candidate countries.

<p>3 Case study on working conditions and career paths of early stage researchers</p>	<p>Country-level, university and RPO information on early stage researchers</p> <p>50 countries are in the scope:</p> <ul style="list-style-type: none"> 40 European countries: The 27 EU Member States plus the countries associated to the Seventh Framework Programme for research and technological development: Norway, Iceland, Liechtenstein, Switzerland, Israel, Turkey, Croatia, Macedonia (FYROM), Serbia, Albania, Montenegro, Bosnia & Herzegovina, Faroe Islands the USA, Canada, Japan, China, India, South Korea, Singapore, Australia, Brazil and Russia 	<p>Career paths and working conditions</p>	<p>Network of 50 country experts Universities and RPOs</p>
<p>4 Case study on remuneration</p>	<p>Country-level, university and RPO information</p> <p>50 countries are in the scope (as in WP3)</p> <p>Additional interviews with business sector in Austria, Denmark and Germany</p>	<p>Remuneration</p>	<p>Network of 50 country experts Universities and RPOs</p> <p>Interviews with business sector in Austria, Denmark and Germany</p> <p>SES data (Eurostat)</p> <p>Stated choice experiment based on the WP1and2 surveys of individual researchers</p>
<p>5 Researcher Indicators</p>	<p>Researchers</p>	<p>All</p>	<p>Existing data sources (Eurostat, OECD,...) and other WPs</p>

Two surveys were implemented:

- For the survey on individual researchers in European Higher Education Institutes (WP1), a two-stage stratified random sampling strategy was implemented to set up a survey that would provide accurate estimates and indicators at both EU27 and country level and would allow analysis at different sublevels (fields of science, gender, career stage). To optimize response, and accuracy of the results, a multichannel approach was developed, combining simultaneous and coordinated online (CAWI) and telephone (CATI) interviews.
- The survey on researchers currently working outside the EU (WP2) was a 'convenience' sampling based survey, implemented only online and with the aim to reach as much researchers in different subgroups as possible, without the strict ambition of providing estimates representative for all researchers working outside the EU.

Both surveys included a stated choice experiment as input for the analysis on remuneration in WP4. Researchers were asked to choose between 3 job options with different, randomly selected, characteristics among which remuneration.

Alongside the surveys, the main information collection took place through a network of 50 country experts who filled in the information on their country and coordinated further data collection at 3 universities and 2 RPOs in their country.

Existing data sources such as Eurostat and OECD data are systematically consulted in WP5 on the Researchers Indicators and WP4 on remuneration. Furthermore, these sources were used to provide context to the results in all work packages.

4.4 Analytical approach

Table 2: Data, analysis method and results per work package

Work package	Data	Analysis method	Results
1	10,547 individual researchers currently working in the EU	Statistical descriptive analysis including a calibration and weighting procedure	Indicators representative at EU27 and country level ⁴¹ and with sub-indicators for fields of science, gender and career stage
2	4,090 individual researchers working outside the EU	Statistical descriptive analysis	Indicators for (non-representative) subgroups of the sample: <ul style="list-style-type: none"> - EU researchers currently working abroad - Non-EU researchers who have been to the EU in the past - Non-EU researchers who have never been to the EU but who have been to non-EU countries - Non-mobile non-EU researchers
3	47 country fiches with detailed qualitative information ⁴²	Cluster analysis and cross-country comparison	Indicators and cross-country comparison First collection of large-scale and detailed information per career stage
4	46 country fiches with detailed quantitative and qualitative information	Cluster analysis and cross-country comparison	Indicators and cross-country comparison; validated by country delegates of the SGHRM ⁴³ Indications of cross-sector factors and job choice factors
5	Existing databases and indicators from other work packages	Descriptive quantitative analysis	Set of Key Researcher Indicators Trends over time

⁴¹ The survey includes all 27 EU Member States plus Associated Countries (Switzerland, Norway, Iceland) and Candidate Countries (Turkey, Macedonia (FYROM) and Croatia).

⁴² Country experts in India, Malta and Slovakia did not provide fiches, the Liechtenstein expert only provided the working conditions fiche.

⁴³ ERA Steering Group on Human Resources and Mobility.

5 CONCEPTUAL BASIS

5.1 Introduction

A set of overarching definitions is at the basis of the MORE 2 project and was implemented in all work packages (where applicable) in the same way. This set of definitions guides the interpretation of the results and indicators from the different work packages, and optimizes the integration of results in this final report. In the following sections we present the applied definitions for 'researchers'; 'fields of science'; 'career stage' and 'mobility'.

5.2 Definition of 'researcher'

As the main definitions on researchers in use, we derive the definition of 'researchers' from the Canberra Manual, covering HRST and from the Frascati Manual, covering Research and experimental development and R&D personnel. These definitions are generally accepted and widely applied, e.g. also in the MORE1 study by the European Commission⁴⁴.

In the Frascati Manual⁴⁵, 'a researcher' is defined as follows:

- Research and experimental development (R&D):
 - "Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications."
- R&D personnel:
 - "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."

This definition is used as a basis for all work packages. For example in the WP1 and 2 surveys, a self-selection paragraph is included in the introduction of the survey:

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.

⁴⁴ IDEA Consult et al. (2010) Study on mobility patterns and career paths of EU researchers. FINAL REPORT (deliverable 7).

⁴⁵ OECD (2002), Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development, OECD, Paris. (Section 2.1 and 5.2.1).

5.3 Selected 'fields of science' (FOS)

Fields of science are defined according to the FOS classifications proposed by the OECD in 2006⁴⁶:

- FOS 1 (Natural Sciences)
- FOS 2 (Engineering and technology)
- FOS 3 (Medical Sciences)
- FOS 4 (Agricultural Sciences)
- FOS 5 (Social sciences)
- FOS 6 (Humanities)

For the purpose of the WP1 survey sample stratification, 3 categories were derived from this (as in MORE1). The 3 categories are an aggregation of the six FOS as follows:

- FOS 1 (Natural Sciences) and FOS 2 (Engineering and technology) fall in 'NATURAL'
- FOS 3 (Medical Sciences) and FOS 4 (Agricultural Sciences) fall in 'HEALTH'
- FOS 5 (Social sciences) and FOS 6 (Humanities) fall in 'SOCIAL'

Work package and final reports refer to either of the two sets of categories.

⁴⁶ <http://www.oecd.org/science/inno/38235147.pdf>

5.4 Defined 'career stages'

In order to allow for country comparisons in terms of functions and experience levels, the concept of specific career stages was introduced in the different work packages according to the four career stages outlined and defined in the European Commission's communication "Towards a European Framework for Research Careers" (European Commission 2011, p. 2).

These four career stages are:

- **R1: First Stage Researcher** (up to the point of PhD),
- **R2: Recognized Researcher** (PhD holders or equivalent who are not yet fully independent),
- **R3: Established Researcher** (researchers who have developed a level of independence) and
- **R4: Leading Researcher** (researchers leading their research area or field).

According to the definitions given in the EC's communication the different stages are characterized as follows:

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."

(see European Commission 2011, p. 7)

Recognized 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 recognized 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
- 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."

(see European Commission 2011, p. 8)

An **established Researcher (R3)** has developed a level of independence and, in addition to the characteristics assigned to the profile of a recognized 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, organizes workshops or conference sessions.”

(see European Commission 2011, p. 10)

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.
- Recognizes 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”

(see European Commission 2011, p. 11)

As this classification is not formally implemented across Europe as such, an objective guideline to assign researchers to a specific career stage does not exist. We have therefore introduced the classification by means of self-selection of the researchers in the surveys or by means of estimation of the country experts and universities of the shares of researchers in each of these broad groups.

This was a first attempt to implement the classification in a broad-scaled survey and study. In general, tests on the EU HEI survey show that the self-selection process has functioned well. In the EU HEI survey data, the age structure of the researchers in the four career stages follows a logical pattern, whereby age increases according to the career stage. Further, when comparing this self-selected career stage with the function the researcher fills in as ‘current position’ in the EU HEI survey, it is observed that the R1-group consists mainly of PhD students. The R2 & R3 groups are quite heterogeneous, consisting of Post-Docs, researchers & (Assistant/Associate) Professors. While the Post-Docs are highly represented in the R2 group, the (Assistant/Associate) Professors are represented

more in the R3 group. The R4 group is highly populated by researchers at Professor stage. This is also a logical pattern.

However, caution is still needed because at country level we see substantial differences in the proportion of each career stage present in the sample. According to the sampling strategy, these percentages should be a reflection of the population of researchers in the respective countries, but this cannot be verified with validated statistics. A relevant basis for comparison however is the estimation of the proportion of researchers per career stage in the individual country fiches that are provided by country experts and are the result of the third work package of the MORE2 project. For the countries where these estimates are available, differences frequently occur, but the general pattern is still consistent. However, a number of indications of underrepresentation are:

- R1 in Greece: an estimate of 67% of R1 researchers versus 3% in the sample
- R1 in Italy and Portugal: a difference of more than 20% between R1 estimates and R1 in the sample
- R2 in Czech Republic and Latvia: a difference of more than 30% between R2 estimates and R2 in the sample
- R2 in Italy and the Netherlands: a difference of more than 20% between R2 estimates and R2 in the sample
- R3 in Spain: a 29% difference between the R3 estimates and R3 in the sample

The main indications of overrepresentation in the sample are complementary, namely of R3 and R4 in Greece, Italy and Portugal and of R4 in Spain.

This observation certainly points to a selection bias towards higher career stages which could be explained by the differences between the position of PhD students as researchers in South European countries versus West or North European countries. Even though the extra-EU survey is not designed to be representative for the researcher population, the data from this survey point to a similar skewed response pattern towards R3 and R4 career stages.

5.5 Definitions and forms of 'mobility'

Finally, terminology of mobility has been applied in diverse ways in the existing studies. To be consistent across work packages, we built a set of definitions of mobility, based on the existing terminology (cf. e.g. MORE1 and Inzelt⁴⁷) and implemented in all work packages of the project:

- **International mobility versus intersectoral mobility:**
Moving to another country versus moving to another sector (though both can occur in the same move)
- **PhD mobility versus post-PhD mobility:**
Mobility of researchers enrolled in a PhD programme during their R1 career stage

versus

mobility in any of the following research career stages and, even though the for simplicity selected terminology suggests otherwise, regardless of whether or not the researcher has obtained a PhD.
- **PhD degree mobility versus >3 month mobility during PhD⁴⁸:**
Mobility with the purpose of obtaining the PhD in another country versus mobility of three months or more during the PhD while still obtaining the PhD in the home country
- **>3 month mobility versus <3 month mobility:**
Mobility with duration of 3 months or more versus mobility with duration of less than 3 months
- **Employer mobility:**
Mobility including a change of employer
- **Virtual mobility:**
The use of web-based or virtual technology to collaborate internationally
- **Non-mobility or never-mobile researchers:**
Having never been mobile to another country (not within the last ten years nor before)

In agreement with the EC, we decided not to limit the indicators of the survey data on **international >3 month mobility** to one definition and to treat mobility as a multi-dimensional concept. We thus present the number of mobile researchers according to a number of generally used (and accepted) definitions. This does not only increase comparability with other studies, but also allows estimating the effect of the use of these different definitions on the final results. The different definitions of international >3 month mobility are listed in Table 3.

Please note that in the sample of the MORE2 EU HEI data, the potential countries of reference show a high percentage of overlap (Table 4). We thus do not expect large differences in the indicators based on the different definitions.

⁴⁷ Inzelt A., Analysis of Researchers' Mobility in the Context of the European Research Area, Evaluation FP7 as supporting expert.

⁴⁸ The Maunimo project uses the term 'degree mobility' versus '<3 month mobility'. The first includes the mobility to obtain a degree in another country, even when only part of the programme is studied abroad (e.g. joint degree). <3 month mobility in this sense is mobility that is not for the purpose of the degree. To avoid confusion in MORE2 with <3 month mobility defined in terms of length of the move, we prefer the term during-PhD mobility in this context. See www.maunimo.eu.

Table 3: Overview definitions of mobility

Definitions
Move to another country than the country of citizenship
Move to another country than the country of most recent highest educational attainment/graduation
Move to another country than the country of residence
Moves between any two countries
Direct response of researcher to the question (Q47) ⁴⁹ : <i>After your highest educational qualification (PhD or other), how would you typify your international mobility experience?</i> <ul style="list-style-type: none"> • <i>I have worked abroad for more than 3 months at least once in the last 10 years</i> • <i>I have worked abroad for more than 3 months, but this was more than 10 years ago</i> • <i>I have never worked abroad for more than 3 months</i>

Source: IDEA Consult

Table 4: Overlap between countries of reference in the MORE2 HEI sample (EU27+6)

	Equal to panel country	Equal to citizenship	Equal to highest education	Equal to residence	Equal to current employment
Country of citizenship (first)	82.2%				
Country of highest education	76.5%	80.0%			
Country of residence	96.4%	83.5%	76.8%		
Country of current employment	98.4%	82.2%	76.6%	96.8%	
Country of PhD	80.9%	77.9%	95.3%	80.1%	81.3%

Source: MORE2 Higher Education Survey (2012)

Reading note: For 98.4% of the researchers in the sample, the country of current employment is equal to the panel country.

⁴⁹ This definition overlaps the other definitions, but it at the same time complements the others by implying the definition of what the researcher considers to be international mobility.

Part 2 MAIN FINDINGS

1 INTRODUCTION

In the second part of this report we present the main findings of the MORE2 project across all work packages and clustered according to the key research questions on researchers, their career paths, working conditions and mobility. The second part is therefore structured as described in Part 1 - section 0 (p.44), with the chapters and sections corresponding to the blocks of the conceptual framework.

2 EUROPEAN RESEARCHER POPULATION

In 2010, there are about 2.44 million researchers in the EU27, corresponding to a full-time equivalent of 1.589 million researchers. Large countries like Germany, the UK and France account for the vast majority of them (in absolute numbers). The Nordic countries have the highest share of researchers in their active working population; strong growth is witnessed in Portugal, Slovenia, Slovakia and Hungary. In Romania, Sweden and the UK, we can observe a decrease. Denmark, Austria, Ireland and Germany belong to the group of countries where both the number of researchers as a percentage of the active population and the growth of this share (2005-2010) are equal to or above the EU27 average.

Both the number and share of researchers in the EU27 are increasing (200-2010). Compared to the US, China and Japan, the EU27 has the highest number of researchers in 2010. In terms of the active population, the EU27 value is lower than the Japan and US ones, but the gap has reduced in the decade under discussion.

In 2010, 33% of EU27 researchers are female. Differences across Member States are marked. Several Eastern European countries (Latvia, Lithuania, Bulgaria, Estonia, Slovakia and Slovenia) are above the EU27 share. In almost all Member States the share of female researchers increased in the period 2000-2010.

In almost all European countries the majority of researchers work in universities or the business enterprise sector. The presence of non-university researchers in the government sector is significant only in the Eastern European countries (e.g. Slovenia, Bulgaria, Czech Republic, Poland), having public research institutions with strong traditions. The EU27 trend in the number of researchers (FTE) working in both the public sector and the business enterprise sector has been upwards during the period 2000-2010 (respectively 47% and 35% increase).

Estimations from the EU HEI survey shows that of the 1.2 million researchers in EU27 HEI, approximately 70.000 are non-EU researchers currently working in the EU. 40% work in Natural Sciences and Engineering & Technology, 36% in Social Sciences and Humanities and 24% in Medical Sciences and Agricultural Sciences. 13% of post-PhD researchers indicated they had a dual position, that is, were employed both by the university (or higher education institutions) and another sector: 11% for women and 14% for men. Most of those researchers having a dual position are primarily employed by the university. The vast majority have a dual position in the public or government sector, such as a research based organisation (64% of those with a dual position and 8% of all researchers in EU27).

74% of EU27 researchers live as a couple and around 69% have children. This compares to respectively 52% and 46% of all those employed in the EU27. The age structure of the researchers generally reflects that of the employed population in EU27, according to Eurostat.

2.1 Researcher indicators

2.1.1 Stock and evolution of researchers in EU27

In 2010, almost 1.59 million FTE researchers (2.44 million HC) are counted in the EU27, compared to 1.45 million FTE in 2007 (2.16 million HC). This corresponds to a share of 0.66% FTE researchers in the active population in 2010, compared to a share of 0.59% in 2005.

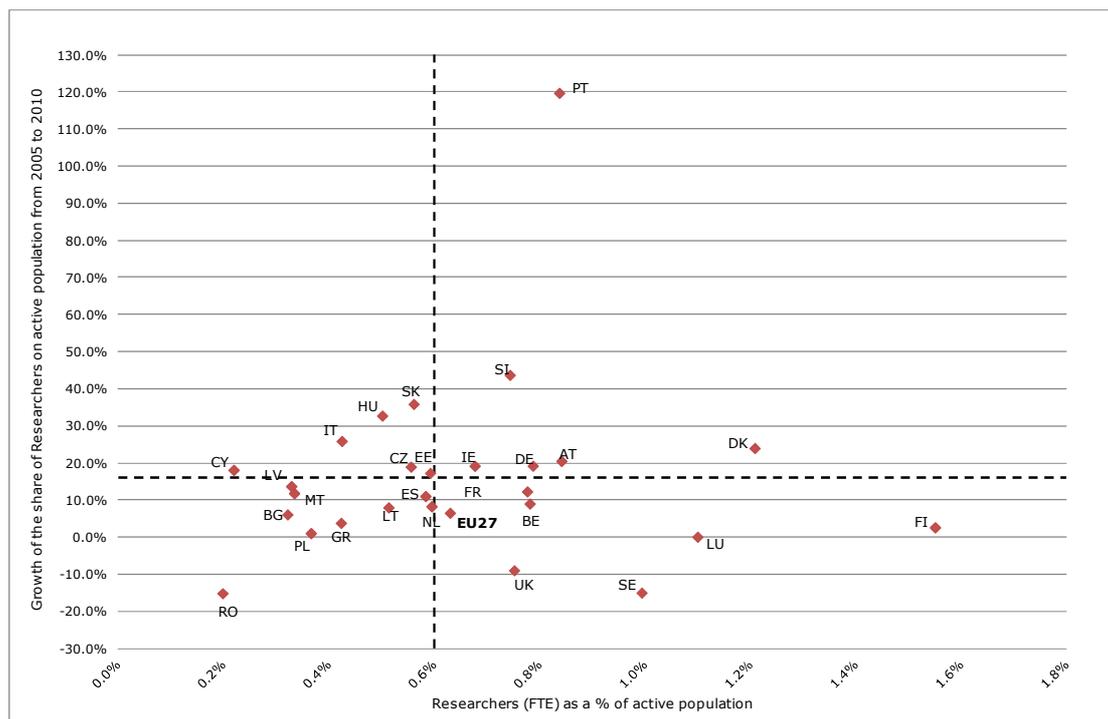
Germany emerges as the country with the highest number of researchers (approximately 500,000 HC), followed by the UK (400,000 HC) and France (300,000 HC). In relative terms, the Nordic countries (1.5% in Finland, 1.3% in Denmark and 1.0% in Sweden) as well as Luxembourg (1.1%) have the highest share of researchers (FTE) relative to the active population. The share is the lowest in Romania (0.2%), Cyprus (0.2%), Bulgaria (0.4%) and Poland (0.4%). Most of the countries fall within a range between 0.5% and 0.8%. Apart from Portugal, Southern Europe Member States are characterized by values lower than the EU27 one.

Looking at the time-trends of the share of FTE researchers in the active population, an increasing trend in the decade 2000-2010 emerges in the EU27 as a whole and in all Member States, apart from Latvia. On the other hand, the growth rates largely differ among Member States, also due to highly heterogeneous starting levels.

In Figure 4, the share of researchers (FTE) relative to the active population in 2010 (horizontal axis) is associated with the percentage increase of this share in the period 2005-2010 (vertical axis). The countries in which the share increased the most between 2005 and 2010 are Portugal (120%, but the data is plagued by a break in the series in 2008), Slovenia, Slovakia and Hungary (between 30 and 40%). Romania (-19.5%), Sweden (-15.5%) and the UK (-10%) experienced a decline. Regarding Portugal, the very high growth rate could depend on the break in the time series recorded in 2008. However, confirming the increasing trend, it has to be pointed out that the Portuguese share increased by 32% in the period 2005-2007 (i.e. before the break).

Denmark, Austria, Ireland and Germany belong to the group of countries where both the number of researchers as a percentage of the active population and the growth of this share (2005-2010) are equal to or above the EU27 average (upper right quadrant in Figure 4). Finland, Sweden, Luxembourg and UK are above-the-EU27-average level of the share of researchers in the active population but below-the-EU27-average levels of the annual growth of this share (lower right quadrant in Figure 4). Many of the new Member States belong to the group of countries where the share of researchers in the active population is lower than the EU27 unweighted average (i.e. the simple mean of the 27 Member States values). Among them, Romania, Poland along with Malta, also exhibit growth rates below the EU27 unweighted average (lower left quadrant in Figure 4). The rest of the new Member States exhibit below-the-EU27-average shares of researchers in active population but above-the-EU27 average annual growth rates. The EU27 as a whole is characterized by a share slightly higher than the unweighted average and a lower growth rate.

Figure 4: Researchers (FTE) as a share of active population¹ in 2010² and growth rate of such share from 2005 to 2010 in EU27 Member States³



¹ Active population is expressed in HC

² Data refer to 2009 for Greece and France

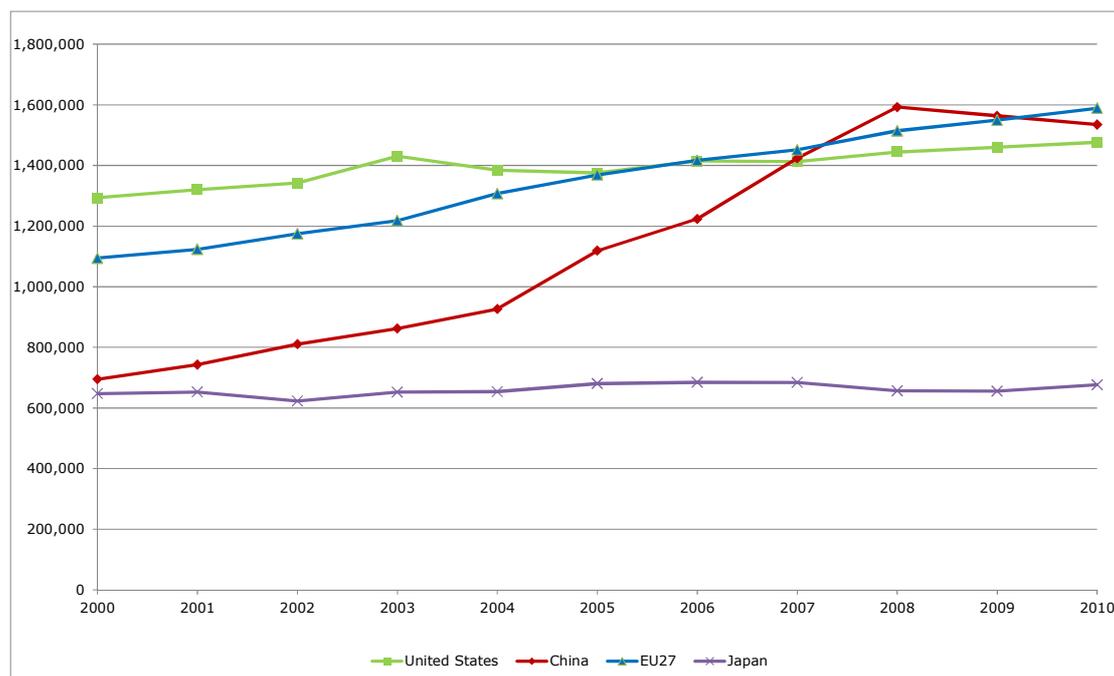
³ For Portugal, a break in the time series has been made in 2008.

Source: Own calculations based on EUROSTAT data from the following website:
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_perslf&lang=en

2.1.2 Regional comparison with US, China and Japan

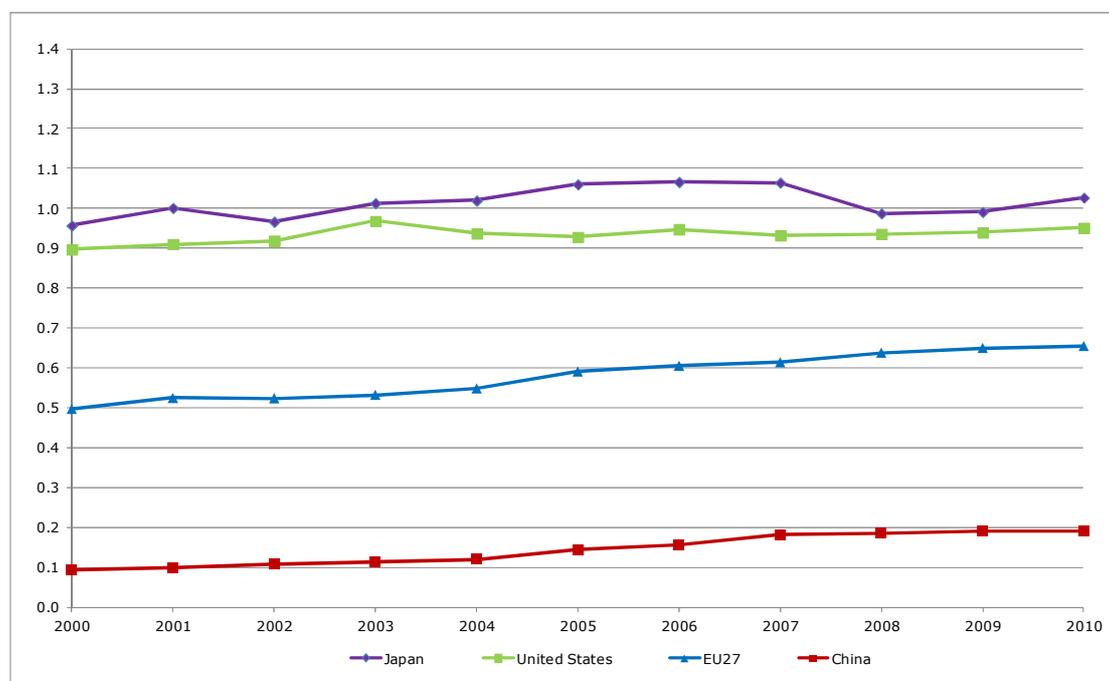
Figure 5 and Figure 6 display, respectively, the trend in the number of researchers in FTE units and as a share of the active population over the period 2000-2010 in EU27, China, Japan and US. Both indicators show an increasing pattern for the EU, especially in units. In absolute terms the EU27 has the highest number of researchers in 2010. Not surprisingly, China shows a strongly increasing trend over the period considered, reaching a value of 1.6 million in 2008 and slightly decreasing afterwards. In terms of the active population (Figure 6), the EU27 value is lower than the Japan and US ones, but the gap has reduced in the decade under discussion.

Figure 5: Number of researchers (FTE) in EU27, China, US and Japan, 2000-2010 (in thousands)



¹ 2009 value for China has been estimated interpolating 2008 and 2010 values.
 Source: Own calculations based on DG Research and Innovation (2013) "Researchers' Report 2013" and on EUROSTAT data from the following website:
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_perssci&lang=en

Figure 6: Number of researchers (FTE) as a share of the active population in EU27, China, US and Japan, 2000-2010

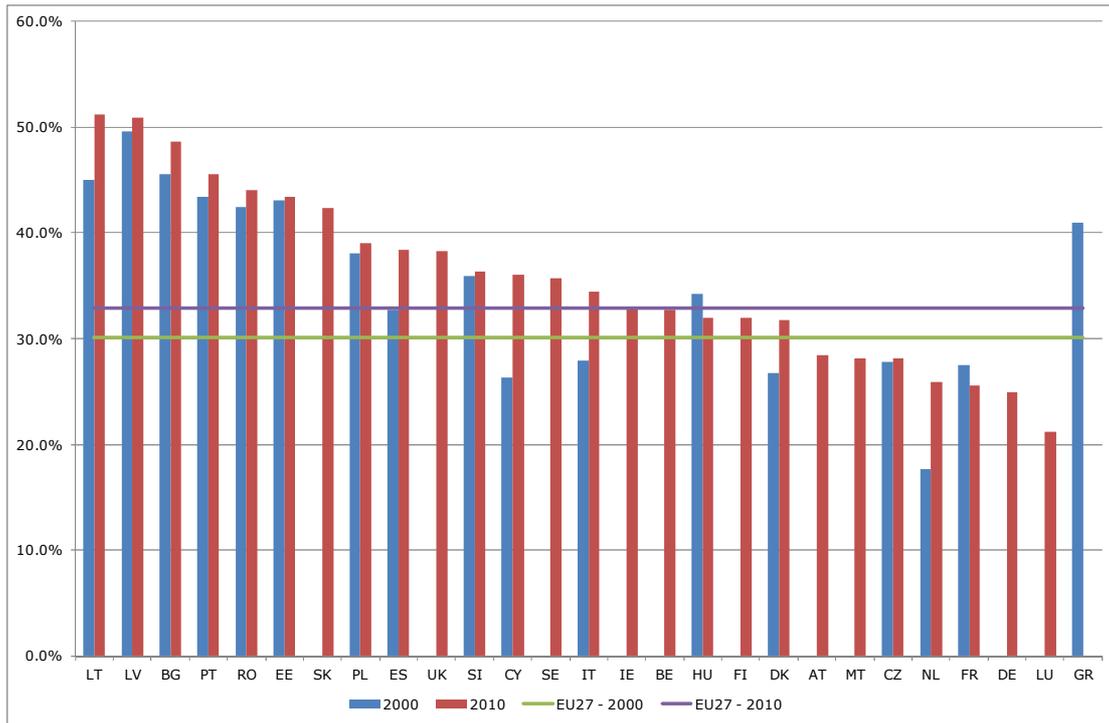


Source: Own calculations based on DG Research and Innovation (2013) "Researchers' Report 2013" and on EUROSTAT data from the following website:
http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_perslf&lang=en

2.1.3 Stock and evolution of researchers in EU27 per gender

In 2010, 33% of EU27 researchers are female. Differences across Member States are marked. Several Eastern European countries (Latvia, Lithuania, Bulgaria, Estonia, Slovakia and Slovenia) are above the EU27 share. By contrast, Germany and France show a percentage of women which is well below the European Union value (around one fourth of total researchers) and Luxembourg has the lowest percentage (only 20%). Nevertheless, it has to be pointed out that in almost all Member States the share of female researchers increased in the period 2000-2010 (Figure 7), but a significant decrease characterize Hungary (-6.5%) and France (-7.0%).

Figure 7: Share of female researchers in 2000 and 2010¹ in EU27 Member States (HC)



¹ Data refer to 2009 for EU27, Denmark, Germany, Netherlands, Luxembourg, Belgium, Austria and Sweden. Data for 2009 are missing for Greece. 2000 data refers to 2003 for EU27, to 1999 for Denmark, Greece and Spain. Member States are ranked according to 2010 values. Source: Own calculations based on EUROSTAT data from the following website: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_persocc&lang=en

2.1.4 Stock and evolution of researchers in EU27 per sector

In the EU27, more than half the researchers (55%) work in the public sector, and only 45% (710 000) are in the business sector.

The presence of non-university researchers in the government sector is significant in the Eastern European countries (e.g. Slovenia, Bulgaria, Czech Republic, Poland), having public research institutions with strong traditions.

As far as the private non-profit sector is concerned, we only find a small percentage of researchers working in this sector in Portugal, Cyprus and Italy.

Table 5: Number of researchers in EU27 Member States by sector of activity as a share of total researchers employed, 2010 (FTE)

	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector	Total
BE	44.4%	7.4%	47.4%	0.7%	100.0%
BG	14.0%	52.4%	32.9%	0.7%	100.0%
CZ	43.3%	21.4%	34.6%	0.7%	100.0%
DK	61.1%	3.1%	35.3%	0.5%	100.0%
DE	56.7%	15.8%	27.6%	0.0%	100.0%
EE	31.4%	13.4%	53.4%	1.7%	100.0%
IE	55.6%	4.0%	40.4%	0.0%	100.0%
GR	29.9%	10.5%	58.9%	0.7%	100.0%
ES	33.7%	18.1%	48.0%	0.2%	100.0%
FR	58.4%	11.2%	29.3%	1.2%	100.0%
IT	37.0%	16.9%	42.0%	4.0%	100.0%
CY	22.1%	11.3%	58.2%	8.4%	100.0%
LV	16.2%	16.3%	67.5%	0.0%	100.0%
LT	14.4%	17.1%	68.5%	0.0%	100.0%
LU	55.4%	25.0%	19.7%	0.0%	100.0%
HU	48.1%	23.6%	28.3%	0.0%	100.0%
MT	56.9%	5.7%	37.4%	0.0%	100.0%
NL	49.5%	13.0%	37.5%	0.0%	100.0%
AT	62.3%	4.5%	32.5%	0.7%	100.0%
PL	18.2%	21.0%	60.7%	0.1%	100.0%
PT	22.9%	5.3%	61.8%	10.1%	100.0%
RO	29.6%	28.3%	41.7%	0.5%	100.0%
SI	44.0%	26.4%	29.4%	0.2%	100.0%
SK	12.7%	19.8%	67.2%	0.3%	100.0%
FI	55.3%	11.0%	32.7%	1.0%	100.0%
SE	61.7%	3.8%	34.4%	0.0%	100.0%
UK	32.8%	3.4%	62.3%	1.5%	100.0%
EU27	44.9%	12.5%	41.6%	1.1%	100.0%

Source: Own calculations based on EUROSTAT data from the following website: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_perssc&lang=en

In 2008 (the more recent year for which data are available) the majority of the private sector researchers (in HC) were employed in the motor vehicles sector (more than 80,000); in the computer sector (about 70,000); in radio, TV and communications (more than 60,000); in the machinery and equipment sector (more than 50,000) and in the pharmaceutical (about 40,000), i.e. in the NACE Rev.1 sectors usually considered as the most innovative sectors.

The EU27 trend in the number of researchers (FTE) working in both the public sector and the business enterprise sector has been upwards during the period 2000-2010 (respectively 47% and 35% increase).

The share of researchers employed in the business sector differs significantly between the EU27 and other major economies. The share of researchers employed by the business sector is much higher for the EU's main economic competitors, e.g. 78% in the United States, 62% in China and 74% in Japan.

2.2 Researcher demographics: estimates from the EU HEI

In EU27, the population amounts to 1.2 million researchers in HEI, of which there are approximately 500,000 female and 740,000 male researchers. Of these 1.2 million researchers in HEI, we estimated that approximately 70,000 are non-EU researchers currently working in the EU.

40% work in Natural Sciences and Engineering & Technology, 36% in Social Sciences and Humanities and 24% in Medical Sciences and Agricultural Sciences (Table 6).

Of the EU27 researchers at post-PhD career stages, 13% indicated they had a dual position, that is, were employed both by the university (or higher education institutions) and another sector: 11% for women and 14% for men. Most of those researchers having a dual position are primarily employed by the university. The vast majority have a dual position in the public or government sector, such as a research based organisation (64% of those with a dual position and 8% of all researchers in EU27). A much smaller group also occupies a position in the private sector (25% of those with a dual position and 3.1% of all researchers in EU27). The country differences are quite significant, varying from 7% to 40%, with the EU27 average of 13%. Below this average are Western and Southern countries, whereas of the 11 countries with more than 20% dual positions, 9 are Eastern European countries. A possible explanation can be found in the working conditions and particularly the (relatively low) level of remuneration for university researchers in these countries, compared to their counterparts in other parts of Europe.

Table 6: The estimated population of the survey: researchers working in EU higher education institutions (2009)

	Total (in HC)	Natural Sciences and Engineering & Technology	Medical Sciences and Agricultural Sciences	Social Sciences and Humanities	Females	Males
Austria	29,039	12,514	7,440	9,085	10,965	18,074
Belgium	30,354	12,553	8,756	9,045	11,835	18,519
Bulgaria	6,575	2,673	1,028	2,874	2,839	3,736
Croatia	7,466	3,017	2,059	2,390	3,389	4,077
Cyprus	986	485	40	461	360	626
Czech Republic	19,419	7,829	6,803	4,787	6,878	12,541
Denmark	22,928	7,089	9,061	6,778	9,359	13,569
Estonia	4,485	2,316	557	1,612	2,062	2,423
Finland	21,450	7,982	5,360	7,229	9,987	11,463
France	105,508	40,713	26,521	38,274	36,250	69,258
Germany	215,474	90,245	55,373	69,855	74,816	140,658
Greece	23,984	9,255	6,029	8,700	9,106	14,878
Hungary	18,395	6,067	4,422	7,906	6,644	11,751
Iceland	1,504	580	378	546	658	846
Ireland	11,900	5,361	2,174	4,365	4,605	7,295
Italy	77,085	30,890	14,236	31,663	29,170	47,915
Latvia	5,048	2,107	787	2,154	2,631	2,417
Lithuania	10,633	3,911	1,459	5,263	5,663	4,970
Luxembourg	550	252	0	298	197	353
Macedonia (FYROM*)	948	382	373	193	466	482
Malta	621	196	134	287	183	438
Netherlands	22,557	7,695	8,233	6,629	8,321	14,236
Norway	21,315	5,570	7,086	8,546	9,392	11,923
Poland	70,592	26,705	16,470	27,417	29,744	40,848
Portugal	57,881	22,175	9,362	26,344	28,715	29,166
Romania	18,137	8,850	4,013	5,274	8,279	9,858
Slovakia	16,485	7,020	3,393	6,072	7,359	9,126
Slovenia	4,231	1,870	1,194	1,167	1,723	2,508
Spain	125,130	53,876	21,969	49,285	49,790	75,340
Sweden	37,566	12,937	10,500	13,961	16,712	20,854
Switzerland	33,603	12,966	8,447	12,190	11,408	22,195
Turkey	83,281	21,282	32,936	29,062	33,802	49,479
United Kingdom	284,277	108,256	72,401	103,619	124,310	159,967
Total	1,389,407	535,619	348,994	503,331	557,618	831,789
EU27	1,241,290	491,822	297,715	450,404	498,503	742,787

Source: Data processing on Eurostat New Cronos database; *FYROM statistical office data

2.3 Social demographics: estimates from the EU HEI

74% of EU27 researchers live as a couple and about 26% are single. This average is considerably higher than the average EU27 employees among whom 52% lives as a couple.

Around 69% of the EU27 researcher population have children. This compares to 46% of all those employed in the EU27 having children.

The age structure of the researchers generally reflects that of the employed population in EU27, according to Eurostat.

3 CAREER PATHS AND WORKING CONDITIONS OF RESEARCHERS

The majority of the country cases indicate that HEIs are organised in departments and have the highest autonomy with respect to academic issues and the lowest with respect to financial issues. However, substantial differences between HEIs and countries are observed.

In terms of typical characteristics per career stage, the R1, R2 and R4 career stages are cross-country comparable while the R3 stage shows largest diversity. Career progression is also country-specific with security generally increasing in positions at later career stages.

The situation of early stage researchers remains precarious, particularly in terms of contractual situation and employment position. This is further confirmed given R1 and R2 researchers' lower levels of satisfaction with their prospects for career progression.

More than half of the doctoral candidates across Europe receive training during their PhD. The focus of this training is on communication and presentation skills, but less so on entrepreneurial skills.

A research position becomes more attractive when career perspectives and research autonomy are high, on the condition that quality of life does not worsen. A fair balance between research and teaching activities is also important. At later career stages, the material component (remuneration, low administrative burden) becomes more important.

3.1 Career path

In order to analyse and compare researchers' career paths, the career stage model which was introduced and defined in the European Commission's communication "Towards a European Framework for Research Careers" (European Commission 2011, p. 2) has been used⁵⁰. This model distinguishes four career stages:

- R1: First Stage Researcher (up to the point of PhD),
- R2: Recognized Researcher (PhD holders or equivalent who are not yet fully independent),
- R3: Established Researcher (researchers who have developed a level of independence) and
- R4: Leading Researcher (researchers leading their research area or field).

3.1.1 How to describe the 'typical' career path of European researchers?

Academic careers develop in stages but are these career stages actually comparable across countries? There are some doubts about this assumption. Differences already occur at the first career stage: we know that doctoral education or early research training phases are organized differently in different countries, for example. Thus, we decided to test to what extent these career stages are actually characterized by similar features. In order to do this, as a first step 1) countries were grouped according to their characteristics per career stage; 2) factors were identified which presented the main dividing line between countries and 3) perspective was generated on the sequence, timing and likelihood of academic careers by covering all career stages.

In the following sections, country comparisons are presented for each career stage and an overall perspective across all four career stages is derived. The results are reached by cluster analysis. The detailed description of the methodological approach can be found in the detailed report⁵¹.

3.1.1.1 Career stage R1

The main features of the R1 level are rather similar across most countries. For the majority of countries career stage R1 can be described as follows: R1 researchers are aged 30 years or younger and they are in many cases employed based on often basic/block-funded temporary contracts. Their autonomy is rather low, tenure-track options hardly exist.

The classification of countries⁵² into a cluster does not correspond⁵² with countries' belonging to certain world region or other possible traditional influences such as Commonwealth membership. Non-European countries are not more prominent in one of these clusters. Within Europe one pattern may be worth noting however: in Southern European countries researchers at the R1 level appear to focus on research-only tasks more prominently. Central and Eastern European countries put more emphasis on teaching⁵³.

⁵⁰ For more detail, see Part1 - section 0 (p.59) of this report.

⁵¹ See report: IDEA Consult et al, 2013. MORE2 - Support for continued data collection and analysis concerning mobility patterns and career paths of researchers, Working Conditions Cross-Country Report (WP3). European Commission, DG Research and Innovation.

⁵² See report: IDEA Consult et al, 2013. MORE2 - Support for continued data collection and analysis concerning mobility patterns and career paths of researchers, Working Conditions Cross-Country Report (WP3). European Commission, DG Research and Innovation.

⁵³ See report: IDEA Consult et al, 2013. MORE2 - Support for continued data collection and analysis concerning mobility patterns and career paths of researchers, HEI Report (WP1). European Commission, DG Research and Innovation.

3.1.1.2 Career stage R2

The majority of countries (29 of 47) represent a somewhat coherent R2 career stage. The main features of career stage R2 can be described as follows: mainly researchers in their early 30s who are employed on temporary contracts, engaged in both teaching and research tasks and having a low level of autonomy. Even though clear-cut differentiations according to regions are hardly visible there are important deviations from 'average' or 'majority' in several countries. The most important differences between countries relate to the availability of tenure-track options at this stage. A number of countries also clearly deviate in terms of average age, funding regime and task division or type of contract.

3.1.1.3 Career stage R3

R3 is the most diverse career stage. In this stage there is a clear dividing line between countries regarding type of contract, task division and level of researchers' autonomy⁵⁴. As such, there are no main features characterizing this career stage and no general description can be outlined. The only generalization we can make is that there is a transition to more stable working conditions from R2 to R3 in a large number of countries, with more and more permanent contracts.

3.1.1.4 Career stage R4

The majority of countries (36 of 47) represent a rather coherent R4 career stage; the distinguishing feature however is whether the positions are offering a tenure-track option and the level of autonomy a researcher is granted. The general features which characterize this career stage in the majority of countries are: the R4 researchers obtain these positions in their 40s, are employed with (in the majority of the countries mainly) basic/block-funded permanent contracts and engage in research and teaching. Country differences lie in the type of contract and the research and teaching nexus. Notable groups of countries, allowing distinguish regions or traditional developments, are not found within any cluster.

⁵⁴ The process to determine the number of clusters suitable for a career stage contains two stages: 1) We identify the best solutions suggested in statistical terms by the Calinski/Harabasz pseudo-F parameter. 2) We verify that this solution provides us with meaningful differences between clusters and that the number does not exceed the number of variables chosen.

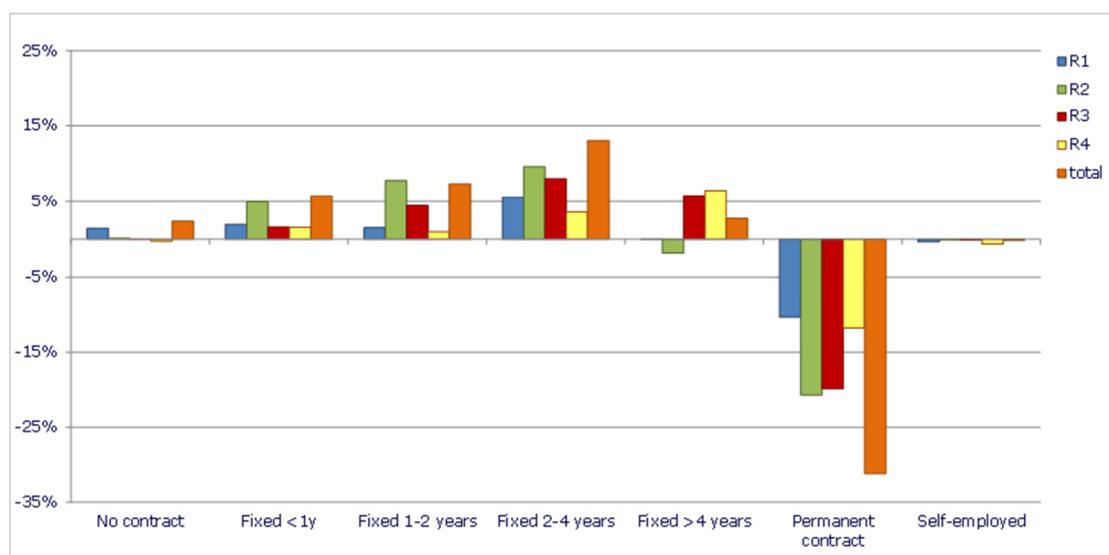
3.1.2 How to describe the working conditions of European researchers?

3.1.2.1 Contractual position along the career path

The EU HEI survey results confirm that the career stages are an important factor in explaining variances in contract features. On reaching the subsequent career stage, the share of positions offering a permanent contract increases (see Figure 11 in the next section). This observation is confirmed in the country cases on working conditions.

In general, contract conditions with regard to permanency of contracts did not improve, as evidence from the EU HEI survey suggests. Researchers with 'recent contracts' - meaning those who started their current employment less than 5 years ago - are less often awarded permanent positions than before. This can be shown by comparing these researchers across their current career stages with the entire population (see Figure 8). According to the data, it becomes obvious that in total (including all career stages) permanent contracts seem to be much less common for employment which began under less than 5 years ago while fixed term contracts, particularly those of two to four years, are more common. This pattern is consistent across all career stages⁵⁵, although is less pronounced at the R4 stage.

Figure 8: Difference in type of contract for recent employment per current career stage (EU27)



Source: MORE2 Higher Education Survey (2012)

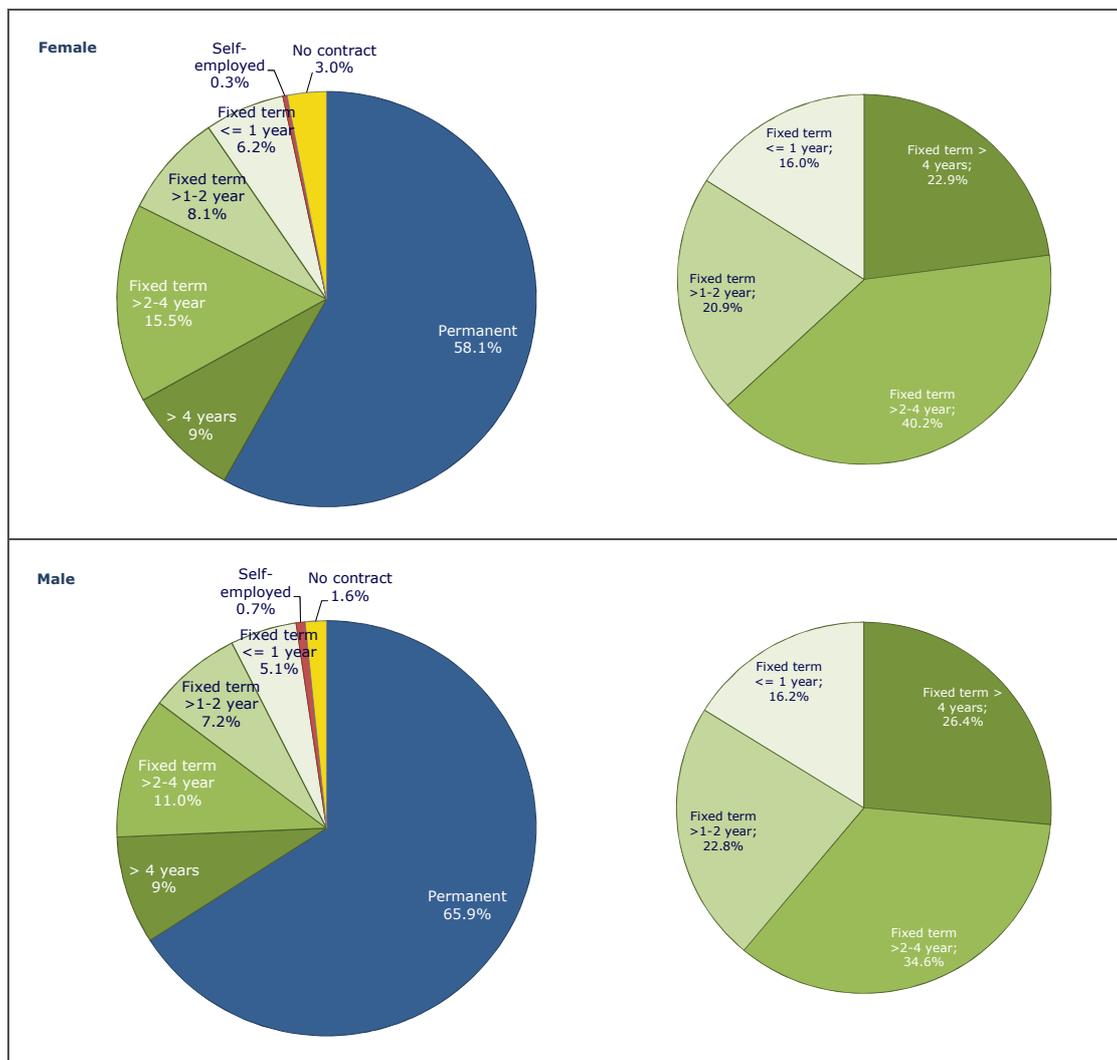
⁵⁵ It can be noted that the differences in R1 career stages are limited due to the fact that the majority (80%) of researchers in this group only started their current position during the last five years, so the total group is very similar to the subgroup of 'recent contracts'.

3.1.2.3 Type of contract per gender

Gender differences can be found with regard to the type of contract awarded (see Figure 9). According to our data, a higher share of male researchers currently holds a permanent contract (66% as opposed to 58% of the female researchers). The only other significant difference among male and female researchers can be found regarding fixed term appointments lasting 2-4 years. While 15% of female researchers are awarded these contracts, only 11 % of their male colleagues hold them. Regarding the other types of contract, the differences between male and female researchers are fractional.

Again, an important factor in explaining gender difference regarding permanent positions is their distribution across the various career stages. Although we find comparable shares of female and male researchers in the earlier career stages, the proportion of employed women dwindles with each subsequent career stage, particularly in the tenured positions. Women’s progress in a scientific career is slower compared to men and their numbers fall when climbing the career research ladder. The previous MORE1 survey also found that women tend to gradually reduce in number as they move from the doctoral stage to the further stages of their career as a researcher.

Figure 9: Type of contract per gender (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: Distribution of researchers over contract type per gender. (n=3,641 for female researchers and n=5,374 for male researchers)

3.1.2.4 Stable employment

Across career stages

As Sorensen (1992) pointed out, it takes longer to qualify for a permanent position in academia than is the case in other sectors because a candidate's performance and productivity are more difficult to measure and to judge. In this way, an early career researcher becomes a permanent member of the academic profession if he or she is assessed to be someone who has the potential to be highly productive and perform well in the future. Even though countries differ in how they organize this evaluation process, we assume as a general rule that such academics will secure a position with a permanent contract and/or a tenure-track-option and that this position will not be challenged by a dependency on competitive funding.

From the perspective of an early career researcher, we synthesize the results gained from the cluster analysis and group countries according to whether they offer positions with a permanent contract, and/or a tenure-track-option and basic/block funding at a certain career stage. In the following these positions are labelled as positions with 'stable employment conditions'.

Only a few countries offer stable employment conditions for early career researchers. Most countries in our sample offer stable working conditions for researchers from R3 career stage onwards. Only Estonia, Macedonia (FYROM), Latvia and Russia appear to not offer 'stable employment conditions' at any career stage.

In a next step, we analysed if the stage where stable employment conditions are granted for the first time can be related to other elements of an academic career. Thus,

- 1) We investigate whether the age when the first permanent position is obtained is related to the career stage with stable employment conditions.
- 2) We discuss whether stable employment conditions are related to the stage when autonomy to pursue ones' own research agenda is reached.
- 3) We discuss whether early stable working conditions lead to the higher education sector being regarded as more highly attractive when compared to other sectors.

Age at first permanent contract

In terms of a life span perspective, the age when a permanent position can be obtained is important because a permanent position offers a certain degree of employment security that, for example, influences family planning. Thus, we checked whether permanent positions at an earlier career stage are related to a younger age for these positions.

Indeed, our results show age and stage when the first permanent position can be secured to be highly related (see Table 7): In countries where stable working conditions can be obtained at an earlier career stage, researchers tend to be younger when they secure their first permanent position. This sounds like a trivial result, but it rejects hypotheses that career systems might have implemented longer qualification periods prior to the career stage with stable working conditions.

Table 7: Age range of first permanent position by career stage with stable working conditions

Career stage with stable working conditions	Age range of first permanent position															
	no rank with permanent contract		-30		31-35		36-40		41-45		46-50		Missing		Total	
	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N
R1	0	0	0	0	33	1	67	2	0	0	0	0	0	0	100	3
R2	0	0	20	1	40	2	20	1	0	0	0	0	20	1	100	5
R3	0	0	0	0	14	3	43	9	29	6	0	0	14	3	100	21
R4	0	0	0	0	0	0	10	1	10	1	60	6	20	2	100	10
No career stage	100	4	0	0	0	0	0	0	0	0	0	0	0	0	100	4
Missing information	25	1	0	0	0	0	25	1	25	1	0	0	25	1	100	4
Total	11	5	2	1	13	6	30	14	17	8	13	6	15	7	100	47

Source: MORE2 country profiles Working Conditions (2012)

3.1.2.5 Researchers’ autonomy to pursue their own research agenda

We assume that when researchers are granted a permanent position they were also trusted to follow their own research agenda. The results show that this relationship can be found in most countries: In 31 out of the 47 countries researchers can pursue their own research agenda in career stage R2 or R3 (see Table 8). In the majority of these countries (18 out of 31) researchers have stable employment conditions at these career stages.

Furthermore, as shown above, pursuing one’s own research agenda is detached from the highest career stage. Even in eight out of ten countries which offer stable employment conditions only at R4 career stage can researchers pursue their own research agenda as early as R2 or R3 career stage.

Table 8: Career stage with own research agenda by career stage with stable working conditions

Career stage with stable working conditions	Career stage with own research agenda													
	never		R1		R2		R3		R4		Missing		Total	
	%	N	%	N	%	N	%	N	%	N	%	N	%	N
R1	0	0	33	1	33	1	33	1	0	0	0	0	100	3
R2	0	0	20	1	20	1	40	2	0	0	20	1	100	5
R3	0	0	5	1	33	7	38	8	10	2	14	3	100	21
R4	0	0	10	1	30	3	40	4	20	2	0	0	100	10
No career stage	25	1	0	0	50	2	0	0	25	1	0	0	100	4
Missing information	0	0	25	1	25	1	25	1	0	0	25	1	100	4
Total	2	1	11	5	32	15	34	16	11	5	11	5	100	47

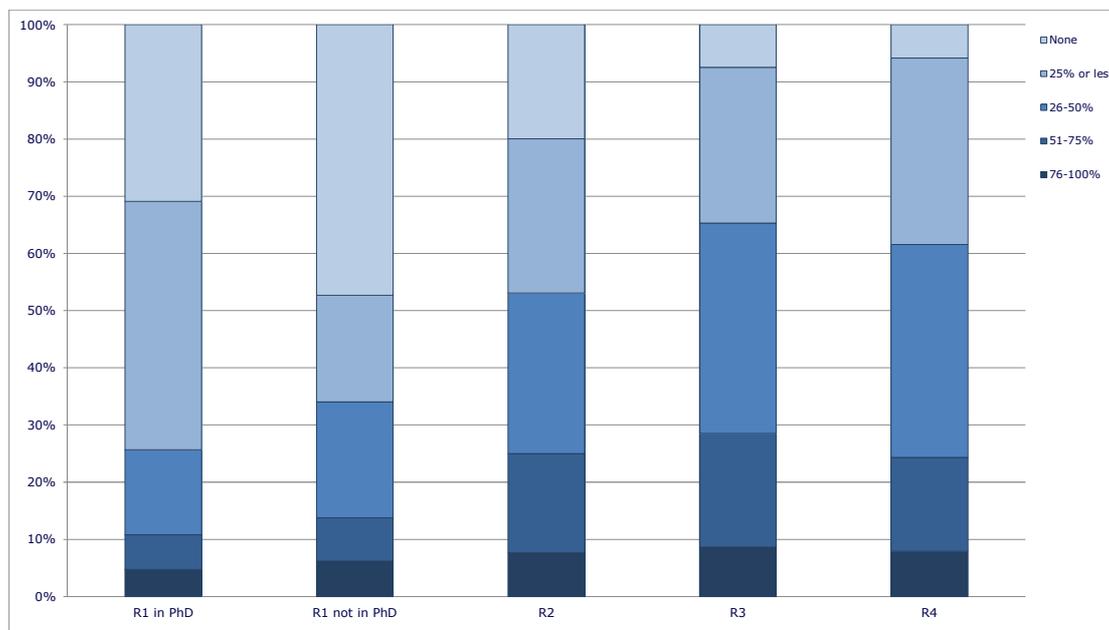
Source: MORE2 country profiles Working Conditions (2012)

3.1.2.6 Researcher’s activities – teaching load

The teaching load differs depending on the position and career stage of the researcher. Researchers with part time positions tend to have a higher teaching load, relatively speaking. While on average, EU27 researchers on full time positions and part time positions exceeding 75% devote 8% of their working time to teaching, this share doubles (16%) for researchers employed with 51-75% contracts and it almost doubles again for researchers on <50% contracts. They spent 31% of their working time on teaching. 14% of researchers reported that they do not have teaching obligations.

The teaching load also varies by career stage (see Figure 10). Earlier career stage researchers have a low teaching load. At the R1 and the R2 level we find the highest share of researchers not having to teach at all. Thus, post-docs in particular can devote most of their time to research. The differences are rather small if R3 and R4 researchers are compared - the established researchers (R4) devote slightly more time to teaching than do the independent researchers (R3). This impression is also reflected by the finding that researchers in permanent positions spend relatively more time on teaching than those on fixed-term contracts.

Figure 10: Teaching activities per current career stage (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: Distribution of researchers over categories of teaching activities per current career stage. (n=8,985)

3.1.3 To what extent is the employment situation of early stage researchers precarious?

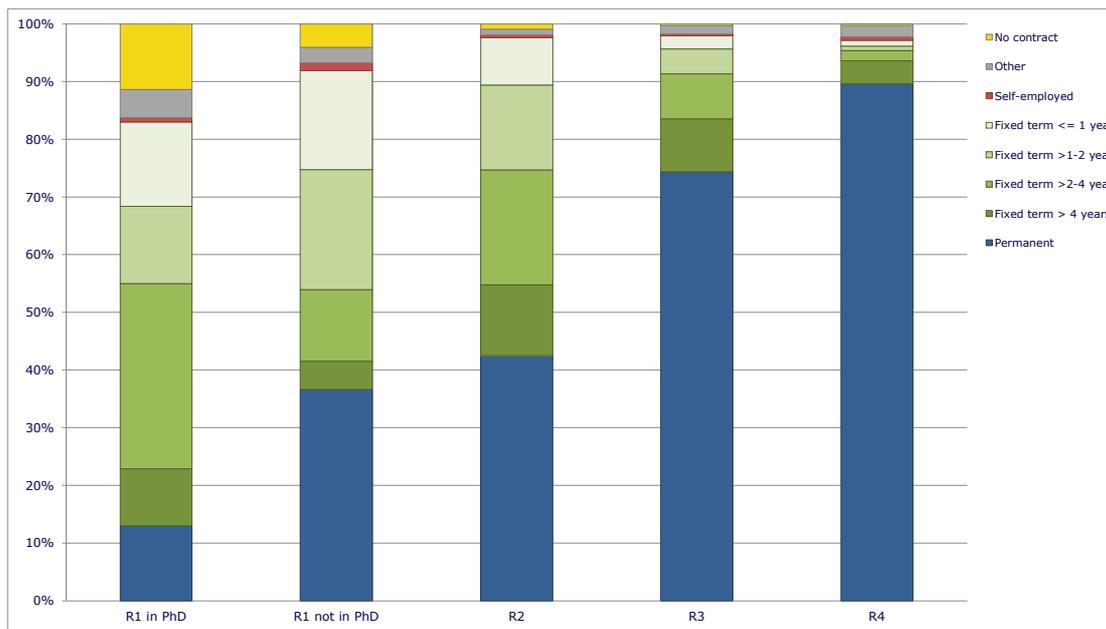
The common features and differences among countries with regard to employment conditions for researchers by career stages have been discussed above. The main differences between the four career stages are the type of contract and whether or not positions are provided with tenure-track options. As we now focus on the question of whether early stage researchers have more precarious working conditions, we refer back to this information and now focus more specifically on the R1 and R2 career stages. It was shown that career stage is found to be the most important factor in explaining variances in contract position and that early career researchers are the ones facing most uncertainties.

Results obtained based on the EU HEI survey among researchers confirm this (see Figure 11). In particular, R1 researchers enrolled in PhD programmes clearly have more limited access to permanent or longer term fixed contracts. The fixed term contract of 2 to 4 years is most common for this group. Furthermore, 11% of doctoral candidates have no contract at all, although this figure seems to be underestimated⁵⁶. As a proxy for a relatively 'unattractive' contractual situation, the categories 'no contract', 'others' (often student status) and 'fixed term contracts of maximum one year' sum up experiences of 31% of R1 doctoral candidates. The rest of the R1 researchers have rather similar contractual positions as the R2 researchers. With each step in the career stage the proportion of researchers holding permanent positions increases. As already discussed, it is highest at the R4 level (established researchers). Here 91% of researchers have a permanent position, at the R3 level (independent researcher) 76% hold permanent positions and 43% of the post-doctoral researchers (R2). Although the permanency gap between R4 and R2 is quite considerable, fixed term positions of R2 researchers tend to be longer lasting (12% of the post-docs have contract over 4 years and 20% a 2-4 year contract). In addition, the chance of getting a contract which offers a tenure track option also increases with the career stage, at least from career stage R1 to R3, at the R4 level the share is very similar to the R3 level but, taken together with the higher share of permanent positions offered and held at the R4 the job security at the R4 level again increases compared to the R3 level.

In addition, the country cases show that only very few countries offer tenure-track options to early career researchers (see Figure 12).

⁵⁶ It should be noted that – even though the academic world was one of the first users of the internet - the frame based on web mails (as any official survey on official register data) may have led to underrepresentation of less visible researchers (who might more frequently work without a contract). Furthermore, different interpretations of the term 'contract' may affect this indicator downwards.

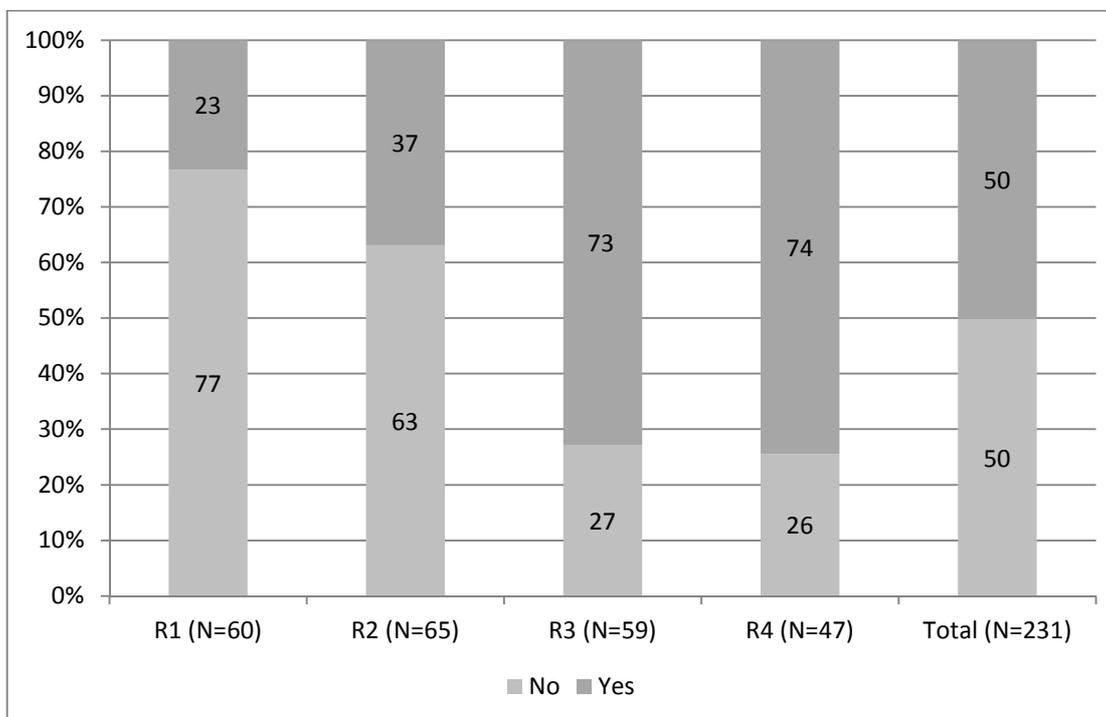
Figure 11: Type of contract per current career stage (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: Distribution of researchers over contract type per current career stage with R1 (doctoral or equivalent), R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers. (n=8,986). Here the R1 group has been split into two groups. "R1 in PhD" contains those researchers in PhD training and "R1 not in PhD" those who are not.

Figure 12: Share of positions offering tenure track by career stage (% of all positions named²⁵)



Source: MORE2 country profiles Working Conditions (2012)

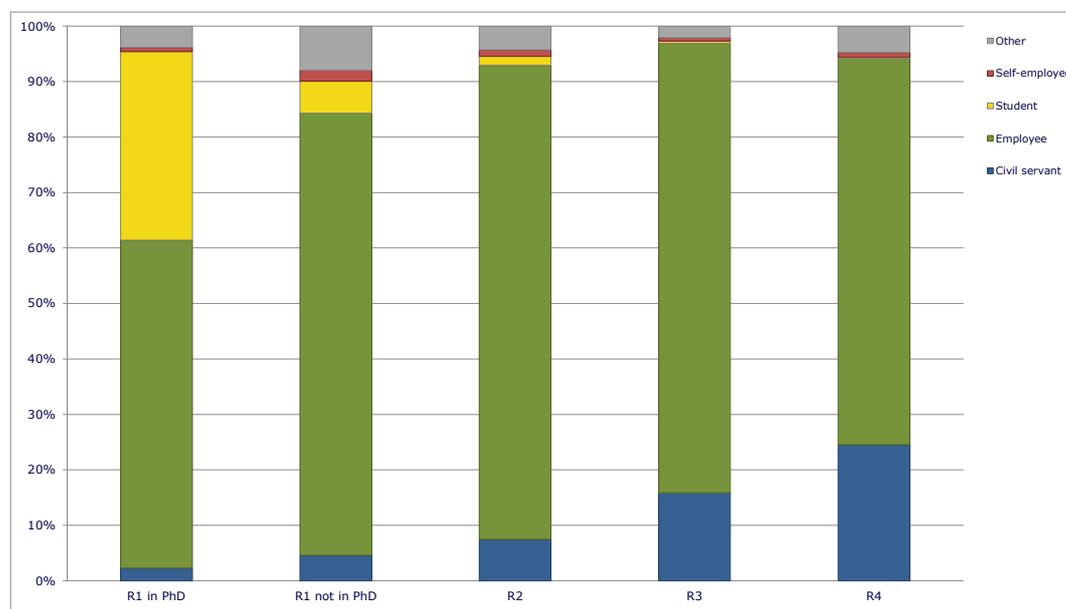
A similar pattern of job insecurity in early career stages or higher job security in later career stages is observed in the analysis of employment relationship from the EU HEI survey (see Figure 13), e.g. the share of researchers being civil servants is higher in later career stages.

The extent to which employment status varies during the four career stages is shown in Figure 13. Of those in the doctoral training stage (R1 in PhD training), 34% have student status and over 59% have employee status. The other R1 researchers are closer to the distribution levels for R2 researchers, but here we also still find 6% with student status.

In the other career stages, civil servant status increases by career stage and employee status decreases proportionally. This raises the question as to how these figures can be interpreted, particularly the difference between R3 and R4 researchers. Of R4, 26% have civil servant status against 16% of R3, whereas 83% of R3 have employee status against 73% of those in the R4 group. This requires further research: do civil service appointments apply equally to all staff employed at a particular institution, or is can on differentiate between them? A possible difference might also lie in the status of civil servants with permanent and tenured positions, versus those with fixed term contracts. To support the latter hypothesis, we can note that 15% of all civil servants in the EU27 population have a fixed term contract instead of a permanent one.

Again, we find indications further reinforcing the trend towards less permanent contractual relations in more recent employment relations. As Figure 14 shows, civil servant positions are less common among researchers who only started in their current post in the last five years than for the overall population we looked at. The share of researchers on student contracts increased among early career researchers⁵⁷, R3 and R4 researchers more frequently work based on an employee contract.

Figure 13: Employment relationship per current career stage (EU27)

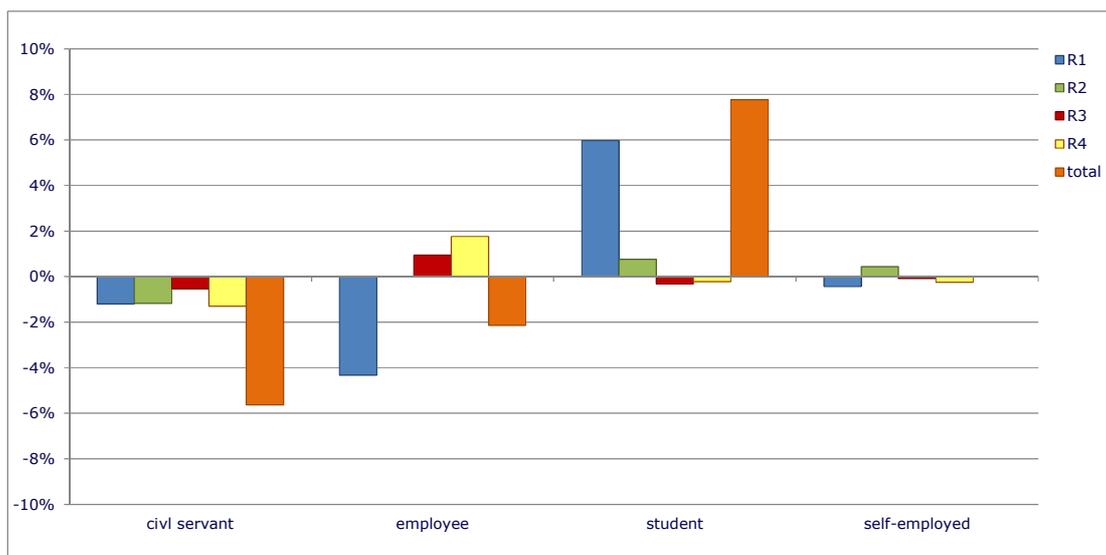


Source: MORE2 Higher Education Survey (2012)

Note: Distribution of researchers over type of employment relationship per current career stage with R1 (doctoral or equivalent), R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers. (n=8,985)

⁵⁷ This should be interpreted with care however, as the majority of R1 (80%) researchers hold recent positions according to the definition used here.

Figure 14: Difference in employment relationship for recent employment per current career stage (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: Difference between the share of researchers with a specific employment relationship of those who are less than five years in their current employment and the total share of researchers with that specific employment relationship per current career stage. (n=8,616)

3.1.4 To what extent are doctoral candidates equipped with skills (bring in doctoral training findings)?

With the Bologna declaration⁵⁸ in 1999 the Bologna process, aiming at the modernization of the European higher education, started. In 2010 the European Higher Education Area was officially launched⁵⁹. With the aim of improving the competitiveness of European Higher Education, a transparent and comparable system of academic degrees was to be introduced, the mobility of students and researchers to be promoted, and high quality training to be ensured (Bologna declaration 1999). The progress made and the problems faced in this process have been analysed and documented in various reports. It has been shown that the degree of implementation varies across the individual countries (see Budapest-Vienna declaration 2010). Differences are still obvious with regard to doctoral training.

3.1.4.1 Extent of structured doctoral training

The picture across countries with regard to the form in which doctoral education is offered is ambiguous, not only in Europe. Doctoral training is provided either in structured programs or as an individually supervised doctorate. In the majority of countries, structured PhD training is not mandatory: in 43% structured PhD training programs are mandatory and in 66% structured PhD training is predominant (see Figure 15).

⁵⁸ http://www.bologna-bergen2005.no/Docs/00-Main_doc/990719BOLOGNA_DECLARATION.PDF

⁵⁹ http://www.ehea.info/Uploads/news/Budapest-Vienna_Declaration.pdf

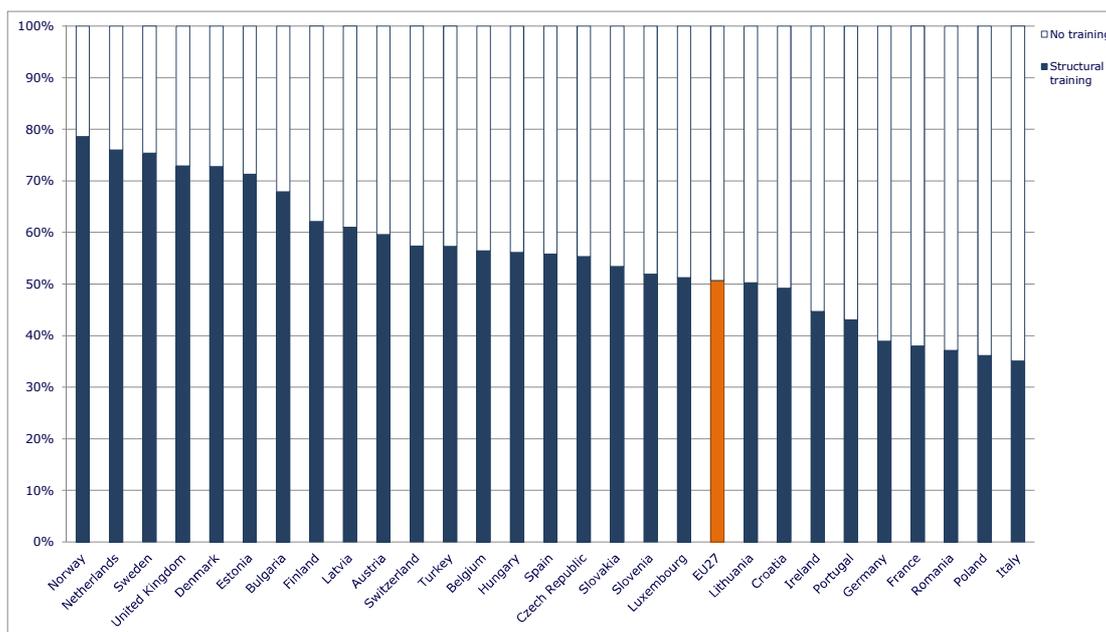
Figure 15: Implementation of structured PhD training programs



Source: MORE2 country profiles Working Conditions (2012)

According to the survey of EU HEI researchers, where respondents were asked about the type of doctoral training they received, just over half of doctoral candidates and recent doctorate holders have received 'structured training' during their PhD (51%). This share seems to be increasing as there is a 9% difference between R2 doctorate holders (47% received training) and current doctoral candidates (56% received training). Variations become obvious when countries are compared. The percentage of doctoral candidates and R2 (post-doctoral or equivalent) doctorate holders who have received structured training during their PhD varies between 35% in Italy and 79% in Norway (see Figure 16). Scandinavian countries such as Norway, Sweden, Denmark and Finland are represented amongst the leaders in terms of structured training, as well as The Netherlands, United Kingdom, Bulgaria and the Baltic countries Estonia and Latvia. Germany, France, Romania, Poland and Italy are at the other end of the spectrum and do not reach 40%. Variations between countries can potentially - at least partially - also be explained by differences in the interpretation of the term 'structured' training.

Figure 16: Share of researchers receiving structured training during PhD per country of PhD



Source: MORE2 Higher Education Survey (2012)

Note: - Percentage of doctoral candidates and R2 (post-doctoral or equivalent) doctorate holders who have received structured training during their PhD per country of PhD. (n=3,892)
 - Countries with less than 30 observations are omitted: Cyprus, Greece, Iceland, Macedonia (FYROM) and Malta.

3.1.4.2 Modules of structured training

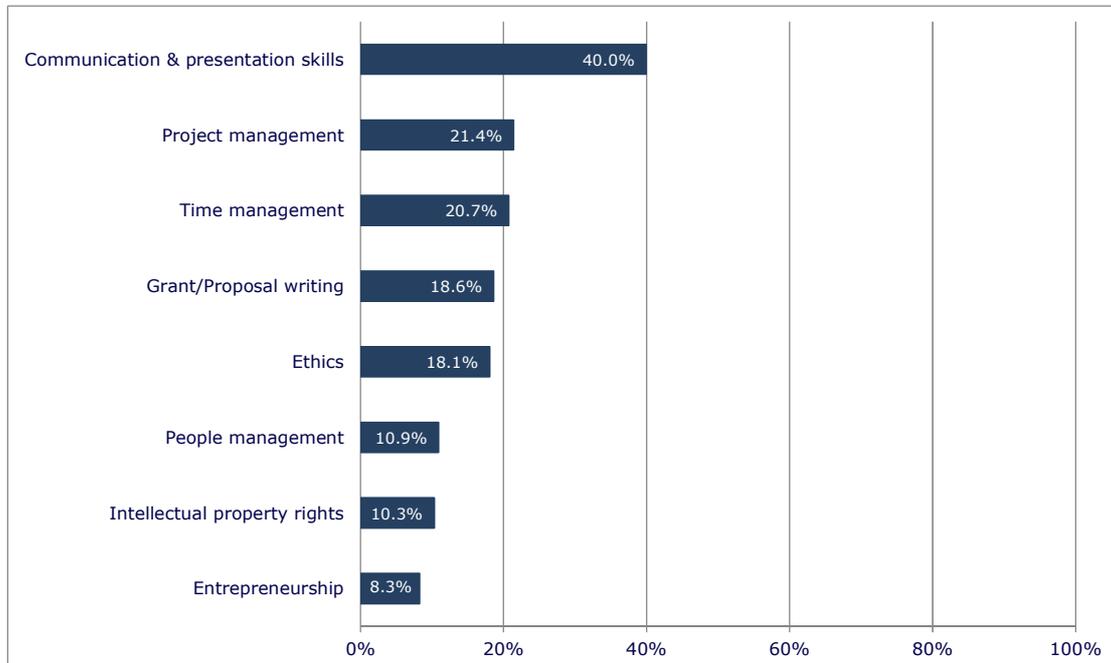
The implementation of modules of structured doctoral training varies. In general, training in communication and presentation skills is most common, with 40% of all doctoral candidates and recent doctorate holders reporting that they have followed training modules in this area (Figure 17). Significantly less common is training in project management, time management, grant or proposal writing and ethics, as these modules were taken up by approx. one fifth of all doctoral candidates and recent doctorate holders. Skills that are more directly related to non-academic positions, such as people management, intellectual property rights and entrepreneurship are even less commonly included as training programmes in universities and higher education institutes.

Again, differences become obvious among countries (see Figure 18). Researchers in the United Kingdom, as well as in Sweden, Turkey, Estonia and Finland appear more likely to receive structured training in all 4 main fields⁶⁰. At the other end of the spectrum, researchers in Italy, Germany, Poland, Luxembourg, Portugal and Macedonia (FYROM) report relatively low shares of 'structured training' during their PhD. France, Romania and Slovenia also have relatively low shares across the board with the exception of training in business skills. Researchers in Spain are more likely to receive structured training in management but report comparatively less training in other modules. Many South and West European countries thus rank relatively low when compared to other countries, or vary across modules.

⁶⁰ With communication = communication, presentation and grant/proposal writing; management = project, time and people management; ethics = ethics and business skills = intellectual property rights and entrepreneurship.

Although the general level and extent of structured training seems interrelated across countries in the same region, no clear pattern is detected for certain modules being given more attention per region. One exception is ethics training which is most common in Scandinavian countries and in the United Kingdom and Ireland.

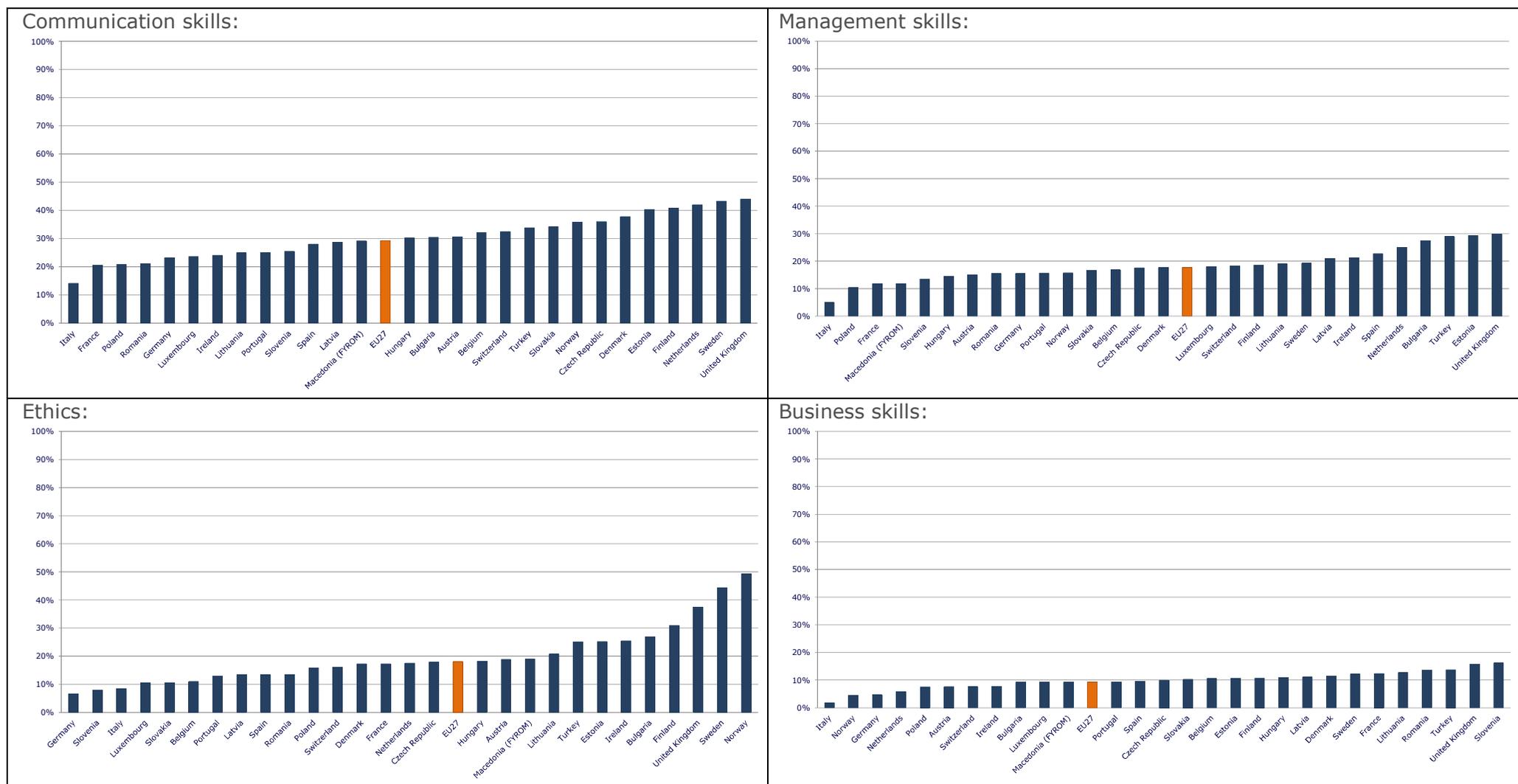
Figure 17: Modules of structured training during PhD (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: Percentage of doctoral candidates and R2 (post-doctoral or equivalent) doctorate holders who have received structured training during their PhD in the respective skills. (n=2,250)

Figure 18: Modules of structured training during PhD per country of PhD



Source: MORE2 Higher Education Survey (2012)

Note: - Percentage of doctoral candidates and R2 (post-doctoral or equivalent) doctorate holders who have received structured training during their PhD in the respective skills. (n=4,043)
 - Communication skills aggregates communication and presentation skills and grant/proposal writing; Management skills aggregates project management, time management, people management; Business skills aggregates intellectual property rights and entrepreneurship; and Ethics refers to one answering category 'ethics'.

3.1.4.3 Quantity of structured training

It is not only the extent to which structured doctoral training is provided and the content of the respective training offered varies, as variations also exist regarding the quantity per year in which these trainings are offered or taken. 28% of doctoral candidates and recent doctorate holders received less than two weeks of training per year (15% less than one week; 13% between one and two weeks). Another 6% received between 2 and 3 weeks of training respectively and 9% more than 3 weeks, amounting to 15% who received more than 2 weeks of training per year. 8% do not know the quantity and 49% did not receive structured training.

With regard to the amount of training provided, no large variations are observed between the current R1 and the current R2 career stages (16% versus 14% training for more than two weeks per year) or between female and male researchers (both 15%). Larger variations occur amongst the different fields of science. Training per year appears to be lowest in Natural Sciences and highest in Social Sciences.

Differences in the share of doctoral candidates and recent doctorate holders who receive more than two weeks of structured training also vary by country, ranging from 5% in Cyprus to 41% in Macedonia (FYROM). Scandinavian countries as well as Baltic countries and a number of East European countries are above the EU27 average, while West European countries are mainly below (except for the Netherlands and Ireland).

3.2 Country comparison and attractiveness

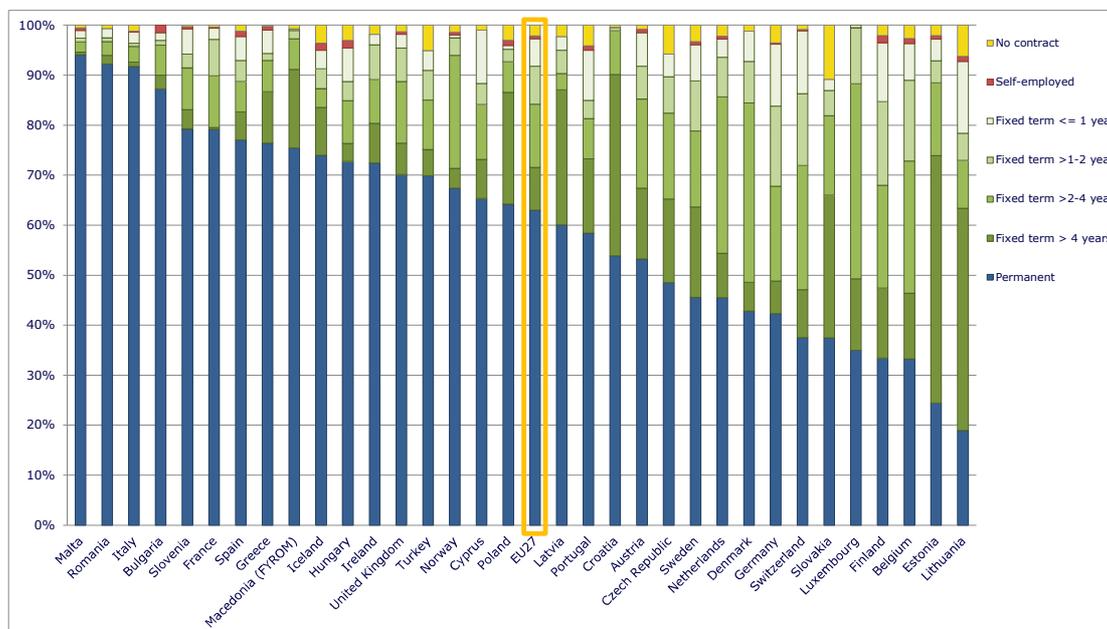
3.2.1 What are the main country differences with respect to working conditions?

3.2.1.1 Contractual position

As already outlined above, career stage is the most important factor explaining variances in contract features. In the vast majority of the countries, researchers at the beginning of their career are only offered temporary contracts. Along the career path, the share of permanent positions increases. At the R4 level most countries award permanent positions. The duration of fixed term contracts also increases in higher career stages. The rather short running contracts, such as those only lasting for up to two years or those between 2 and 4 years, are more typical for R1 and R2 positions. Tenure options are also available more frequently in later career stages.

With regard to country differences, Figure 19 shows the overall contractual position of all researchers per country of current employment. A rather diversified pattern becomes obvious. The proportion of permanent positions varies from over 90% for Malta, Romania and Italy to below a third in Belgium (33%), Estonia (24%) and Lithuania (19%), the EU27 average amounts to 63%. The country differences can, in part, be explained by the distribution and representation of researchers in the different career stages in each country. A country with an overall low share of early-stage researchers in their research population or one where the younger researchers are under-represented, will converge to the working conditions of later-stage researchers, i.e. with more permanent and longer term contracts. This is the case for Malta, Romania and Italy, where respectively only 8%, 9% and 6% of the researchers in the sample are in the R1 career stage.

Figure 19: Type of contract per country of current employment



Source: MORE2 Higher Education Survey (2012)

Note: Distribution of researchers over contract type per country of employment. (n=10,547)

The highest share of researchers with fixed-term contracts lasting more than 4 years can be found in Eastern European countries: Estonia (50%), Lithuania (44%), Croatia (36%), Latvia (27%) and Poland (22%). For the other fixed-term periods the following are worth mentioning:

- Countries which have higher proportions of fixed-term contracts between 2-4 years are Luxembourg (39%), Denmark (36%), The Netherlands (31%), Belgium (26%), Switzerland (25%) and Norway (23%).
- Relatively more 1-2 year fixed contracts can be found in Finland (17%), Belgium (16%), Germany (16%), Switzerland (14%), Luxembourg, (11%), Sweden (10%) and Denmark (8%).
- Finally, fixed-term contracts less than one year can be found in Lithuania (14%), Switzerland (13%), Germany (12%) and Finland (12%).

Less common are the self-employed researchers or researchers without any contract at all. Only in Slovakia (11%), Lithuania (6%) and in the Czech Republic (6%) do a substantial share of researchers have no contract whatsoever.

The greater number of fixed-term positions in several countries reflects the general policy changes regarding academic appointments. Even systems with a strong tradition of hiring researchers on a tenured or tenure-track position, or with permanent civil service hiring arrangements similar to tenure, are moving toward more fixed-term appointments. Several countries (in Western Europe) have formally abolished tenure, and have replaced it with term contracts which are renewed as a matter of course⁶¹.

3.2.1.2 Employment relationship

As mentioned above, career stages are also relevant regarding the status of a researcher when it comes to the employment relationship. In general, most researchers (79%) hold employee positions⁶² and 15% are civil servants. As mentioned earlier, there is a tendency to reduce the share of civil servants. Differences at the country level can also be observed for employment status. Especially high is the share of researchers holding "employee status" in Romania (94%), Poland (93%), UK (93%), Malta (91%), Latvia (90%), Czech Republic (89%), Croatia (88%) and Italy (87%). Particularly low is the share in Greece (38%), Turkey (52%) and Portugal (61%). Greece is the only country where the share of civil servants is higher than the share of researchers with employee status (60% versus 38%). But as mentioned above, there is a potentially significant underrepresentation of those researchers in early career stages in the country sample and thus data should be interpreted with care.

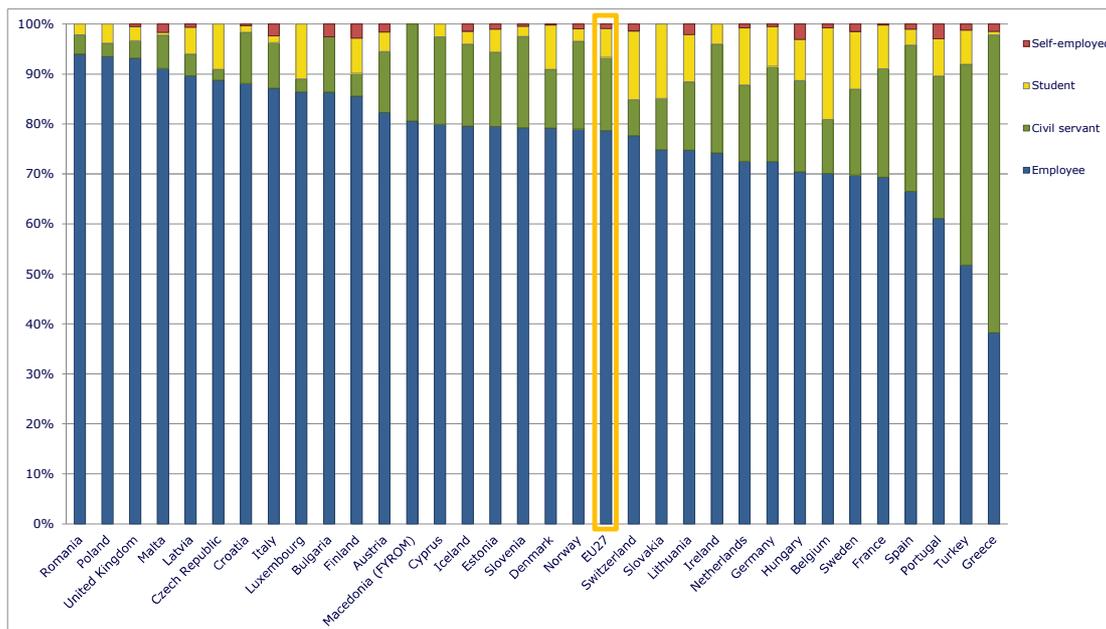
Although Eastern European countries are well represented in the top countries where employee status prevails, a particular pattern does not emerge. The differences between and within countries relate to the extent to which private higher education and research institutions exist in the different national systems.

Relatively speaking, student status is most common in Switzerland (14%), Slovakia (15%) and Belgium (18%).

⁶¹ For example, the Education Reform Act of 1988 in the UK removed tenure, which meant that since then all staff appointed or promoted could be dismissed if considered redundant. Other countries have experienced a similar shift from public to private employment contracts whereby tenure no longer exists because a contract arranged for an indefinite time allows for its termination, in accordance with the conditions as set by national labour legislation. See for an overview of developments in Europe: J. Enders & E. de Weert (2004) *The International Attractiveness of the Academic Workplace in Europe*. Gewerkschaft Erziehung und Wissenschaft (GEW) Frankfurt /Main.

⁶² Here, 'country' refers to the country of employment, and country differences are to be interpreted taking into account the relative proportion of researchers in each career stage.

Figure 20: Employment relationship per country of current employment



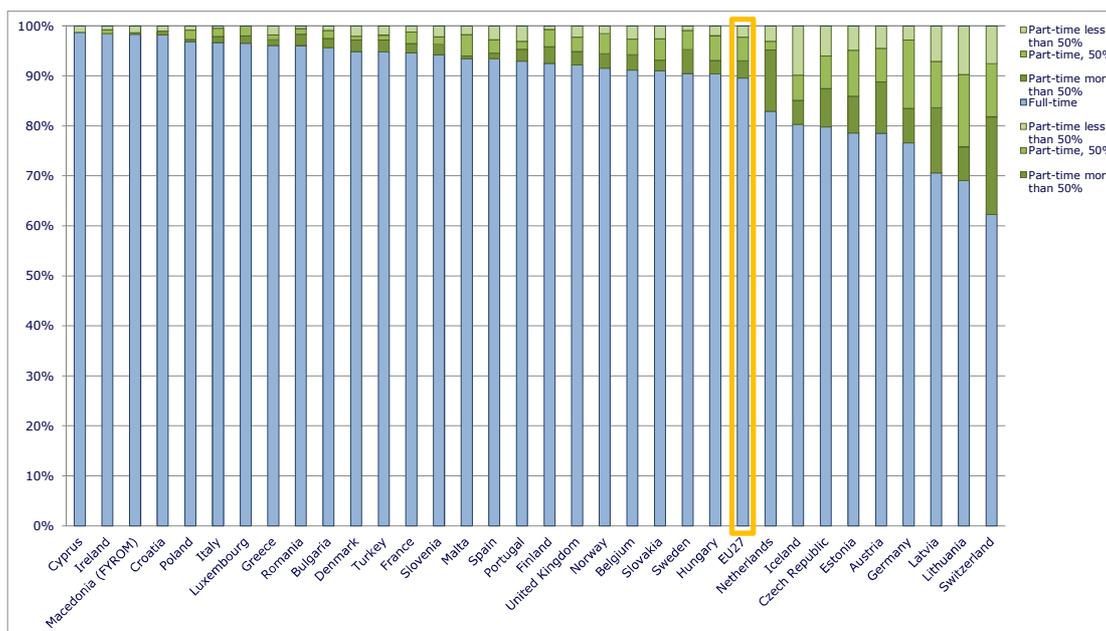
Source: MORE2 Higher Education Survey (2012)

Note: Distribution of researchers over type of employment relationship per country of current employment. (n=10,546)

3.2.1.3 Full time versus part time positions

The majority of researchers (90%) in the EU27 countries hold full time positions, as Figure 21 illustrates. Some differences can be found among countries (see Figure 21). Considerably lower is the share of full time employment in Switzerland (62%), Lithuania (69%), Latvia (71%) and Germany (77%). In these countries a fair proportion of researchers are working on 50% contracts.

Figure 21: Type of position per country of current employment (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: Distribution of researchers over type of position per country of current employment. (n=10,546)

3.2.1.4 Researcher’s activities – teaching load

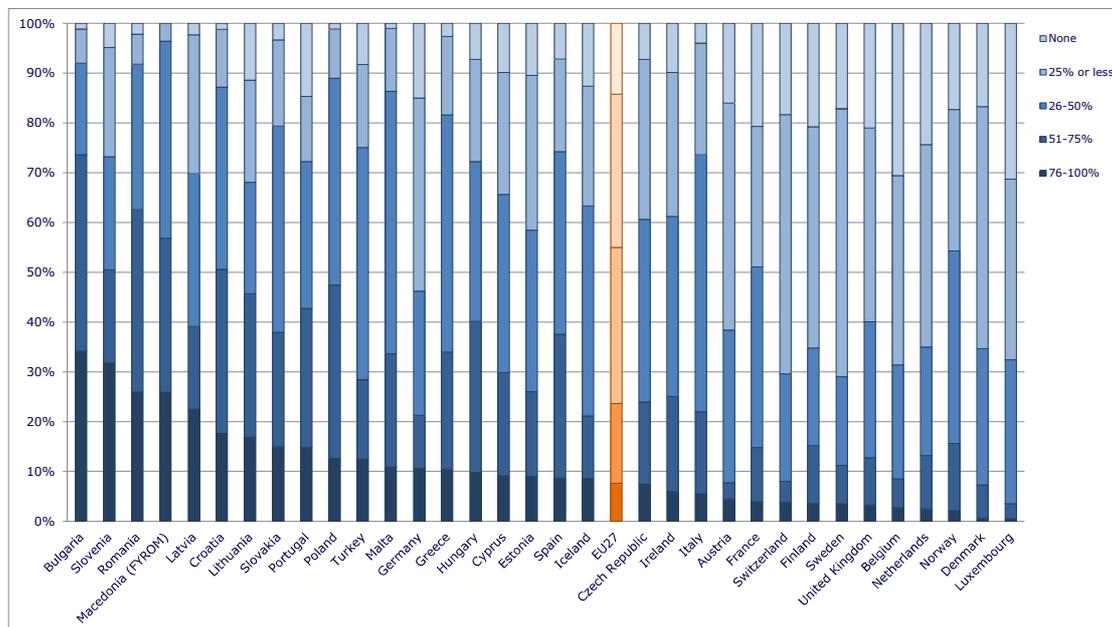
The picture of teaching load of the researchers across countries is rather diverse. (see Figure 22). Researchers in the Eastern European countries tend to have the highest teaching load. And they are thus more limited when it comes to pursuing research interests.

A comparatively high share of researchers with a relatively low teaching load (25% or less) can be found in Denmark (49%), Austria (46%), the Netherlands (41%), Sweden (54%) and Finland (44%). While in Luxembourg (31%), Belgium (30%), the Netherlands (24%), the UK (21%), and France (21%) we find the highest shares of researchers who do not teach at all. Employment positions at independent research institutes may partly explain this, but we also note that in Luxembourg, Belgium and the Netherlands R1 researchers make up more than 40% of the sample, which could bias results towards this career stage.

These findings point to the fact that Western European countries might be more attractive for researchers as they can devote more of their time to pursue their research activities.

Changes with regard to teaching load can be observed in recent times. Particularly since 2005, teaching loads seem to be decreasing. The share of researchers devoting ‘25% or less’ to teaching is increasing: 28% of researchers with their current positions having started in 2000-2004 and 36% of those having started between 2005 and 2012. 20% of those researchers with their current post having started in 2005-2012 also said that they did not have any teaching, whereas this was considerably lower (9%) in the previous period.

Figure 22: Teaching activities per country of current employment



Source: MORE2 Higher Education Survey (2012)

Note: Distribution of researchers over categories of teaching activities per country of current employment. (n=10,546)

3.2.2 Which aspects can be identified which determine the attractiveness of a position or country as a working environment for researchers?

Based on the stated choice experiment⁶³ in the fourth work package of the MORE2 study, as described in Part 1 - section 4.3 (p.51), a number of factors can be identified which determine the attractiveness of a position or country as a working environment for researchers.

An important factor influencing job decisions is the factor "quality of life". It is not improving their recent status that researchers are worried about but rather, that they would not accept any decrease in their "quality of life". Thus, when it comes to the question of whether or not to move to another country to pursue a research career, their "quality of life" must not be worse than in the country in which they currently reside. At the same time, the difference regarding whether "quality of life" remains at a comparable level or improves does not have a big impact on a job decision. This could also imply that most researchers are satisfied with the quality of life in their current country of residence and they seem to be able to adapt to varying levels of quality of life. This job characteristic can be seen as a clear case of a "necessary, but not decisive" factor for job choice. It also somehow diminishes the outlook for countries who assume that offering a higher quality of life compensates for other deficits in researcher jobs (such as low salaries).

The factors which are highly relevant in influencing job decisions are career perspectives and research autonomy. The latter, especially when it comes to gaining it in an early phase of the career, has to be earned, as early independence is clearly linked to research performance. It was also found that department-style universities are more likely to provide required frameworks than institutions using the chair-based model.

Attractive LSR jobs have a higher material component, salaries are more important; LSR want attractive grants systems, minimal administrative burden and ease of starting new lines of research. Both ESR and LSR jobs require a fair division between teaching and research. The different European countries differ considerably with regard to their system of higher education and in terms of the possibilities for universities to offer attractive and competitive jobs.

⁶³ For a more detailed description of the methodology please see IDEA Consult et al, 2013. MORE2 - Support for continued data collection and analysis concerning mobility patterns and career paths of researchers, Remuneration Cross-Country Report (WP4). European Commission, DG Research and Innovation.

3.3 Satisfaction and career progression

3.3.1 How satisfied are researchers with different aspects of their job?

3.3.1.1 Recruitment process in HEI

A research career usually starts with a researcher being recruited by an institution. Therefore, the first issue we tackle regarding the question “how satisfied are researchers?” concerns the recruitment process. Recruitment procedures are part of staffing procedures. The country correspondents also provided information regarding the autonomy of the HEI⁶⁴ for this dimension. According to the assessment by the country correspondents, in more than half of the countries, staffing autonomy of the HEI is high or even very high. Therefore, HEI can influence these processes thus to a large extent. Regarding researchers’ satisfaction with these processes, we draw on results from the survey among researchers carried out in the MORE2 context.

Respondents were asked their opinion about recruitment policies at their institution. Generally, the picture is rather positive with around 60-66% of researchers indicating that they were 'satisfied' with the levels of openness, transparency and the degree of merit-based recruitment (see Table 9).

Table 9: Satisfaction with recruitment process at home research institution (EU27)

	R1	R2	R3	R4	% satisfied
open recruitment	56.1%	58.6%	60.1%	63.3%	60.0%
transparent recruitment	62.3%	60.6%	65.0%	68.8%	64.6%
merit-based recruitment	67.3%	60.1%	66.9%	67.9%	65.7%

Source: MORE2 Higher Education Survey (2012)

Note: % of researchers that were satisfied (vs. not satisfied) with the researcher recruitment process (n=9,016)

In general, R4 researchers are more satisfied with the different aspects of the recruitment process in HEI than are researchers at other career stages. R2 researchers are the least satisfied with transparency and merit-based recruitment. R1 researchers, on the other hand, are the least satisfied with openness.

Differences can be found when comparing assessments by male and female researchers. Female researchers are generally less satisfied with the recruitment process (between 6 and 9 pp difference with their male counterparts in the EU HEI survey).

Satisfaction between the three aspects is interrelated per country, but substantial differences between countries do exist. The United Kingdom has the highest proportion of satisfied researchers in terms of all three features; whereas Italy has the lowest shares for open and transparent recruitment and the one-but-lowest for merit-based recruitment. In Luxembourg, Ireland and Estonia, the proportion of satisfied researchers are also generally high, but in Croatia, Bulgaria and Slovenia, shares are overall low.

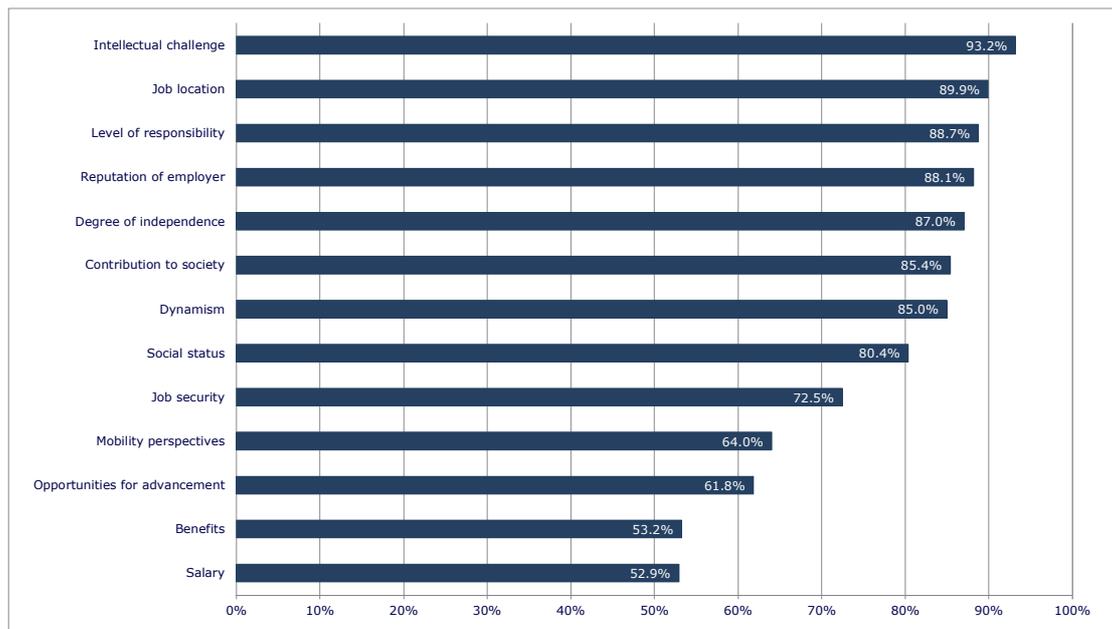
⁶⁴ For details see IDEA Consult et al, 2013. MORE2 - Support for continued data collection and analysis concerning mobility patterns and career paths of early career researchers, Career paths Cross-Country Report (WP3). European Commission, DG Research and Innovation.

3.3.1.2 Satisfaction with current position

Looking beyond recruitment, how satisfied are researchers with different aspects of their current academic position? Despite the fact that researchers' positions - especially during the early stages - are characterized by temporary and often rather short-term contracts, researchers are very satisfied with their current position. Aspects unrelated to formal working conditions seem to account for this positive assessment. Researchers are highly satisfied with aspects related to academic life - such as intellectual challenge, level of responsibility, independence, reputation of the employer and job location researchers (see Figure 23).

Satisfaction regarding mobility perspectives and opportunities for advancement is relatively lower - yet 62-64% of the researchers are satisfied with their current situation. Lowest levels of satisfaction are found when salaries and benefits are concerned. To what extent does mobility have a bearing on these assessments? Is the assessment regarding mobility perspectives specifically related to whether or not researchers are or were mobile? Does mobility have a bearing on these assessments? It appears that all mobility profiles are relatively satisfied with their mobility perspectives, but the researchers who were >3 month mobile in the last 10 years are particularly so (68%). Career stage may also be an important factor influencing satisfaction (see next section).

Figure 23: Degree of satisfaction with different aspects of the current academic position (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: Percentage of researchers who are satisfied with the different aspects of the current academic position (as compared to the researchers answering either satisfied or dissatisfied). (n=9,016)

3.3.2 What are the differences in satisfaction with career progression amongst career stages; countries, genders and fields of science?

3.3.2.1 Satisfaction per current career stage

To what extent is satisfaction related to the career stage of a researcher? Table 10 illustrates these differences. It shows the difference between the shares of researchers satisfied with the different aspects of their current academic position by career stage and compares it to the total percentage among respondents.

Most pronounced is the difference regarding job security. Here, we find increasing satisfaction along the career path. This reflects the general employment condition of tenured versus non-tenured positions or fixed term versus permanent contracts. Post-doctoral researchers (R2) are particularly unsatisfied with their current situation. Post-docs (R2) are also considerably less satisfied with their degree of independence and opportunities for advancement. More generally, it is particularly the R2 researchers who appear to be least satisfied with many of the aspects addressed regarding their current situation. This should alert policy makers, as post-docs are of major relevance to the science system, yet their situation may well discourage them from continuing working in the research profession.

Researchers at the R3 level (independent researcher) deviate least from the average percentages. This group is only relatively less satisfied regarding mobility perspectives, whereas doctoral candidates reveal the highest satisfaction rate in this area. In terms of the other aspects the differences are rather minor.

For the established researchers (R4) job security, opportunities for advancement and degree of independence seem most favourable.

Table 10: Degree of satisfaction with different aspects of the current academic position per current career stage (EU27)

	R1	R2	R3	R4	Total
Job security	61.9%	56.6%	74.6%	89.0%	72.5%
Contribution to society	79.8%	80.9%	87.2%	89.9%	85.4%
Social status	78.1%	77.6%	80.2%	84.0%	80.4%
Job location	90.2%	92.3%	88.7%	89.4%	89.9%
Benefits	53.7%	55.4%	52.1%	52.7%	53.25%
Level of responsibility	89.2%	85.3%	86.9%	93.3%	88.7%
Dynamism	85.8%	82.0%	84.3%	87.6%	85.0%
Intellectual challenge	94.0%	91.5%	92.5%	94.9%	93.28%
Degree of independence	88.8%	78.3%	87.4%	92.4%	87.0%
Reputation of employer	90.8%	90.2%	86.8%	86.6%	88.2%
Opportunities for advancement	66.2%	55.1%	59.6%	67.3%	61.8%
Mobility perspectives	69.7%	64.8%	58.9%	66.1%	64.0%
Salary	59.0%	49.1%	51.8%	53.6%	52.9%

Source: MORE2 Higher Education Survey (2012)

- Note:
- Difference between percentage of researchers that are satisfied with the different aspects of their current academic position in each career stage and total percentage of researchers that are satisfied with the different aspects of their current academic position. (n=8,962)
 - With satisfied compared to the researchers who answered either satisfied or dissatisfied.
 - With R1=doctoral stage; R2=post-doctoral stage; R3=established researcher; R4=leading researcher.
 - Reading note: The share of researchers currently in the R4 career stage that is satisfied with job security in their current academic position exceeds the total share of researchers who are satisfied with job security in their current academic position by 16.5 percentage points. The total share is 72.5% whereas the share for R4 researchers is 89.0%.

3.3.2.2 Satisfaction per country

The researcher's degree of satisfaction varies per country of current employment⁶⁵. If we determine the share of respondents who are satisfied with this aspect as compared to those who replied either satisfied or dissatisfied, the following picture emerges.

Again, researchers across all countries are satisfied with issues relating to 'academic' qualities such as dynamism and intellectual challenge. Virtually all countries have high satisfaction rates of between 75% and 97%. Regarding level of responsibility (range 78-95%), degree of independence (range 75-93%) and contribution to society (70-90%) researchers are also widely satisfied. Most satisfied are researchers in the Netherlands, followed by most of the Scandinavian countries.

More variation among countries was found in the EU HEI survey (2012) as regards the following aspects:

- Opportunities for advancement: Here satisfaction is particularly low in Italy (24%), Portugal (40%), Ireland and Romania (both 44%), while researchers in Estonia and the Czech Republic (both 77%) as well as Bulgaria (74%) seem to be particularly satisfied.
- Mobility perspectives: satisfaction levels are particularly low in Portugal (46%) and Greece (48%), while in Latvia (82%), Luxembourg (78%), Slovakia (76%), Denmark (75%), Finland (75%) and Belgium (72%) the majority of researchers are satisfied.
- Social status: Lowest is the satisfaction rate in Slovakia (49%), Hungary (61%) and Croatia (65%) while researchers in Iceland (95%), Denmark (90%), Switzerland (89%), Luxembourg (88%), Austria, Belgium, Netherlands and Sweden (all 87%) are widely satisfied.
- Salaries: Generally low – as mentioned above – are the satisfaction levels regarding researchers' salaries. Specifically, researchers in Greece (10%), Romania (21%), Poland (23%), Bulgaria (30%), Lithuania (30%), Estonia (31%), and Latvia (36%) are largely dissatisfied while those in Luxembourg (92%), Belgium (83%) and Switzerland (82%) are satisfied.
- Benefits: Similar is the picture regarding benefits. Again, Greece (20%), Romania (27%), Italy (28%), Portugal (29%), Bulgaria (40%), and Lithuania (41%) have the lowest shares of satisfied researchers. Luxembourg (90%), Netherlands (77%), Switzerland (70%) and Denmark (70%), show the highest scores.
- Job security: Comparably low are the satisfaction levels among researchers in Portugal (58%), Cyprus and Finland (both 61%) and Belgium (63%) as opposed to Malta (95%), France (89%) and Bulgaria (86%), where a high share of researchers are satisfied with the level of job security.

With regard to the remaining aspects, the differences are comparably smaller, with satisfaction levels across countries ranging between 82-94% of the researchers (job location) and 70-94% (reputation of employer).

A significantly pronounced pattern between the European countries cannot be detected. As expected, satisfaction with salaries in eastern European countries is lower than elsewhere, but for several other issues the differences are quite minimal. In terms of 'opportunities for advancement' and 'mobility perspectives' they can keep score with many Western European countries. In that sense, attempting to assess the attractiveness of a research career per country is indeed a precarious undertaking.

⁶⁵ Note: Interpretation should be taken with care as, again, the differences in proportions of researchers in each career stage per country need to be taken into account.

3.3.2.3 Satisfaction per gender

Finally, satisfaction differences in these areas between the sexes are not huge. Still, in virtually all areas, women are less satisfied than men: percentage point differences range between +1 (social status) and -7 (opportunities for advancement). Next to the opportunities for advancement, women are also less satisfied with mobility perspectives (6 pp difference with male researchers), job security (6 pp difference) and salary (5 pp difference).

3.3.2.4 Satisfaction per field of science

Overall, the opportunities for advancement are not the cause for differences in researcher satisfaction across the different fields of science. Between 60% (Social Sciences) and 65% (Engineering&Technology) of the researchers are satisfied with this issue in their current position. Low differences in satisfaction levels across fields of science are observed in terms of intellectual challenge and social status.

The largest difference occurs for salaries and benefits. The least satisfied with their salary are the Agricultural Science researchers (40%) and the most satisfied are the Medical Science researchers and Natural Science researchers (57%), followed by Humanities (54%), Social Sciences (50%) and Engineering & Technology (48%). With benefits, 49% of the researchers are satisfied in Agricultural Sciences, compared to 59% in Natural Sciences.

3.3.2.5 Extra-EU survey: researchers working outside the EU

As a point of comparison, it is also observed that researchers currently working outside the EU27 are very satisfied with many aspects of their current employment and, the differences if compared to researchers working in the EU, are limited. Again, researchers are particularly satisfied with academic aspects. About 80-90% of the (non-representative) sample of researchers currently working outside the EU are satisfied with the levels of intellectual challenge and responsibility, their degree of independence, and their contribution to society that their current job provides.

They also have a similar level of satisfaction concerning their opportunities for advancement, their social status, the benefits and attractiveness of their job location. Nevertheless, we noted some differences between the EU researchers and non-EU researchers which worth mentioning.

EU researchers currently mobile outside the EU were generally more satisfied with their mobility perspectives, their salary level, the reputation their employer and dynamism than the non-EU researchers. At the same time, they seem to be less satisfied with their current level of job security compared to non-EU researchers; this could be partly explained by the fact that the share of R4 researchers was higher among the latter group. This is also reflected in the share of researchers having a permanent contract. About 39.5% of EU researchers currently abroad had a permanent contract; for non-EU researchers who have been in Europe before, this percentage was 71%; for non-EU researchers who have been mobile but not to Europe, the percentage who had a permanent contract was 62%. Thus, one could assume that this lower degree of job security might encourage EU researchers currently abroad to return to Europe - of course under the right conditions and with the right stimuli.

4 REMUNERATION OF RESEARCHERS

In terms of purchasing power parity (PPP) adjusted salaries the EU countries were, on average, outperformed by the sample of non-European countries covered, particularly by the US and Brazil.

Both health care insurance and retirement pension insurance are usually provided to university researchers. Almost all researchers have a retirement pension insurance included in their remuneration packages.

In the EU countries, most of the remuneration related aspects are regulated by national authorities. The university level, but also individual negotiations are mainly important for decisions about salary at appointment and any subsequent salary rise. This type of autonomy is higher when the researcher is located in countries which are innovation leaders. Research performing organizations also have more autonomy in wage setting and pay higher salaries.

In the EU27, compared to non-EU, salaries are lower but insurance and social security are higher for both junior and senior researchers. Within the EU, the countries with higher innovation capacities offer a higher share of research time, security and flexibility to junior researchers than other countries.

Even though it is indicated that wages are higher in non-academic research positions, the differences in work flow and necessary skills have higher importance than remuneration in choosing positions. A move out of academia most often takes place early in a researcher's career.

4.1 Remuneration of researchers in Europe

4.1.1 What do we know about remuneration of researchers in Europe?

In terms of purchasing power parity (PPP) adjusted salaries, the EU countries are on average outperformed by the sample of covered non-European countries. The average salaries across all career stages are by 5 to 10 percentage points (R2-R4) and about 25 percentage points (R1) higher in non-European countries than in the EU. The largest differences occur with the US and Brazil (>80% of the highest salaries in all career stages compared to 45-55% in EU27). When comparing EU countries with European countries which are not EU members, the average salary levels are quite similar. Amongst the best paying countries are the US (R2-R4), Brazil (R1-R4), Switzerland (R2-R4), Cyprus (R2-R4), the Netherlands (R3, R4), Ireland (R4), and Belgium (R1). Denmark pays the highest stipends for PhD candidates across countries.

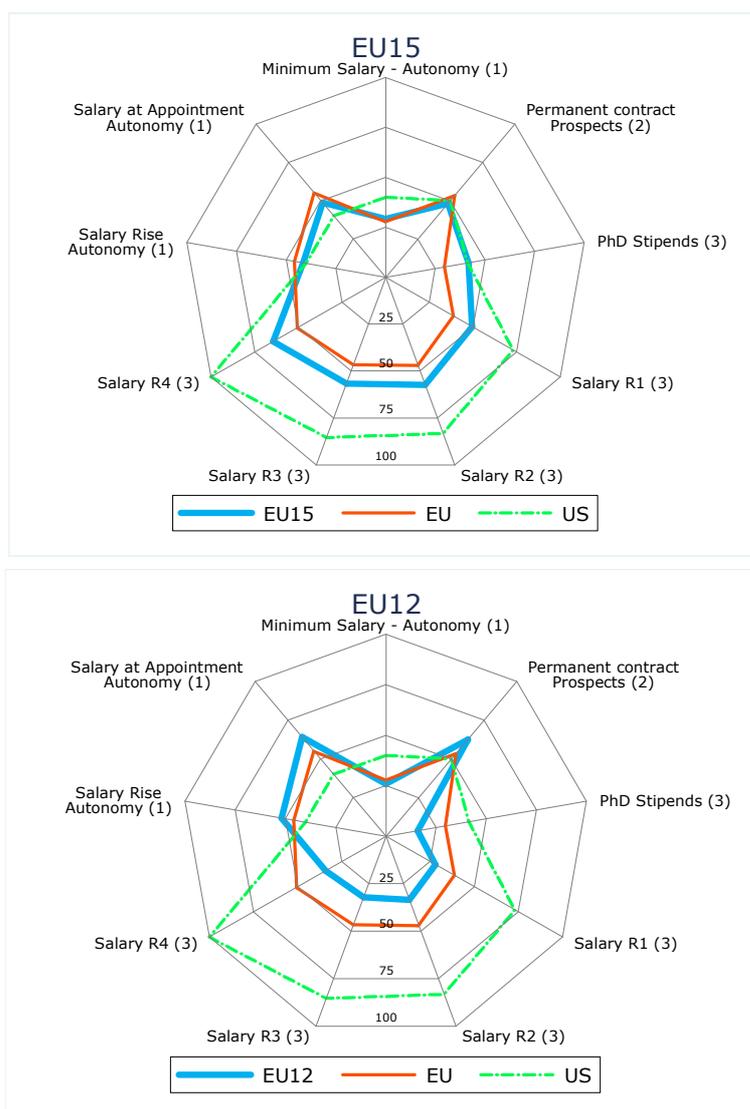
Civil servant positions are rarely offered to doctoral candidates. On the other hand, in more than half of the countries R3 and R4 researchers are employed as civil servants. This is less common in the non-EU countries, in particular in the other non-EU European countries.

Both health care insurance and retirement pension insurance are usually provided to university researchers. Additional health care insurance provided by universities which exceeds what is mandated by law is less common in the EU than outside. Almost all researchers have retirement pension insurance included in their remuneration packages. In the EU, half the country experts indicated that universities do not provide additional retirement pension insurance exceeding what is mandated by law. Half of them, almost exactly those who did not reply positively the previous question also indicated that researchers usually purchase their own private retirement pension insurance.

Unemployment insurance is provided across countries less frequently. Only about three quarters of the EU countries and half the non-European countries insure their researchers against unemployment.

In the EU countries, most of issues relating to remuneration are regulated by national authorities. In particular - health care insurance, retirement pension insurance, and unemployment insurance are centrally organised. Salaries (at appointment) and salary rise are only determined nationally in less than half of the EU countries. The university level and also individual negotiations are mainly important for the decision on salary at appointment and salary rise. Working time is determined on various levels, ranging from the national level via collective agreements, to universities, and to individual negotiations.

Figure 24: Remuneration of university researchers – selected indicators by country groups



Source: MORE2 country profiles Remuneration (2012) – expert survey

Notes: Spokes are normalised (see below) Missing values are set to zero.

- 1) **Degree of autonomy:** „Salary rise“, „Salary at appointment“, and „Minimum salary“ based on question: „Please indicate the institutional level at which the following aspects of public university researchers are determined?“ Scale: (1) National, (2) Regional (state), (3) Sector/collective agreements, (4) University, (5) Individual negotiation, (0) missing value; In graph, maximum = 5
- 2) **Prospect of a “permanent contract”** shows the lowest career stage (R1-R4) at which university researchers can obtain permanent contracts. In graph, maximum = R1
- 3) **Salaries:** „PhD Stipends“, „Salaries R1-R4“ show gross annual salaries (in PPP €) paid in the country as a percentage of the best paying country at this career stage. In the graph, minimum = 0 and maximum = 100%

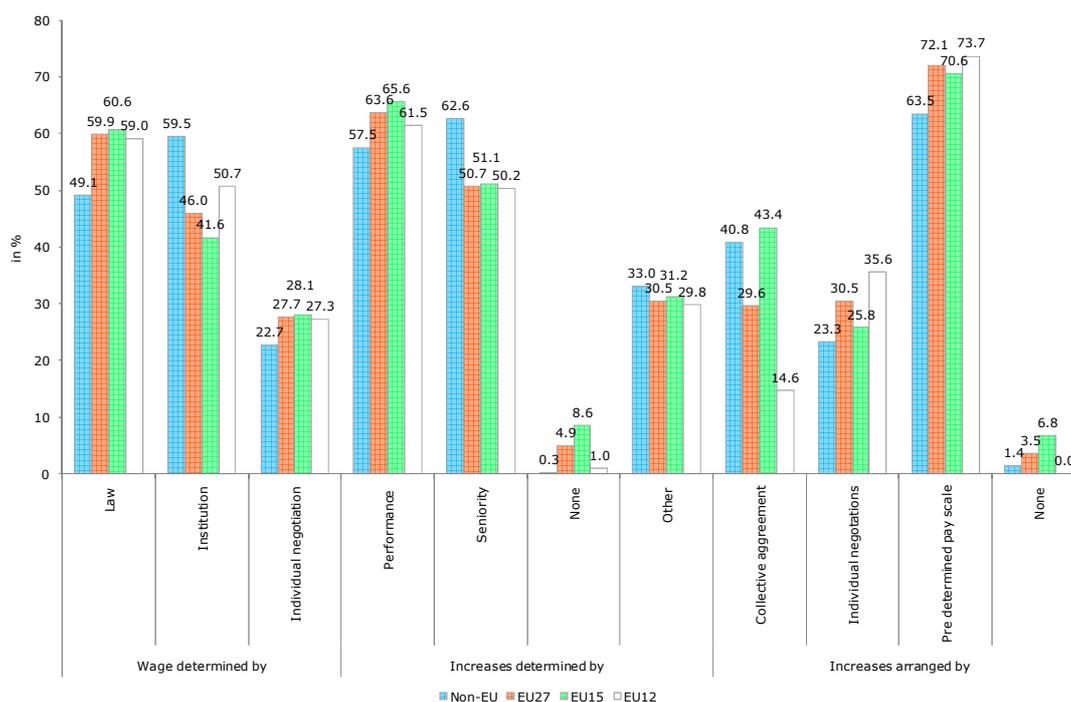
4.2 Remuneration factors

4.2.1 How is the remuneration of HEI researchers determined across countries?

With respect to the institutions governing remuneration, major differences in setting of salary levels and wage increases for academics exist between countries of different innovative capacities. Particularly at institutions located in countries which are innovation leaders, salaries for academic positions are more often determined by the research institutions themselves rather than by law. Research institutions put a lower emphasis on seniority and a larger one on performance for pay increases as well as emphasizing individual negotiations more strongly than pre-determined wage scales when considering increases in salary.

By contrast, research institutions located in EU27 countries – after controlling for compositional effects - differ from institutions located outside the EU. They give a significantly lower role to seniority and a significantly higher one to performance when determining wage increases, but also by apparently having lower autonomy in setting wages. They are also less willing (or able) to negotiate over non-wage components of the remuneration packages such as provisions or allowances for exceptional candidates.

Figure 25: Determinants of wages and pay increases (by region - % of positive answers)



Source: MORE2 country profiles Remuneration (2012) - research institution questionnaire unit of observation = research position

Wage schedules also vary substantially between countries with different innovative capacities and different organizations as well as research fields. Countries which are innovation leaders pay slightly higher wages but, more importantly, also allow more wage dispersion within positions than countries that have a lower innovative capacity. In these countries, additional income is also less important for the researchers and institutions (although the income earned through such additional income is not necessarily lower in these countries). Among universities, salaries are lower in physics and economics than in

engineering, with researchers in engineering also earning more in additional jobs than in other disciplines.

The results furthermore imply that more senior positions are awarded higher wages and point to remuneration differences for different disciplines. For the positions of recognized researcher and established researcher, however, these differences are often not significant, which suggests rather low wage premiums for these positions. For leading researcher positions, by contrast, coefficients are highly significant and large. This indicates a particularly large wage increase for such senior positions. With respect to field of research, by contrast, results suggest that while all disciplines seem to have rather similar minimum wages, average and maximum wages of both researchers in economics and physics are significantly lower than among researchers in research performing organizations (RPOs). By contrast, researchers working in engineering earn similar salaries as researchers in RPOs.

Concerning the institutional level at which important aspects of researchers' remuneration are determined, in the EU countries most issues are regulated by the national authorities. In particular, health care insurance (22 out of 24), retirement pension insurance (23 out of 24) and unemployment insurance (21 out of 24) are centrally organised. On the other hand, salaries (at appointment) and salary rise are only determined nationally in less than half of the EU countries. This holds for Cyprus, Spain, France, Greece, Italy, Portugal, Romania, and Slovenia. Regions or states only play a role in Spain and Belgium. The university level, but also individual negotiations are mainly important for the decision on salary at appointment and salary rise. Working time is determined at various levels, ranging from the national level (in 14 out of 24 countries) via collective agreements (8 out of 24), and universities (6 out of 24) to individual negotiations (5 out of 24). The picture looks very similar when looking at countries outside the EU. Salary at appointment and salary rises are mainly determined by universities and individual negotiations. Health care insurance and retirement pension insurance are, again, most frequently regulated on the national level. In comparison to the EU countries, more non-EU countries determine aspects of remuneration of university researchers on the regional / state level. This holds particularly for China, Bosnia and Herzegovina, Switzerland, but also to some extent for the US, Canada and Russia. Collective agreements again play a role for working time, but more of the country experts named the university level (10 out of 21) rather than collective agreements (8 out of 21) as being important. In the US, both the university level and collective / sectoral agreements play a role for all aspects except unemployment insurance.

4.2.2 What does the evidence suggest with respect to remuneration differences between genders or career stages?

No specific evidence on remuneration differences between gender or career stages was collected in the country cases. However, the EU HEI survey does reflect a small difference in satisfaction with remuneration between men and women: female researchers are less satisfied with this aspect of their current position by 5 pp difference compared to male researchers.

The variable on satisfaction with salary shows even less of a difference between career stages, except for the R1 career stages where 59% of the researcher are satisfied compared to 53% on average.

4.2.3 To what extent are EU HEIs able or willing to negotiate remuneration and related aspects to attract top scientists?

In the university survey collecting data on the institutional level, a set of questions was devoted to whether the HEI would be willing (or able) to negotiate wages and a large list of bonuses, provisions, allowances and leave with exceptional candidates. Wages are by far the most important elements which are negotiated with exceptional candidates. In total, 43% of the research institutions state that they would be willing to negotiate wages with exceptional candidates. By contrast, provisions (such as health, pension, unemployment accident or other insurance) as well as allowances (for housing commuting the family, childcare or others) are much less frequently subject to negotiation. Here, 12% of the respondents stated that they would negotiate on pension insurance and 11% over housing allowance, being the two most popular items in the category of provisions and allowances.

Bonuses and leave (i.e. sabbaticals and study, maternity or annual leaves) are an in-between case. They are generally negotiated over more frequently than allowances and provisions but less often than wages. Among the bonuses, function bonuses (over which 30% of the institutions are willing to negotiate) and research bonuses (28%) are most frequently negotiated with exceptional candidates. Appointments and other bonuses, by contrast, are negotiated at only 17% or 19% of the institutions, respectively. Similarly, extra study leave is negotiable at 34% of the institutions, while maternity leave can be negotiated at 18% or 16% of the institutions. Sabbaticals are negotiated with exceptional candidates at only 6% of the institutions.

Table 11: Fields of negotiation with exceptional candidates (by region and research capacity - % positive answers)

	By region				By research capacity				Total
	Non-EU 27	EU 27	EU 15	EU 12	Innovation leaders	Innovation followers	Moderate innovators	Modest innovators	
Gross salary	44	42	42	42	49	40	44	39	43
Health insurance	12	11	4	18	11	5	7	22	11
Pension insurance	12	12	4	21	8	5	15	18	12
Unemployment insurance	8	3	0	6	4	0	0	16	5
Accident insurance	11	2	0	4	10	2	2	10	6
Other insurance	5	2	0	5	4	0	4	5	3
Appointment bonus	21	15	13	17	22	8	18	22	17
Function bonus	32	29	19	38	30	18	28	42	30
Research bonus	30	27	16	39	21	17	27	45	28
Other Bonus	19	19	7	32	9	12	17	36	19
Housing allowance	7	13	19	7	22	10	9	5	11
Commuting allowance	10	5	5	4	6	6	8	7	7
Family allowance	9	6	8	5	8	11	3	8	7
Childcare Allowance	8	5	0	10	6	0	4	14	6
Other Allowances	9	5	2	8	8	2	7	9	6
Sabbatical leave	7	5	2	7	6	6	9	2	6
Study leave	35	32	36	28	30	40	23	42	34
Maternity leave	14	22	13	31	22	14	15	24	18
Annual leave	12	20	15	25	18	16	16	16	16

Source: MORE2 country profiles Remuneration (2012) - research institution questionnaire

Note: unit of observation = research position

There are, however, rather large differences among research institutions in terms of which aspects of remuneration schemes they are willing to negotiate with exceptional candidates. Thus for instance:

1. Function and research bonuses are particularly frequently subject to negotiation in the EU12 countries, as are additional maternity and annual leave as well as health and pension insurance. Research institutions in EU15 countries are much less willing to negotiate these items.
2. Parts of remuneration packages other than wages are much less often negotiated over in EU15 countries than either in EU12 countries or in non-EU27 countries. The only exceptions to this are study leave and housing allowance. These are negotiated over more often in EU15 countries than in both EU12 and non-EU27 countries. In addition, commuting and family

allowances are negotiated over more often in EU15 countries than in EU12 countries.

3. All aspects of the remuneration package, with the exceptions of maternity leave and housing allowance are less readily negotiated over even for exceptional candidates in research institutions based in EU27 countries than in institutions based outside them.
4. Research institutions located in countries which are innovation leaders are most willing to negotiate over wages, while for almost all other components of the remuneration package, institutions located in modest innovators are more willing to negotiate than innovation leaders. This indicates that top institutions located in countries with poorer innovation capacity and low flexibility in determining wages compensate for this disadvantage when recruiting exceptional candidates by showing greater willingness to negotiate over other components of the remuneration package. The only exceptions to this are family, commuting and housing allowances as well as annual and sabbatical leave.
5. Differences among disciplines in the negotiable aspects of remuneration packages are rather small. Engineering universities seem to make less use of appointment, research and other bonuses as well as being less willing to negotiate on study leave. Physics universities are more willing to negotiate childcare allowances but less willing to negotiate family allowances.
6. There is an increasing willingness to negotiate over all components of a remuneration package with increasing seniority of the position. The only exceptions to this are health and other insurance, as well as maternity and annual leave.

In sum, therefore, these results suggest that the most important differences in the institutions governing wage levels and wage increases of academics are those between countries of different innovative capacities. Particularly among institutions located in those countries which are innovation leaders are wages for academic positions, which are more frequently determined by the research institutions themselves than by law. Moreover, such institutions also put lower emphasis on seniority and more on performance for pay increases as well as emphasizing individual negotiations more strongly than pre-determined wage scales.

By contrast, research institutions located in EU27 countries – after controlling for other differences - differ from institutions located outside the EU by giving a significantly lower role to seniority and a significantly higher one to performance in determining wage increases. However, they also appear to have less autonomy in setting wages at the level of individual research institutions as well as being less willing (or able) to negotiate over non-wage components of remuneration packages such as provisions or allowances.

In addition, collective agreements play a significantly less important role in determining wage increases in EU12 countries and individual negotiations are significantly more important for wage increases in the EU15 countries than in non-EU27 countries, with institutions in EU12 countries also being generally more willing than institutions in EU15 countries to negotiate over other aspects of remuneration packages than wages.

4.3 Country comparison and attractiveness

4.3.1 What are the main country differences?

Table 12 compares gross annual salaries by stage across countries. The table also lists the annual value of stipends for PhD-candidates. The displayed numbers equal the percentage⁶⁶ of salaries in PPPs relative to the best paying country within the given stage as described above. We also display averages of the covered country groups EU and non-EU, whereas we also distinguish between non-EU European (other Europe) and non-European countries.

When analysing best paying countries by position in Table 12 we can see that although the US universities pay relatively low amounts for the R1 level researchers (both in terms of stipends but also to less extent in terms of salaries for employed PhD candidates) the higher the career level is, the higher the PPP converted salaries are in the US in comparison to all other countries. Aside from the US, Brazil, Cyprus, Ireland, the Netherlands, and Switzerland are among the best paying countries in R4. The same holds for R3 with the exception of Ireland. In R2, amongst the best paying countries are Cyprus, Brazil, Switzerland, and the US, while it is Belgium, Brazil and Norway in R1. Denmark pays the highest stipends for PhD candidates across countries. On the other end, Bulgaria, Romania, Lithuania, Latvia and Hungary pay very low levels in each of the available categories, sometimes paying less than 20 per cent of the respective best paying country. Outside the EU, the lowest annual gross salaries are paid in Albania and China.

When comparing the country groups, the results show that given the high heterogeneity in the salary ranges paid inside the EU, the non-European countries covered in this survey pay on average higher salaries in all categories. An outlier in this group is China. However, even taking into account the effect it might have on the averages in the group of non-EU countries, the average salaries across all career stages are by 5 to 10 percentage points (R2-R4) and about 25 percentage points (R1) higher in this group than in the EU. When comparing EU countries with European countries which are not EU members, the average salary levels are quite similar. They are slightly higher for R1, R2, R3 and PhD stipends in the EU. However, the average of the group of other European countries is mainly driven by Norway and Switzerland. When comparing the EU with all non-EU countries, gross annual salary levels are lower by about 5 percentage points in R1 and R4.

The comparison of EU countries with non-EU countries is strongly affected by the choice of non-EU countries. In this case there are top performers in university rankings (e.g. the US or Switzerland) mixed up with countries with low performance of their university system. When comparing the EU countries with the US, the EU pays more than 30 percentage points (with regard to the best paying country) less than the US in all four career stages. Only in case of stipends is the gap between EU and US smaller. Here the EU pays, on average, 40% of the best paying country Denmark, while US stipends equal about 65% of Danish PhD stipends. Nonetheless, there are also large differences across EU countries. The top performing EU countries related to gross salaries almost equal the salaries paid in the US on the R1 level, but the higher the career stage the larger the difference. Considering other non-EU countries, Brazil pays very high PPP adjusted salaries in all four career stages. Switzerland also pays higher salaries than the best paying EU countries (to some extent, except Cyprus). On the other end of the scale, China pays slightly higher PPP adjusted salaries than the least paying countries in the EU in all four career stages.

⁶⁶ Values are rounded to 5 percentage points due to methodological issues.

When looking at employment status, there are only 4 out of 22 countries in the EU (Hungary, the Netherlands, Sweden and Slovenia) which offer civil servant positions to PhD candidates. In the non-EU countries, 4 out of 21 countries also offer PhD candidates civil servant positions (Norway, Turkey, Brazil and Japan). Within the EU, countries tend to offer civil servant positions for researchers at higher career stages. In more than half of the countries, R3 and R4 researchers are employed as civil servants, while in the non-EU countries civil servant positions are less common at these stages. Among the group of non-EU European countries, R3 and R4 researchers only have civil servant status in Croatia, Norway and Turkey. In the countries with top performing university systems (including US, Switzerland, and Canada), the country experts indicated that university researchers have the status of a civil servant in none of the career stages.

Concerning the duration of contracts, early career stages are usually fixed term for less than 4 years. In the EU, PhD candidates have permanent contracts in only two countries (Poland and Romania). Similarly, outside the EU, permanent contracts are only available for PhD candidates in Albania and Brazil. On the other hand, at the full professor level (R4) almost all countries provide permanent contracts. In the EU, Estonia, Latvia and Spain are the only countries having fixed term contracts (more than 4 years) for their R4 researchers. When looking outside the EU, only the Faroe Islands, Russia, Australia and China have no permanent positions for full professors.

When looking at social security insurance cover for university researchers, both health care insurance and retirement pension insurance are typically provided to university researchers. Within the EU only in Denmark, Latvia, the Netherlands and the UK do researchers' remuneration packages not compulsorily cover health care. In Germany, compulsory coverage is not provided for all researchers within different career stages. In the non-EU countries the picture is quite similar. Switzerland, Australia and Brazil (and in the R1 and R2 stages also Canada) do not compulsorily insure their researchers on health care. Researchers are insured in all other countries covered outside the EU.

Additional health care insurance exceeding what is mandated by law is less common in the EU. In only 4 out of 24 countries in the EU do universities offer such benefits to all their researchers (Cyprus, Lithuania, Luxembourg, and Sweden). In five other countries (Austria, Belgium, Finland, Italy and Latvia) the provision of such benefits falls to the autonomy of the universities. In 4 other countries it depends on either employee status or the contract (Belgium, Ireland, Italy, and Portugal). In 12 of the 24 countries the survey results indicate that universities never provide additional health care insurance. Outside the EU, in half of the countries universities always provide additional health care insurance to their researchers. Outside Europe this holds for the US, Singapore, South Korea, Japan, Canada and China, while within Europe it is the case for Serbia, Turkey and Croatia. Furthermore, the experts stated that universities in the investigated countries outside Europe provide additional health care packages at least in specific cases. On the other hand, it is also common for researchers to privately purchase additional health care insurance in these countries. Australian, Brazilian, Korean, Singaporean and US researchers usually extend what is provided in their remuneration packages. This is less common in the EU where it is common in 8 out of 20 countries.

In terms of retirement pension insurance, almost all researchers have insurance included in their remuneration packages. Only Latvia and, in the PhD candidate stage, Cyprus do not foresee retirement pension insurance compulsorily for their researchers. Outside the EU, pension retirement insurance is not compulsory only in South Korea and in the first two career stages in Canada. In the EU, for eleven out of 24 countries, the survey results show that universities do not provide additional retirement pension insurance beyond what is mandated by law. In

these countries, researchers usually purchase private retirement pension insurance. 15 out of the 24 EU experts indicated that additional private retirement pension insurance is important for researchers to maintain their standard of living after retirement, while in the UK private retirement pension insurance is highlighted as being very important. Outside Europe, universities always provide additional retirement pension insurances for their researchers. However, in Canada, South Korea, Singapore and the US, researchers can upgrade this insurance by buying into private pension funds.

Unemployment insurance is less frequently provided across countries, and only about three quarter of the EU countries and half the non-European countries insure their researchers against unemployment. In particular Brazil, Australia, South Korea and Singapore do not have unemployment insurance. On the other hand, in Europe all the non-EU countries (except Macedonia (FYROM)) have their researchers insured against unemployment, at least above the R1 level. Employed PhD candidates are only insured in Albania, Faroe Islands, Iceland, Montenegro, Norway and Russia.

Table 12: Gross annual salaries and PhD stipends of university researchers as percentage of the best paying country within career stages. A country comparison

	EU	EU15	AT	BE	DE	DK	ES	FI	FR	GR	IE	IT	LU	NL	PT	SE	UK	EU12	BG	CY	CZ	EE	HU	LT	LV	PL	RO	SI
Salaries																												
Salary R1	45	55	70	>80	80	75	40	45	35	<20	.	.	.	65	.	45	75	30	<20	65	35	.	25	<20	<20	25	<20	55
Salary R2	50	60	80	80	70	65	45	55	25	50	50	60	.	75	75	55	55	35	<20	>80	40	35	25	<20	20	30	<20	70
Salary R3	55	65	65	80	65	65	60	60	45	45	75	65	.	>80	65	55	65	40	<20	>80	40	35	25	<20	.	30	<20	65
Salary R4	55	70	75	75	60	65	60	.	45	45	>80	75	.	>80	65	60	80	35	<20	>80	55	40	35	<20	<20	30	20	55
Annual Stipends for PhD candidates																												
R1	40	55	.	75	45	>80	55	35	65	20	45	60	.	.	55	.	75	20	20	.	<20	20	20	20	.	20	25	35
	non-EU	OECD non-EU	other Eur.	OECD Eur.	non-OECD Eur.	AL	BA	CH	FO	HR	IS	ME	MK	NO	RS	RU	TR	non-Eur.	OECD non-Eur.	AU	BR	CA	CN	IL	JP	KR	SG	US
Salaries																												
Salary R1	50	60	40	65	30	20	<20	60	.	50	40	35	40	>80	40	.	25	70	60	.	>80	.	.	55	75	30	.	75
Salary R2	50	60	45	70	35	.	35	>80	.	45	40	30	45	80*	35	.	25	55	55	60	>80	45	25	45	70	40	.	>80
Salary R3	55	65	50	65	40	30	40	>80	.	45	45	35	50	65*	35	.	40	65	65	70	>80	80	25	45	70	40	.	>80
Salary R4	60	70	55	70	45	.	45	>80	.	60	45	30	50	70	25	.	70	65	70	65	>80	75	30	45	65	65	.	>80
Annual Stipends for PhD candidates																												
R1	40	45	40	60	35	<20	40	.	.	35	60	50	65	.	30	.	30	40	40	45	.	35	.	20	.	.	45	65

Source: MORE II expert survey. Minimum, average and maximum of gross annual salaries and PhD stipends (in PPPs) of each country are compared with minimum, average, and maximum of the best paying country in the covered sample respectively. The resulting shares for each country are then averaged within the country and rounded to 5 percentage points. The shown shares for country groups are averages across the respective countries. Covered countries: other Europe: AL, BA, CH, FO, HR, IS, ME, MK, NO, RS, RU, TR; non-Europe: AU, BR, CA, CN, IL, JP, KR, SG, US; OECD (excl. EU): AU, CA, CH, IL, IS, JP, KR, NO, US.*) The Norwegian Associate Professor is classified as both R2 and R3. Therefore, for Norway the comparison of R2 and R3 with the best paying country might be upward and downward biased respectively.

4.3.2 How important is remuneration: which factors determine employment choice (remuneration and/or others)?

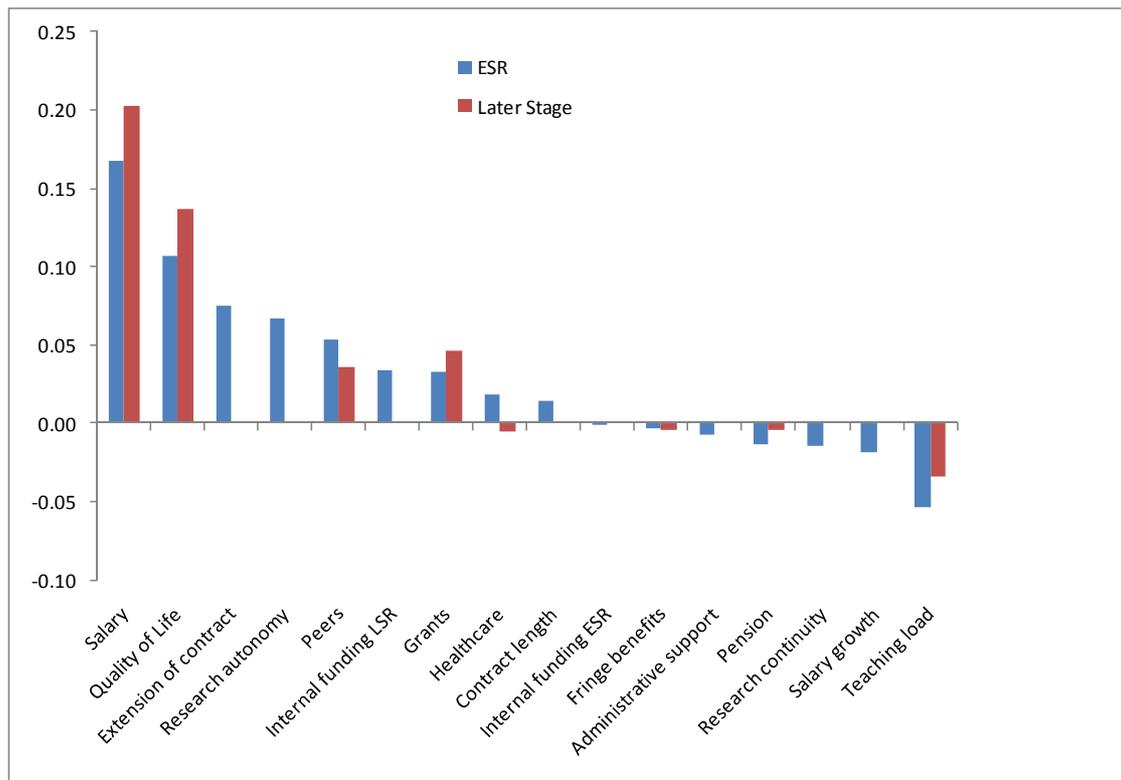
Job choice increases with the level of salary up to a threshold which is around €45,000 across all early stage researchers (ESR) and female ESR. Yet for male ESR and later stage researchers (LSR) looking back at their career, job choice increases in relative frequency up to a level of €55,000, suggesting that male ESR and LSR looking back attach more importance to salary levels. For the health, pension and fringe benefits components of the remuneration package, there is no such obvious trend, as job choice is nearly evenly distributed over the five (health), four (pension) and 7 (fringe benefits) values (approx. 20, 25 and 14.2% each).

The same pattern holds true for mobile researchers overall, with two exceptions: First, compared with total ESR, there are slightly higher relative frequencies of job choice for higher salary levels or for lower salary levels in the case of not-mobile researchers. Second, another hint as to the robustness of overall results – or for proper effort to choose between jobs – may be seen in the slightly above-average choice frequency of jobs including childcare and a job offer for the partner among mobile researchers (from approx. 16 to 18.7%). These are certainly crucial “fringe benefits” for mobile researchers. For non-EU researchers who have not been mobile at all, relocation support is also valued above-average at more than 18%, which is also plausible, as people who have not been mobile at all have no experience of the practical consequences of moving country.

As with ESR, job choice also increases for LSR with salary levels, but all the way up to the highest salary level, with the exception of female LSR (who are less than a third of the dataset). The same pattern holds true for LSR grouped by mobility behaviour. Job choice is quite evenly spread over the values of health care and pension rate, with full coverage-health care scoring slightly above-average job choice frequencies. Among fringe benefits, available childcare (for female LSR) and quality schooling (male LSR) achieve above-average job choice frequencies, for the subgroup of mobile LSR in addition the job offer for the partner.

Across all ESR and ESR subgroups, including mobile and not mobile ESR, there is a clear pattern regarding the frequency of job choice in conjunction with quality of life: it must not be worse than in the current country of residence. However, there is not much difference between a comparable level of quality of life or a better one. This implies that most researchers are happy with the quality of life of their current country of residence and, by implication, they get used to varying levels of quality of life. This job characteristic can be seen as a clear case of a “necessary, but not decisive” factor for job choice. It also somehow diminishes the outlook for countries which offer with an excellent quality of life but hope that this compensates for other deficits in researcher jobs (such as low salaries e.g.). As with ESR, the quality of life for LSR must not be worse than in the country of their current post.

Figure 26: Correlation of the variable job choice with the job characteristics, ESR compared with LSR



Source: MORE2 country profiles Remuneration (2012) - WIFO calculations.

Job choice increases with the amount of time which can be devoted to research up to the level of teaching 25%, research 75%; interestingly, it decreases again with research only. This pattern holds true for all the ESR and LSR subcategories examined: females are even less likely to choose research only jobs, with males and mobile ESR showing slightly higher preferences for research only jobs in comparison with total ESR (but still lower than teaching 25%). Mobile LSR see research only- positions less negatively.

In terms of available funding for research activities, poor availability of both short and long-term grants is clearly associated with a lower frequency of job choice, while there is not much difference between the two other categories. The accessibility mode to internal funding does not seem to play a role for ESR. On the other hand, jobs where university internal funding can only cover 25% of research expenditure are clearly less sought after in case of LSR, while the difference between the other three categories is not substantial, suggesting that funding one's research half via internal funding and half via external grants is not uncommon.

The quality of a researcher's peers at their future workplace increases job choice when the peers are among the top 50 in their field worldwide. Within the top 50, differences are less pronounced. Female LSR seem to value the quality of peers somewhat more than male LSR.

As regards career perspectives, job choice is somewhat evenly distributed across the different values of the length of the initial contract, with the minimum duration of 2 years showing slightly below-average frequencies. When this first contract cannot be extended, it clearly decreases job choice. Otherwise, the other extension possibilities show no marked differences. No autonomy for own research is also a clear job disincentive, while from a low research autonomy

content to a high one, there are only small positive changes in job choice frequencies.

For LSR, job choice increases the lower the requirement for research continuity somewhat, i.e. the less LSR are bound by the research of any chair holder they are replacing. This effect is more marked for female LSR and particularly for EU researchers who are currently in the EU and who have been mobile for more than 3 months in the past 10 years. This may point to the effect of EU researchers having been to countries without a chair-based organisation model.

Job choice frequency across the values of time to be devoted to administrative tasks shows a unique pattern: while the two extremes – the lowest and the highest amount of time to be devoted to administrative tasks – show the lowest frequencies, the two middle values show higher job choice frequencies for LSR. This could be explained either by the limitations of this descriptive account of the results (which looks at decisions across all chosen jobs, not at the level of decisions between three individual jobs) or by a low importance of this job characteristic for job choice.

Finally, job choice of LSR is highest for the job characteristic of advancement of salary by a public scheme, which includes a possible bonus for research performance, followed by a public scheme. Job choice frequency is lowest for a system which makes salary advancement dependent on individual research performance evaluation, which seems to be a particular problem for male LSR. This points in favour of a system which features performance elements, but one where there is only upward variation – there are carrots for the high performers, but no sticks for the not so high performers. This would be well in line with the risks and uncertainty faced by researchers.

4.3.3 To what extent does remuneration play a role in the decision to become internationally mobile?

The main evidence gathered in order to answer this research question was collected through the individual researchers' surveys and involves the information on how important remuneration was as a motive for a specific mobility event or move.

For PhD mobility of researchers who currently work in the EU (MORE2 EU HEI survey, 2012) it is observed that 50.8% regard remuneration as important (ranks 10th out of 13 motives). When it comes to mobility of three months or more during post-PhD career, 40.6% consider this an important reason to move (ranks 11th out of 13 motives). R4 researchers find remuneration less of a motive for international mobility than their R2 and R3 counterparts. When the move includes a change of employer, the motive ranks 8th out of 14 (1.3% of those moves).

Of the researchers currently working outside the EU (MORE2 Extra-EU survey, 2012), 61% of the (non-representative) researchers indicate that remuneration is a motive for mobility to their non-EU destination. For researchers from France and Italy this share is even higher (78% resp. 69%). When it comes to mobility to EU destinations, remuneration is motive to a lower 42%. Distinguishing by citizenship, results show that the remuneration motive occurs more frequently for Russian (71%) and Turkish (64%) researchers whereas for US (32%) and Australian (36%) researchers remuneration is less frequently a motive for EU mobility.

4.4 Sector comparison and attractiveness

4.4.1 What does the evidence suggest with respect to the relation between remuneration of researchers in the industry and HEI sectors?

Comparing the remuneration of researchers in the industry and the HEI sectors is very complex. The most important problem when comparing the remuneration packages in the academic sector with those in companies is how to identify meaningful comparison groups. The most important problems are (1) identifying the researchers in the non-academic sector, and (2) identifying comparable career stages.

In one of the preceding studies of this report (see Huber et al., 2010) it turned out to be rather difficult to find a definition or a corresponding notion of a researcher⁶⁷ working for companies. When asking employees who are involved in research or development, they themselves have very different perceptions of their own activities. They might identify themselves as researchers, scientists, development engineers or something else but are involved in the creative production of innovations or new knowledge. Although there are some cases where it is not clear whether a university employee should be classified as researcher or not, in most cases the university researchers can be distinguished from other supporting or administrative staff etc. This discrimination is less clear for companies.

Probably the clearest case is that of a researcher in a company who might be working in a chemical or biotechnology laboratory, for example⁶⁸. However, employees who fulfil research tasks might also be working on the production site, marketing or quality control but are involved (probably only temporarily) in the development of new products or processes using their experience. The closer a research and development activity is to the market, the more difficult it becomes to distinguish standard engineering activities from research activities. Although it is possible to define rather clear concepts of who is a researcher or rather what tasks define a researcher, it is quite difficult to collect the relevant data for them. Furthermore, it is often not possible to identify precisely the group of researchers when using existing databases. A sharp distinction between research staff and other employees is virtually impossible.

Furthermore, companies strongly differ from academia but also from other companies in:

- the career stages they offer,
- the naming of these career stages,
- the tasks and remuneration packages related to these career stages,
- the promotion prospects within the company and
- the requirements for promotion within the company.

⁶⁷ In the related analysis we used the term 'researcher' for all employees that are carrying out or supervising research, improve or develop (new) products or processes or supervise these activities. This definition therefore includes e.g. researchers, scientists and development engineers.

⁶⁸ These two sectors are examples of a broad range of research positions in the private sector. Many large companies have research labs with full time researchers outside these two sectors, for instance the car industry, electronics, or aerospace are the most well-known, but it is also the case in food industries and even textiles etc. Restricting the definition of researchers to job positions in R&D labs would ease any comparison with the academic sector. However, it would also neglect a very large share of researchers (or equivalent) in the private sector.

Concluding the discussion above, career stages and positions are extremely heterogeneous in the non-academic sector. All the issues raised above hamper the identification and comparison of similar career stages across firms and therefore complicate a meaningful comparison with the academic sector.

Taking into account the concerns raised above, the research team carried out explorative interviews with business representatives who are responsible for recruiting researchers. We focused on the permeability between the academic and the private sector in order to identify potential outside options for academic researchers. As we do not know the equivalents of university job positions in private companies, the idea is to investigate those posts which university researchers can take up in the private sector. Knowing which positions a researcher can take up given his/her individual skills and work experience might allow an assessment as to whether the researcher earns more or less in academia than at private companies. Nonetheless, the interviews do not deliver representative data on the salaries in private companies where a university researcher might take up a job.

The results based on the explorative interviews indicate that lifetime earnings are higher for researcher careers in the non-academic sector. Although it is quite difficult to directly compare salaries and remuneration packages between the academic sector on the one hand and the non-academic sector on the other, the interviewees reported that they would expect financial gains for (full) professors shifting to a private company. However, this premise is based on the assumption that the professor has the skills to take over management tasks. If this premise is not fulfilled – and a professor started to work as a researcher ‘at the bench’ - this would come with a considerable loss in income.

The interviews do not provide a clear picture with regard to differences in remuneration between the private and academic sector on the low end of the career ladder. For researchers at early career stages, such as doctoral candidates or post-graduates, some companies reported that they pay less than what is paid for comparable positions at universities. Others claimed that their pay levels were higher than at university. However, researchers can expect faster increases in their salaries when they work for companies as their seniority increases. Furthermore, the companies frequently offer better promotion prospects and faster promotion. All in all, from a monetary point of view, it is beneficial for researchers to start working in private industry and stay in the same company. This observation is in line with (1) the premise stated above that university professors would increase their remuneration when they become mobile to the non-academic sector and (2) the pattern that companies do not headhunt for researchers from competitors or other companies because they are too expensive.

Finally, some of the companies reported advanced bonus schemes that are more sophisticated and provide better endowed premiums than those offered by universities. This might include monthly monetary bonuses, performance fees, additional health care or retirement pension insurance, but also company cars for senior researchers or for those researchers who became members of the management board. Although some universities also have (or start to implement) remuneration schemes that reward outstanding research performance companies still outperform the academic sector in this respect.

4.4.2 To what extent is remuneration an important motive for intersectoral mobility?

Based on exploratory interviews with company representatives who are responsible for recruiting researchers, we conclude that remuneration is not a primary factor impacting intersectoral mobility. The workflows and type of work strongly differ between universities and industry (see also Kalpazidou Schmidt, 2008). Although there are differences across fields of science and sectors, university researchers need different skills and capabilities to be successful in academic research than those of their counterparts in research performing companies. Furthermore, the different types of work also require different types of personal qualities. Researchers often decide to work at a university (or at a company) because the workflows are as they are and better suit their character/expectations. Other motives such as remuneration may often be secondary.

Furthermore, university researchers are less likely to move to non-academic research positions the older they are or, more precisely, the longer they are working at the university. Those researchers who struggled through the tough competition and became top level university researchers (i.e. full professors) are often not willing to give up their positions. If university professors move they most often take over management positions or become members of the advisory board or similar.

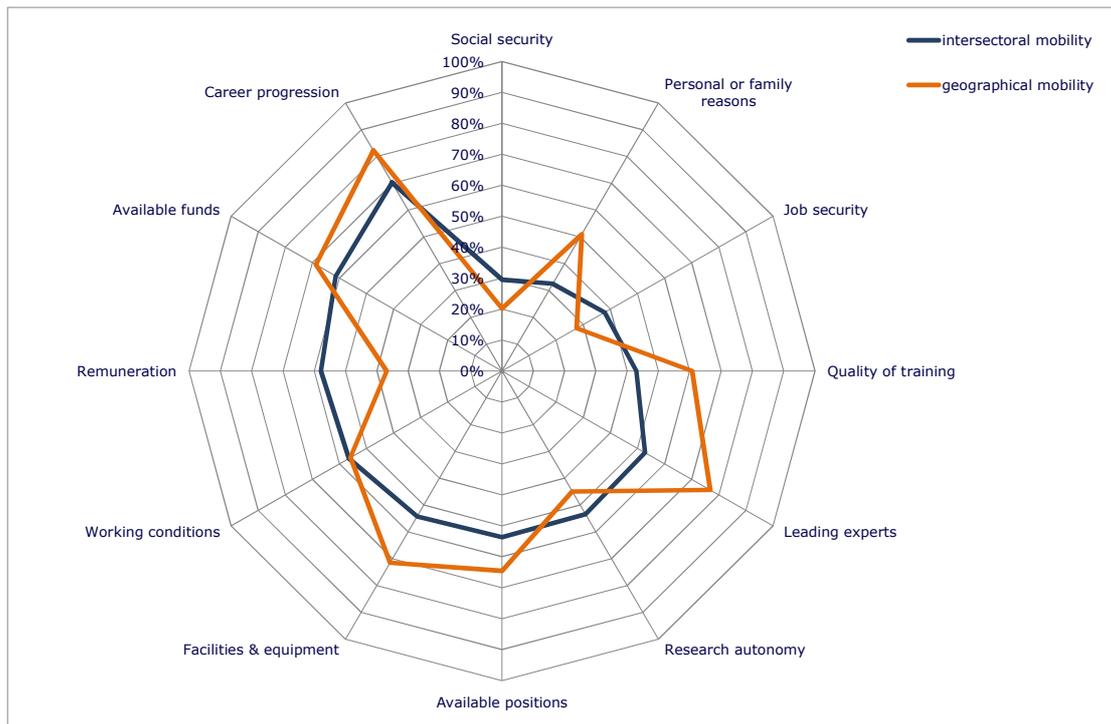
Moreover, university researchers would most often need additional education in management or business activities in order to be able to move to companies⁶⁹. Researchers who start their career in a company at a relatively early age are able to take over management tasks more easily, as they have a better knowledge about the business environment.

When analysing the EU HEI survey we also find that remuneration is not the first motive taken into account if making a move to the private industry sector. Researchers indicated that achieving career progression and gaining first-hand experience of industry, practices, etc. were the most important issues. Moreover, increasing employability, availability of research funding and bringing research to market were also considered to be important factors by more than 60% of the private sector mobile researchers.

Even though the ranking of the motives for intersectoral mobility is similar to the priorities in international mobility, Figure 27 does suggest that intersectoral mobility is more often motivated by remuneration, social security, job security or even research autonomy. Remuneration, together with research autonomy, personal/family reasons and social security, is also a more important motive for intersectoral mobility towards private industry when the researcher has children.

⁶⁹ Many universities have already recognised that career development training is an important issue and activities to improve the training are rapidly expanding. However, the chapter is based on interviews with company representatives who were not yet aware of these activities. Time is needed so that companies can recognise the results from these activities.

Figure 27: Mobility motives for intersectoral mobility and for long term international mobility (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: Share of researchers who indicated these motives to be important (vs. unimportant) for intersectoral mobility (n=392) vs. international mobility (n=1,348)

5 STOCKS OF MOBILITY OF RESEARCHERS

At EU27 level, the main findings of the EU HEI survey on international mobility can be summarized as follows:

- Around 15% of researchers who currently work in the EU are currently mobile.
- 14% of R2-3-4 researchers moved to another country to obtain their PhD.
- A slightly higher proportion (18%) of current or recent doctoral candidates was mobile during their PhD (returning 'home' to obtain their PhD).
- Around 30% of researchers were mobile for three months or more in the last ten years during their post-PhD career.
- Just under one-third of this mobile group (12% of all researchers) changed employer when moving abroad.
- A higher share of researchers (41%) were <3 month mobile in the last ten years during their post-PhD career. No substitution between >3 month and <3 month mobility for family reasons is observed.
- 31% of EU HEI researchers have never been internationally mobile in post-PhD career stages.
- Female EU HEI researchers are less likely to be mobile.
- Across fields of science, high PhD mobility is observed among EU HEI researchers in Humanities and Social Sciences, while high post-PhD mobility is observed in Natural Sciences and Engineering.

At country level:

- >3 month international mobility is least common in East-European and Baltic countries. At the other end of the spectrum, more than 50% of post-doctoral researchers in Switzerland and Denmark were >3 month mobile in the last ten years. In Poland, Czech Republic, Greece and France, a relatively large group was only >3 month mobile more than 10 years ago.
- In the United Kingdom, Austria, Cyprus, Estonia, Ireland, Finland and Switzerland the majority of >3 month mobile respondents have undertaken at least one employer move. Yet in Croatia, Slovenia and Norway less than one quarter changed employer in one of their moves.

When comparing the researchers who currently work in the EU with those outside the EU, we find that duration of moves is longer for EU researchers currently outside EU than for the EU researchers currently inside the EU; and non-EU researchers also prefer shorter moves. EU researchers currently outside the EU move more frequently than EU researchers currently in EU HEI. EU researchers are more likely to change employer when moving outside the EU than within the EU.

In view of the brain drain and circulation concepts, the surveys showed that 11% of EU HEI researchers return to their country of citizenship or that of highest previous education. There is more potential as 23% of the EU researchers currently outside the EU consider returning to the EU and retention of non-EU researchers in the EU is greater than in non-EU countries. Non-EU researchers would also be interested in moving to the EU, according to the Extra-EU survey.

Overall, OECD and Open Doors data show that the US is an important destination for EU27 researchers and that this flow is quite substantial. The number of EU born citizens who were awarded a doctoral degree in the US increased from 1,882 in 2000 to 2,021 in 2011. This figure represents around 2% of all EU citizens who earned a doctoral degree in 2011. On average, an increasing share of EU-born individuals attaining a doctoral degree in the US remains to work there (28.1% in 2000 and over 40% in 2005 and 2011). In 2011, the highest share is found in Bulgaria, Romania, Greece, Hungary and Sweden. Comparing the number of EU27 scholars in the US to the total number of researchers employed in one of the 27 Member States, 1.15% works in the US. This is highest in Cyprus and lowest in Greece. The OECD on Human Resources in Science and Technology by occupation (HRSTO) show that the total number of EU citizens residing in the US, Canada, Australia, New Zealand or Mexico numbered over 430,000 in 2000. Almost 45% of them were employed in the US; Australia follows with a share of about 28%.

Even though this information is relevant to sketch the main patterns, it is too scattered in terms of definitions and scope to estimate the total absolute number of EU researchers abroad. Based on the more detailed US data and a number of basic assumptions on the researcher's careers and mobility, a careful estimate is presented in three scenarios. Referring to the "baseline" scenario, the stock of EU researchers in the US is estimated to have increased from around 9,000 in 2000 to around 15,000 in 2011, with a steady increase year after year. This would correspond to a total of around 34,000 EU-born individuals working as researchers in 2011 in US, Australia, New Zealand, Canada and Mexico.

In the opposite direction, the HEI sample reached 495 researchers with non-EU citizenship. By re-proportioning this sample information relative to the total number of researchers in the country, the total number of non-EU researchers is estimated at 69,856 in EU27. This is 5.6% of the total amount of researchers working in the EU. Furthermore, these non-EU researchers in the EU are concentrated in a small group of countries. When taken together, we find more than 50% of all non-EU researchers in the UK and Germany. There is also concentration in terms of origin: 78.8% of all the non-EU researchers come from 20 countries with the largest share coming from China (13%), India (12%) and the US (11%). Most non-EU researchers are counted in the R1 doctoral career stage. Based on Eurostat data on non-EU doctoral students in the EU, it is estimated that their share as a percentage of all doctoral students in the EU is around 20% in 2010. The UK, France and Norway have the shares of non-EU doctoral students alongside with Switzerland.

Of the researchers currently working in the EU HEI, 77% collaborate internationally. Emphasis is on collaboration with academic partners rather than non-academic partners. Collaboration also increases in later career stages. Virtual mobility is important in this respect as it partly substitutes short term mobility for EU researchers.

Finally, in what concerns intersectoral mobility we find that 23% of researchers in the PhD stage and 30% of researchers in the post-PhD stage have been intersectorally mobile.

5.1 Measurement of mobility

5.1.1 What lessons/insights are drawn with respect to the measurement of mobility?

Researcher mobility takes many forms. Defining mobility is therefore a complex task with several dimensions. There are different types of mobility (physical or virtual mobility; international, intersectoral or interdisciplinary mobility), and different characteristics of the specific moves (duration, moment in the career e.g. during or after PhD career stage, including a change in employer or not). And even though the destination of a move can be clearly identified, the researcher's country of origin is not. A move can refer to the country of citizenship, country of previous highest education, country of the previous employment, etc. Depending on the purpose of the analysis and the flows one wants to depict, the origin can be of major influence when measuring mobility.

The EU HEI survey is not a priori restricted to one definition or concept of mobility, but several concepts are constructed from the data and compared. For international mobility the following estimates are provided:

- Currently on-going
- In the last ten years (versus before or never)
- For a duration of more than 3 months and less than 3 months
- With changes in employer (versus without)
- During PhD, to obtain a PhD or in post-PhD career stages

These estimates are calculated with reference to the country of citizenship as origin and to the country of the most recent highest education as origin.

This offers a unique opportunity to compare the outcomes and thus to provide an indication of the impact of definition. The results are presented in the following section. Here, we list a number of insights from this extensive measurement exercise:

- *>3 month post-PhD mobility in last ten years*
Both at aggregate EU27 level and at country level, reference country of origin (citizenship versus highest education) affects the indicator only to a limited extent. Asking the direct question as to whether the researcher has been mobile (with no definition of origin) results in a similar share as well.
- *PhD mobility*
Even though both are measured under the same term 'PhD mobility', the interpretation of PhD degree mobility (to obtain a PhD in another country) versus >3 month mobility during the PhD is very different. The first refers to an outflow of students to build a research career in another country, while the latter refers to an often single experience for the researcher.
- *PhD degree mobility*
Compared to post-PhD mobility or mobility during PhD, the measurement of PhD degree mobility requires special attention when expressed in terms of origin and destination. The departure country of the researcher is per definition not the country where the PhD will be obtained. Expressing this type of mobility in terms of country of PhD is thus to be interpreted as incoming mobility: what share of the doctoral candidates in a country has moved from another country of obtain the PhD there? Outgoing mobility can be expressed in with reference to the country of previous highest education, for example.

In general, there are many perspectives through which one can interpret researcher mobility. The combination of different angles requires careful interpretation, but at the same time offers a unique opportunity to reach nuanced findings and deepen mobility profiles of researchers.

5.2 Stock of mobility

5.2.1 How mobile are European researchers, based on different definitions?

In the following section on the stock of mobility, we provide estimates of current mobility flows from and towards Europe. In this section we present the key indicators of the different types of definitions and dimensions of mobility as measured through the HEI survey data for all researchers currently working in the EU, thus regardless of their destination or origin.

At EU27 level, the main findings are summarized as follows:

- Around 15% of researchers who currently work in the EU are currently mobile. This corresponds to around 186,200 researchers. The same percentage works in an EU country other than their country of highest education.
- 14% of R2-3-4 researchers moved to another country to obtain their PhD. The share is the same among researchers currently enrolled in a PhD programme or who have recently obtained a PhD and are now in their R2 career stage, implying that such mobility during the PhD phase has not increased.
- A slightly higher proportion (18%) of current or recent doctoral candidates was mobile during their PhD (returning 'home' to obtain their PhD).
- Around 30% of researchers were mobile for three months or more in the last ten years during their post-PhD career.
- Just under one-third of this mobile group (12% of all researchers) changed employer when moving abroad. This represents the activities of around 40% of all internationally mobile researchers and provides an indication of 'employer mobility'.
- A higher share of researchers (41%) were <3 month mobile (less than three months) in the last ten years during their post-PhD career.

It is also important to note that these results are (to the extent that comparison is possible given the use of different scopes and data) in line with existing literature on the topic:

- The 2011 Eurodoc survey finds that between 11% (Croatia) and 32% (Spain) of doctoral students are or were pursuing their doctorate abroad. For countries like Belgium, Portugal and Sweden they reach results which approximate the 15% for PhD degree mobile researchers in the MORE2 HEI sample.
- The MORE1 study shows that more than half (56%) of all EU27 HEI researchers are estimated to have been internationally mobile (for at least three months) at least once during their research career. Of these researchers, more than half (that is 29% of all EU27 HEI researchers) have moved abroad during the last three years. Estimates seem to give lower results in the MORE2 project, which could be due several factors, such as the applied definition (MORE1 defined mobility with reference to country of highest educational level) or weighting procedures at country level.
- The 2009 CDH figures, for example, result in an average of 14% of national citizens with a doctorate who have moved abroad in the previous 10 years (OECD, 2012). This statistic is based on data for returnees only, thus not taking into account those who are currently and may remain abroad. If the latter is calculated in terms of our 16% estimate for current international mobility, we could reach a figure which is close to our estimates of long term post-PhD mobility in the last 10 years.
- Cañibano et al. (2011) research (into Andalusian researchers') short to medium term mobility, defined as research visits abroad of one week to two years, and finds a share of 38% mobile researchers, close to the 41% estimate from the MORE2 HEI survey.

Table 13 presents the results at country level:

- >3 month international mobility is least common in East-European and Baltic countries. At the other end of the spectrum, more than 50% of post-doctoral researchers in Switzerland and Denmark were >3 month mobile in the last ten years. In Poland, Czech Republic, Greece and France, a relatively large group was only >3 month mobile more than 10 years ago.
- In the United Kingdom, Austria, Cyprus, Estonia, Ireland, Finland and Switzerland the majority of >3 month mobile respondents have undertaken at least one employer move. Yet in Croatia, Slovenia and Norway less than one quarter changed employer in one of their moves.

Table 13: Comparison of different international mobility types and definitions per country

Type of international mobility	Current mobility		Overall PhD degree mobility		R1-R2 PhD degree mobility		>3 month mobility during PhD	>3 month post-PhD mobility in last ten years				>3 month post-PhD employer mobility in last ten years	<3 month mobility in last ten years	
	Reference point	citizenship	highest education	citizenship	highest education	direct targeted question (country of citizenship)	direct targeted question (country of highest education)	direct targeted question	citizenship*	highest education*	both citizenship and highest education*	direct targeted question	direct targeted question	direct targeted question
Austria		24%	23%	12%	14%	13%	15%	12%	44%	41%	39%	45%	26%	52%
Belgium		18%	17%	15%	19%	3%	5%	12%	45%	45%	44%	46%	22%	55%
Bulgaria		1%	11%	8%	12%	31%	10%	15%	-	-	-	18%	5%	41%
Croatia		3%	7%	4%	8%	7%	4%	18%	18%	17%	17%	19%	3%	39%
Cyprus		31%	89%	-	-	10%	-	-	37%	38%	27%	44%	24%	43%
Czech Republic		7%	6%	8%	13%	14%	8%	27%	-	-	-	16%	2%	44%
Denmark		31%	24%	12%	9%	7%	10%	48%	52%	50%	49%	53%	20%	55%
Estonia		12%	26%	8%	14%	11%	10%	37%	26%	24%	24%	27%	14%	48%
Finland		21%	16%	17%	19%	7%	8%	20%	40%	41%	40%	42%	22%	42%
France		14%	8%	14%	12%	7%	8%	17%	26%	25%	25%	26%	7%	33%
Germany		15%	13%	15%	19%	11%	16%	12%	42%	37%	36%	45%	16%	49%
Greece		2%	43%	6%	23%	40%	45%	-	32%	31%	28%	34%	13%	44%
Hungary		5%	10%	8%	8%	17%	14%	22%	34%	33%	33%	34%	16%	61%
Iceland		5%	83%	-	-	-	-	-	-	-	-	49%	15%	55%
Ireland		31%	44%	18%	37%	34%	25%	11%	35%	33%	31%	37%	19%	40%
Italy		2%	6%	7%	12%	25%	27%	56%	25%	24%	24%	25%	8%	37%
Latvia		4%	8%	10%	25%	18%	17%	16%	-	-	-	20%	3%	46%
Lithuania		2%	10%	5%	8%	20%	16%	24%	-	-	-	18%	5%	40%
Luxembourg		76%	86%	-	-	-	-	11%	42%	43%	37%	47%	22%	51%
Macedonia (FYROM)		12%	31%	6%	21%	-	-	-	-	-	-	34%	12%	40%
Malta		7%	79%	9%	-	61%	-	-	23%	22%	21%	24%	8%	37%
Netherlands		37%	25%	36%	30%	29%	25%	18%	45%	43%	42%	46%	22%	47%
Norway		32%	27%	19%	19%	9%	15%	21%	43%	41%	41%	43%	10%	43%

MORE2 - Higher Education Sector Report

Type of international mobility	Current mobility		Overall PhD degree mobility		R1-R2 PhD degree mobility		>3 month mobility during PhD	>3 month post-PhD mobility in last ten years				>3 month post-PhD employer mobility in last ten years	<3 month mobility in last ten years
	citizenship	highest education	citizenship	highest education	direct targeted question (country of citizenship)	direct targeted question (country of highest education)	direct targeted question	citizenship*	highest education*	both citizenship and highest education*	direct targeted question	direct targeted question	direct targeted question
Poland	1%	3%	2%	6%	6%	4%	12%	-	-	-	9%	3%	29%
Portugal	7%	28%	5%	10%	24%	7%	23%	26%	25%	24%	27%	7%	45%
Romania	2%	6%	5%	12%	13%	7%	34%	20%	19%	19%	20%	5%	56%
Slovakia	4%	10%	6%	8%	20%	14%	35%	26%	25%	23%	28%	9%	45%
Slovenia	2%	12%	10%	19%	36%	8%	21%	33%	33%	32%	34%	7%	45%
Spain	4%	7%	4%	8%	12%	20%	40%	31%	32%	31%	32%	8%	41%
Sweden	31%	21%	21%	19%	8%	17%	12%	37%	39%	37%	39%	18%	43%
Switzerland	51%	43%	43%	55%	8%	27%	14%	48%	45%	42%	53%	27%	42%
Turkey	3%	19%	3%	8%	19%	11%	33%	27%	27%	24%	29%	8%	38%
United Kingdom	26%	21%	20%	13%	7%	16%	11%	27%	26%	25%	29%	16%	37%
EU27	15%	15%	13%	14%	12%	13%	18%	30%	28%	27%	31%	12%	41%

Source: MORE2 Higher Education Survey (2012)

*: *The indicators on citizenship and highest education for >3 month international post-PhD mobility are calculated by means of the countries registered in the 'moves' in the questionnaire, compared to either the country of citizenship or the country of highest education. We therefore assume that this group of mobile researchers are, by definition, researchers who also respond positively to the direct question "to have worked abroad for more than 3 months in the last ten years". That said, we reweight the share of mobile researchers according to this definition to bring the relative size of the sample in line with the number of mobile researchers in the direct question.*

5.2.2 How do different dimensions (gender, family status, career stage, field of science) affect researchers' mobility?

5.2.2.1 Current mobility in the EU HEI survey

The share of currently mobile female researchers is similar to that of currently mobile male researchers. Across the scientific disciplines, one minor difference can be observed: the highest share of currently mobile researchers is 19% in the Natural Sciences versus 12% in the Agricultural Sciences. Current international mobility is, on average, highest among researchers with a fixed term contract of between 1 and 4 years duration and among researchers without a contract.

5.2.2.2 PhD degree mobility

The current PhD candidates will be more PhD degree mobile than the R2 PhD holders (19% versus 12%). The share of PhD degree mobile female researchers in R1 or R2 career stage is below that of their male counterparts (13% versus 18%). PhD candidates and recent PhD holders without children (at the time of the survey) are more inclined towards PhD degree mobility than those with children (17% versus 11%). Finally, no real differences are observed across the various scientific disciplines.

5.2.2.3 Mobility during PhD (>3 months)

The share of female researchers mobile in R1 or R2 career stage who moved for a limited period during their PhD is similar to that of their male counterparts (18% versus 19%). >3 month mobility during PhD is most common in the fields of Humanities and Social sciences (25% and 22%) compared to around 16 % in the other fields.

5.2.2.4 Mobility in post-PhD career stages (>3 months)

Variation exists between the different fields of science, where the highest proportions of post-doctoral researchers who have been mobile in the last ten years are those working in the Natural Sciences (38%) and the lowest for the in Agricultural Sciences (24%). Results for Engineering & Technology researchers are also above the general average (31%) and figures for researchers from the Social Sciences and Humanities are around 30%.

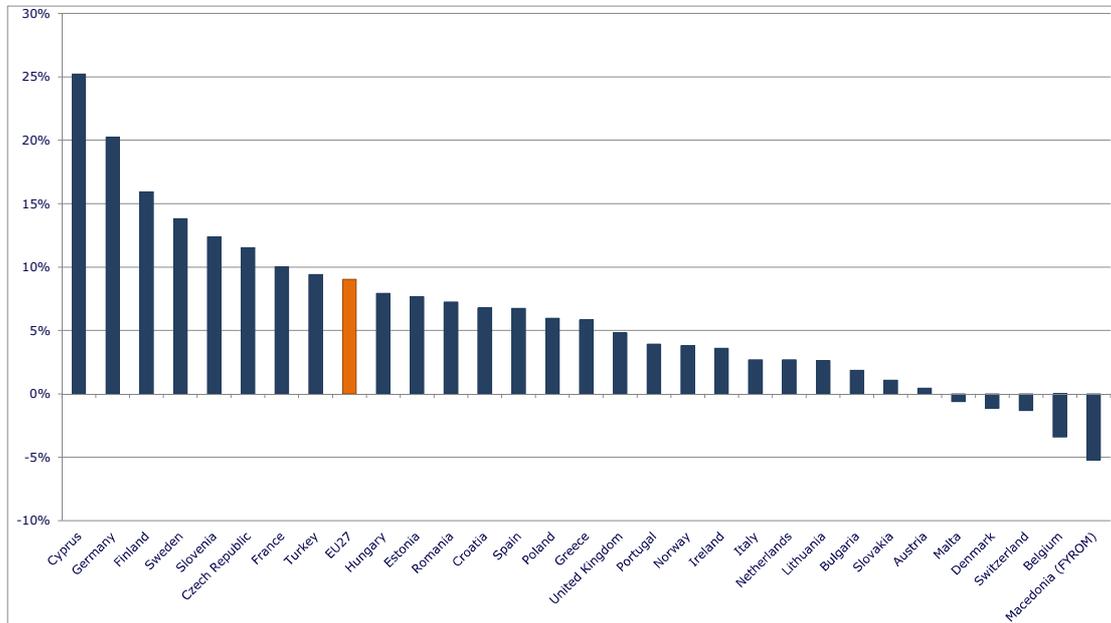
Female researchers are less inclined to >3 month international mobility in post-PhD career stages during the last ten years, as compared with their male counterparts (25% versus 34%). The gap is greater for those at the higher career stages: 7 pp difference in R2, 10 in R3 and 11 in R4. Together with the observation that a gender gap concerning >3 month mobility is nearly non-existent during the PhD phase, this may point towards an improvement of the mobility gender gap over time.

The gender gap exists within all fields of science, being the most pronounced in the Social Sciences and Humanities (24% mobility among female researchers versus 35% among male researchers) and Natural Sciences and Engineering & Technology (26% versus 37%). In Medical and Agricultural Sciences, 25% of female researchers have been >3 month mobile in the last ten years, versus 27% of men.

Variations in this gender gap also occur across countries (Figure 28). Male researchers are substantially more >3 month mobile in Cyprus, Germany, Finland, Sweden, Slovenia and Czech Republic (11 to 25 pp difference). On the other hand, female researchers are more >3 month mobile than their male counterparts in Macedonia (FYROM), Belgium, Switzerland, Denmark and Malta.

>3 month mobility in the last ten years was also more common among single researchers (36% versus 30% couple) and researchers without children (39% versus 28% with children).

Figure 28: Differences in gender for international >3 month mobility in post-PhD career stages per country



Source: MORE2 Higher Education Survey (2012)

Note: - Difference between percentage of male and female researchers in R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) career stage who have worked abroad for 3 months or more at least once in the last ten years. (n=8,357)
 - Countries with less than 30 observations for one of the gender categories are omitted: Iceland, Latvia and Luxembourg.

5.2.2.5 Employer mobility

No real variations between the fields of science or gender are observable for employer mobility, although female researchers are slightly more inclined towards employer mobility than their male counterparts (44% versus 39%).

Overall, there is an inclination towards more employer mobility when the overall degree of >3 month mobility is higher. Most prominent exceptions are the United Kingdom and Estonia, where the degree of employer mobility is relatively high as compared to a relatively low degree of overall >3 month mobility; and Norway and Iceland, where the degree of employer mobility is relatively low as compared to a relatively high degree of overall >3 month mobility.

5.2.3 To what extent are researchers internationally mobile from the EU?

The report on Researcher Indicators provides an overview of the available data on EU-born researchers abroad. This information is mainly piecemeal, covers only a few years and a few countries and/or does not refer to researchers identified both on the basis of their education and occupation. This is why it is not possible to determine the exact number of European researchers working outside Europe⁷⁰. The mentioned report does make an attempt based on the available data and a number of well-defined assumptions.

In the following, we first present the data available on doctoral candidates and researchers in the US. Second, we briefly outline the estimate of the total number of EU-born researchers abroad.

5.2.3.1 EU researchers in the US

Table 14 shows the flow of the number of EU doctoral candidates in the US, identifying those who effectively remain in the US, having a definite commitment for a research position. However, the data do not specify what kind of job those who stay, actually secure.

The number of EU born citizens who were awarded a doctoral degree in the US increased from 1,882 in 2000 to 2,021 in 2011. This figure represents around 2% of all EU citizens who earned a doctoral degree in 2011. On average, an increasing share of EU-born individuals attaining a doctoral degree in the US remains to work there (28.1% in 2000 and over 40% in 2005 and 2011). In 2011, the highest share is found in Bulgaria, Romania, Greece, Hungary and Sweden. The gap between the number of doctoral graduates and the number of those remaining in the US may depend on several factors (personal reasons for changing their plan; lack of opportunities in the host country; more favourable condition in other countries, including their home country).

However, from these data alone it is impossible to infer the magnitude of EU researchers in the US. One of the most updated pieces of information on EU citizens employed abroad as researchers is the number of scholars from EU27 countries working in the US. 'Scholars' are defined as someone who, after a long period of study, has profound knowledge of a particular subject in a given branch or field of science. This is a very broad definition which cannot be assumed to correspond to that of all researchers. The trend of scholars in the US is increasing over the whole period, but in the last three years the rise has been relatively small. The stock in 2011/12 is about 27,500.

In Figure 29, the number of EU27 scholars in the US by EU Member State of origin as share of the researchers employed in the Member State of origin, is reported. For the whole EU27 the share is a not negligible 1.15%. Cyprus gets the highest value, but Italy is the first among the big countries (almost 2.5%). Greece shows the lowest share.

⁷⁰ See Franzoni *et al.* (2012).

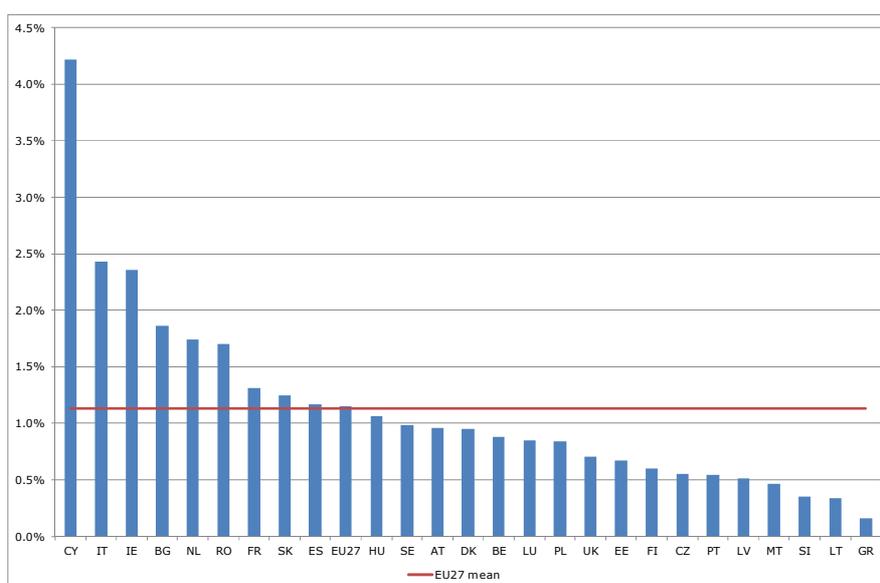
Table 14: European-born US research doctorate recipients and those with definite commitments for research position in the US by EU27 country of birth¹

	2000			2005			2011		
	Doctoral graduates	Commit. in US	Share	Doctoral graduates	Commit. in US	Share	Doctoral graduates	Commit. in US	Share
AT	17	3	14.7%	21	11	52.4%	22	9	40.9%
BE	37	8	21.6%	37	18	48.6%	24	7	29.2%
BG	66	21	31.8%	98	46	46.9%	83	39	47.0%
CZ	32	5	15.6%	38	17	44.7%	20	7	35.0%
DE	436	132	30.3%	406	176	43.3%	445	193	43.4%
DK	28	7	25.0%	16	9	56.3%	22	6	27.3%
EE	0	0	n.a.	3	3	83.3%	6	3	41.7%
ES	131	39	29.8%	140	69	49.3%	137	53	38.7%
FI	19	3	13.2%	22	6	27.3%	13	3	19.2%
FR	144	49	34.0%	169	71	42.0%	180	71	39.4%
GR	113	30	26.5%	130	60	46.2%	92	46	50.0%
HU	52	17	32.7%	52	17	32.7%	26	13	50.0%
IE	27	8	29.6%	27	14	51.9%	34	14	41.2%
IT	136	30	22.1%	203	89	43.8%	193	66	34.2%
LT	0	0	n.a.	11	5	45.5%	11	3	22.7%
LU	3	3	83.3%	0	0	n.a.	0	0	n.a.
LV	0	0	n.a.	12	3	20.8%	11	5	45.5%
MT	3	3	83.3%	3	3	83.3%	3	0	0.0%
NL	62	21	33.9%	50	17	34.0%	38	10	26.3%
PL	70	15	21.4%	91	43	47.3%	119	48	40.3%
PT	25	8	32.0%	42	10	23.8%	32	12	37.5%
RO	137	43	31.4%	247	140	56.7%	183	94	51.4%
SE	37	9	24.3%	57	25	43.9%	32	15	46.9%
SI	16	3	15.6%	6	3	41.7%	6	3	41.7%
SK	7	3	35.7%	19	8	42.1%	18	8	44.4%
UK	285	80	28.1%	312	139	44.6%	272	104	38.2%
EU27	1,882	537	28.5%	2,211	1000	45.2%	2,021	830	41.1%

¹ Data for Cyprus are not available.

Source: Own calculations based on National Science Foundation, National Center for Science and Engineering Statistics, NSF/NIH/ED/USDA/NEH/NASA Survey of Earned Doctorates; special tabulation (July 2013).

Figure 29: Number of scholars from EU27 Member States employed in US as a percentage of total researchers employed in the Member State in 2009



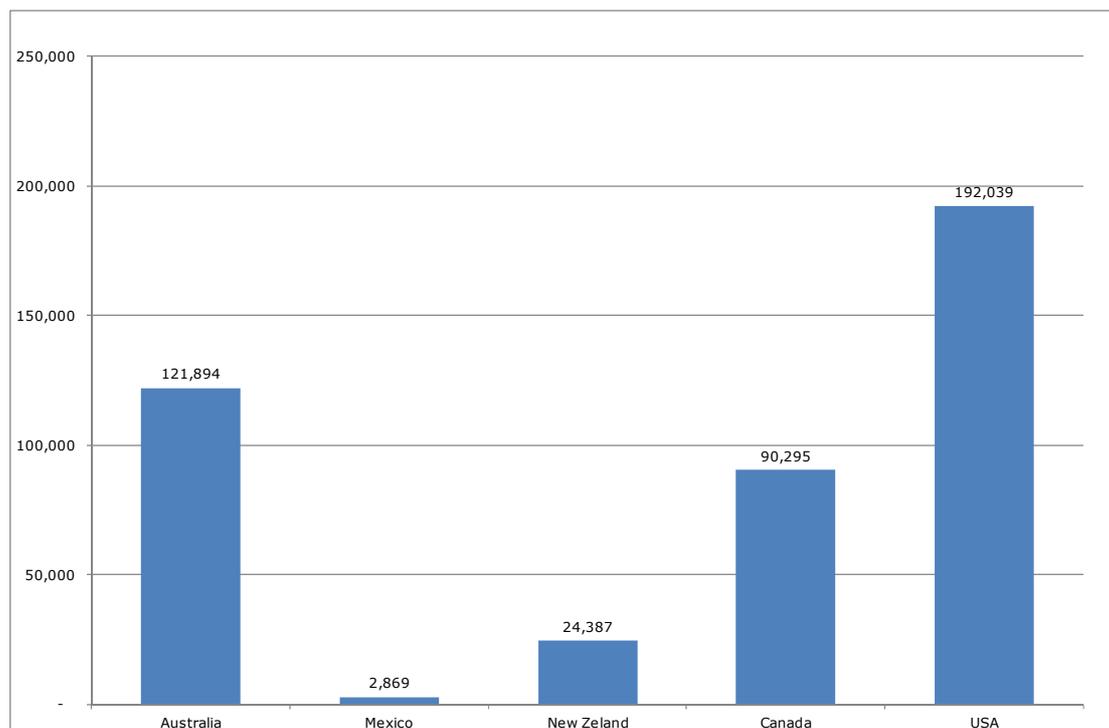
Source: Own calculations based on Institute of International Education. "Institutions Hosting the Most International Scholars, various years." Open Doors Report on International Educational Exchange.

A further piece of information relates to the number of EU citizens who hold a PhD in Science and Technology and are employed in the US. This number was 31,600 in 2008, with an increase of more than 4,200 since 2006. The great majority of these doctoral graduates are employed in Science and Engineering related occupations (around 78% in both 2006 and 2008). However we know too little about their occupations to classify all of them as researchers.

The OECD database on International Migration contains information on both the country of birth and occupation of a person residing in a foreign country. Data refer to Human Resources in Science and Technology by occupation (HRSTO). They are obtained by considering all residents in the selected country born in one of the EU27 Member States, who are employed in one of the occupations of the Sciences and Technology field or related to it. Moreover, it covers not only the US but also Canada, Australia, New Zealand and Mexico. This data however also has limitations, particularly the non-availability of such data after 2000 and the lack of information on the level of education.

The data reported in Figure 30 show that the total number of EU citizens with the above-mentioned characteristics numbered over 430,000 in 2000. Almost 45% of them were employed in the US; Australia follows with a share of about 28%.

Figure 30: Number of EU27 HRSTO employed in selected foreign countries



Source: Own calculations based on OECD International Migration Statistics (database)

5.2.3.2 An estimate of the EU-born researchers working abroad

As previously noted, there are no data on EU researchers which cover a large number of countries, refer to a long period of time and are based upon a homogeneous definition of "researcher". There is no internationally coordinated survey on this phenomenon and many countries do not collect data. This implies that it is extremely difficult to determine the number of EU-born researchers (by education and occupation) working abroad and their trends over time.

The country for which more and better data are available is the US, but again, there are some difficulties in estimating the stock of EU-born researchers and their trends over time.

Given the lack of data, the stock of EU born researchers working abroad can only be estimated. Our attempt to produce an estimate which is as reliable as possible takes as its starting point important information provided by the Survey of Earned Doctorates (SED), which is a census of all research doctorate recipients from US institutions⁷¹. This survey records for each year over the period 1962-2011 the number of doctorate recipients who, at the time they completed the SED, reported: (i) to have "definite commitments" for employment or a post-doc position in the US in the following year, and (ii) that the primary or secondary work activity of this forthcoming position was "research".

These numbers are displayed, after calculating them cumulatively in 5-year periods, in Table 15 (except the first and the last ones that are of different length). At the EU level, a huge increase took place (+326%) between 1970-74 and 2005-2009, the largest rise occurring over the last 10-15 years. However, once again, the performances of each individual Member State have been very different.

It is interesting to note that the growth rate of these numbers exceeds by far the growth rate of the EU born who earned a doctorate in US. The implication is that a growing share of the latter secured a job as researcher in the US: from the 1970's to the first decade of this century this share approximately doubled, increasing from 18.8% to 37.5%.

⁷¹ See <http://www.nsf.gov/statistics/srvydoctorates/>

Table 15: EU27 Member States born US research doctorate recipients with definite commitments for research position in US after graduation, by country of birth¹, 1962-2011

	1962-1969	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2011
DE	244	269	306	245	306	379	448	625	844	354
UK	146	236	247	256	321	335	376	469	645	219
RO	26	31	33	43	29	27	108	285	603	178
IT	40	54	59	71	101	97	125	249	401	131
FR	46	60	83	70	113	127	147	230	405	130
PL	88	62	65	56	61	84	103	107	244	101
ES	22	20	33	37	53	95	154	228	298	101
GR	94	76	102	134	179	160	160	171	285	91
BG	13	10	10	10	3	8	56	117	248	89
IE	20	26	25	48	32	38	62	60	80	32
NL	59	58	49	49	57	62	86	75	96	30
HU	113	65	32	30	21	28	27	60	82	27
SE	15	13	24	19	28	25	32	41	88	27
PT	5	8	10	13	15	13	24	48	62	26
SK	0	0	0	0	0	0	5	13	47	17
CZ	45	31	28	27	21	17	33	38	59	16
BE	25	25	27	24	40	41	51	52	65	15
DK	18	19	13	17	15	14	15	41	50	14
AT	71	48	46	32	28	30	29	30	56	12
LV	0	0	0	0	0	0	0	3	23	11
FI	13	8	13	13	13	15	13	22	28	5
SI	0	0	0	0	0	0	3	13	19	5
EE	0	0	0	0	0	0	0	3	16	5
LT	0	0	0	0	0	0	0	3	21	5
LU	5	3	0	3	5	8	5	8	5	3
MT	3	0	3	8	3	8	5	10	13	0
EU27	1,105	1,117	1,205	1,202	1,440	1,607	2,065	2,996	4,781	1,643

¹ Data for Cyprus are not available. Member States are ranked according to 2010-2011 values.

Source: Own calculations based on National Science Foundation, National Center for Science and Engineering Statistics, NSF/NIH/ED/USDA/NEH/NASA Survey of Earned Doctorates; special tabulation (July 2013).

All these data are annual flows. On the contrary, we are interested in the stocks of EU-born researchers working in the US. To transform these flows into stocks we need to know:

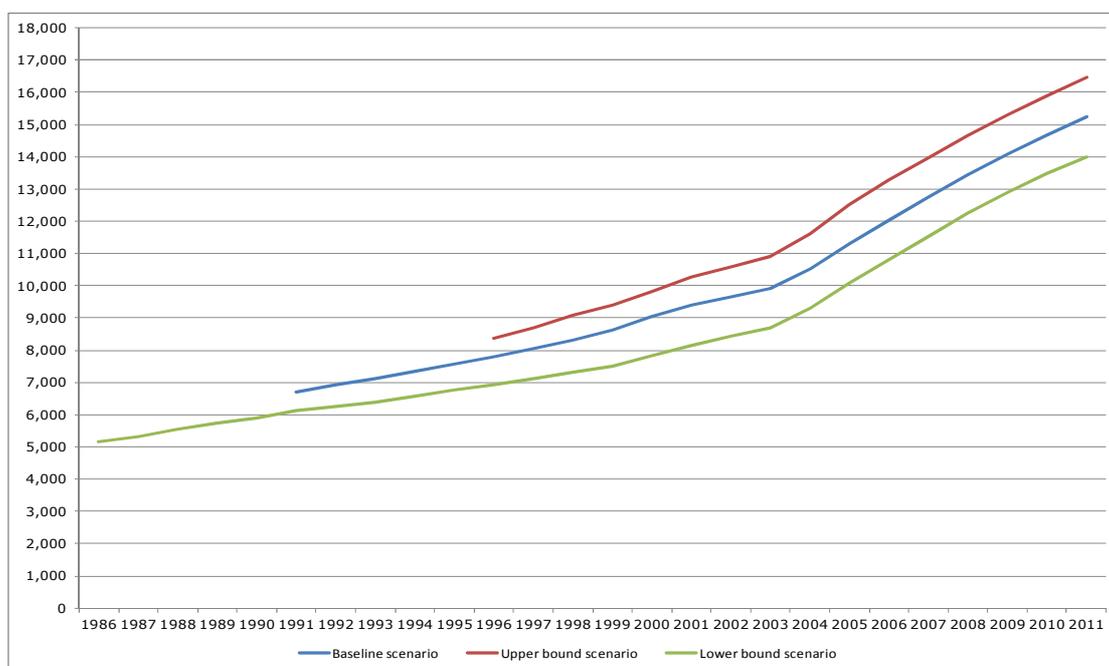
- a. how long does the job last and what comes after its termination (another job as researcher in US or abroad or in Europe? Any other job? Retirement?);
- b. how many EU-born researchers who did not earn their doctorate in US get a job as researcher in this country and how long did that job last?

Having no possibility of getting accurate information on these two aspects, we make the following assumptions:

- i) the post-doctoral career lasts for 30 years (our "baseline" scenario), or alternatively for 25 years (the "lower bound" scenario) or for 35 years ("upper bound" scenario);
- ii) the numbers of outflows (EU citizens moving away from US) and inflows (EU researchers moving to US after completing the doctorate) are equal over the period of observation. It should be noted that compared to the "baseline" scenario, the "lower bound" scenario is consistent with outflows larger than inflows (and vice versa in the case of the "upper bound" scenario).

On the basis of these assumptions, with annual data available from 1962 up to 2011, the trend for the stock of EU-born researchers in US can be estimated for the period 1991-2011 (where 1991, in the “baseline” scenario represents the cumulated flows of the 30 years period from 1962 to 1991, 1992 that of the period 1963-1992, etc..., while the cumulated periods will be 25 and 35 years in the two other scenarios). The results of our estimates in the three scenarios are displayed in Figure 31.

Figure 31: Estimated stock of EU27 born researchers in the US in three different simulation scenarios



Source: Own calculations based on National Science Foundation, National Center for Science and Engineering Statistics, NSF/NIH/ED/USDA/NEH/NASA Survey of Earned Doctorates; special tabulation (July 2013).

Referring to the “baseline” scenario, the stock is estimated to have increased from 9,045 in 2000 to 15,239 in 2011, with a steady increase year after year. The overall rate of increase in this 12-year period is estimated to be 68.5%, corresponding to an average yearly increase of about 4.5%.

In the “lower bound” scenario the absolute numbers are lower but their rate of increase is bigger (79% over the whole period). Of course, the opposite holds in the “upper bound” scenario.

Starting from these estimates on the stock of EU- born researchers working in the US, we can also attempt to reach an estimate of the EU-born researchers working in other countries. To accomplish this, given the lack of data, we need to make further assumptions:

We start from the stock of EU-born HRST working in US, New Zealand, Australia, Canada and Mexico. These stocks are made available by the OECD for year 2000, with no recent updates. Our strategy consists of the following two steps:

- i) to calculate the stock of EU-born researchers working in US in 2000 (estimated above) as a share of the stock EU-born HRST working in the US in that same year;
- ii) to apply the resulting ratio to the four other countries, on the assumption that in each of them basically the same share of EU-born doctorate recipients gets a job as researcher as in US;

- iii) to apply to the resulting estimated stock of researchers in 2000 the same rate of growth of the stock of researchers we calculated in US between 2000 and 2011.

According to our data, around 190,000 EU-born HRST worked in US in 2000, while our calculations estimate a stock of EU-born researchers in US between 7,820 and 9,817 (in the three simulations scenarios). The estimated share of researchers on total HRST in 2000 in the US is then between 4.1% and 5.1% and equal to 4.7% in the baseline scenario.

Applying these shares to the number of HRST working in 2000 in the four other countries, we compute the stocks of EU-born researchers in New Zealand, Australia, Mexico and Canada in 2000.

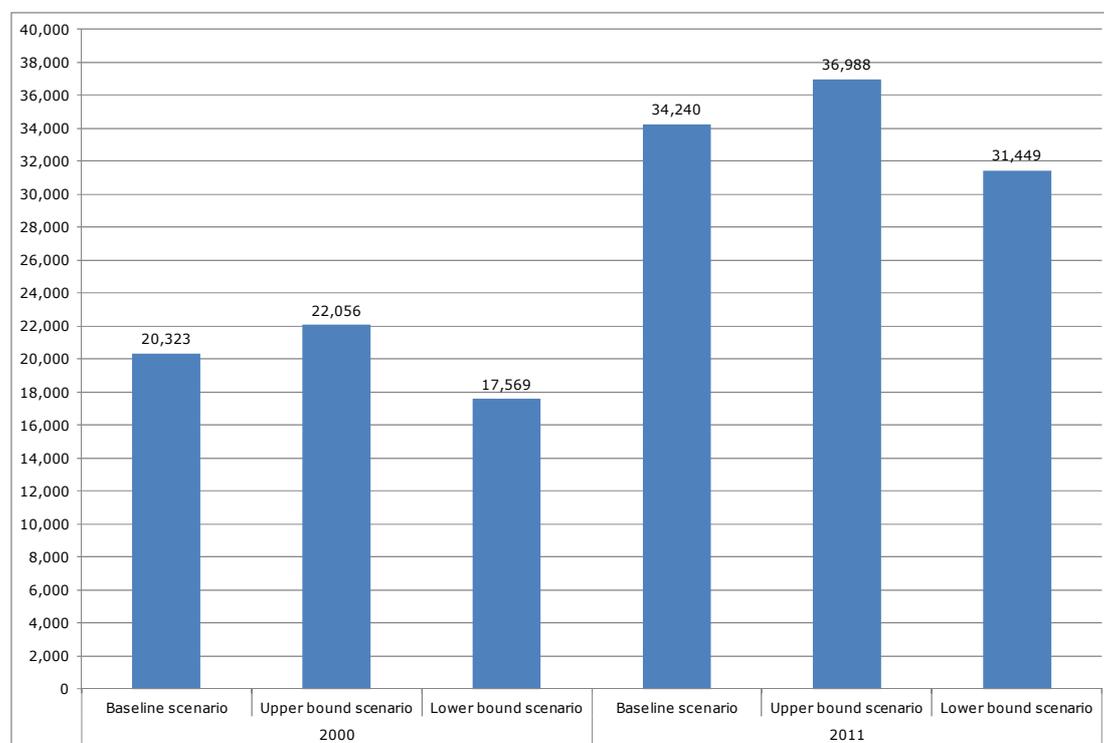
Finally, the stock of EU-born researchers in these four countries has been updated to 2011, applying the growth rate of the stock of EU born researchers in US in the period 2011-2000 (around 70%). Figure 32 displays the resulting figure for 2000 and 2011.

In particular, according to these estimates and assuming the “baseline” scenario, the total number of EU-born individuals working as researchers in 2011 in US, Australia, New Zealand, Canada and Mexico was around 34,000.

We emphasise, once again, that these are estimates based on disputable, though not unreasonable, assumptions.

The methodology we have used can yield better results once reliable data become available on one or another of the assumptions we have made. A definite knowledge of the magnitude and the trend of the stock of EU researchers abroad needs better and more complete data.

Figure 32: *Estimated stock of EU27 born researchers working in 5 non-EU countries (US, AUS, NZL, CAN and MEX) in three different simulation scenarios in 2000 and 2011*



Source: Own calculations based on National Science Foundation, National Center for Science and Engineering Statistics, NSF/NIH/ED/USDA/NEH/NASA Survey of Earned Doctorates - special tabulation (July 2013) – and on National Science Foundation/Division of Science Resources Statistics, Scientists and Engineers Statistical Data System (SESTAT)

5.2.4 To what extent are researchers internationally mobile towards the EU?

In order for the EU to grow and remain competitive, it needs to attract talented non-EU students and researchers. Moving to Europe temporarily is an opportunity embraced by over 200,000 students and researchers from outside the EU every year.⁷²

As non-EU researchers are important for the EU, this section provides an overview of some (estimated) figures on non-EU researchers currently working in the EU by country, field of science and career stage. The EU HEI survey will be the main source of information for providing some estimated figures. Comparison with other data sources was possible.

Although the survey on HEIs is representative, it has not been designed for estimating researchers according to their citizenship, and it is thus not easy to generalize about any result with accuracy, as the necessary auxiliary information is not available. In many strata the sample includes only some units with the non-EU feature (i.e. non-EU researchers). Before any generalizations can be made, some benchmark with official data (which is problematic) is necessary. Despite all the limitations it is possible, adopting an 'empirical' method, to provide some estimation of the shares of extra-EU researchers currently working in Europe (in HEI), based on the HEI survey sample.⁷³

The HEI sample reached 495 researchers with non-EU citizenship, through the re-proportioning within the sample in each country of the ratio Non-EU researchers/Total researchers. The total number of non-EU researchers adopting re-proportioning within the sample is equal to 69,856 in EU27. This is 5.6% of the total amount of researchers working in the EU.

5.2.4.1 Non-EU researchers by country

An estimation of the distribution of non-EU researchers working in the EU by country⁷⁴, based on the HEI sample, shows that non-EU researchers in the EU are concentrated in a small group of countries. In Germany and UK together we find more than 50% of all non-EU researchers.

According to Eurostat, in the 24 EU Member States covered by the data, around 7,000 non-EU nationals arrived in 2011 for the purpose of research⁷⁵; mostly in France (2,075), the Netherlands (1,616), Sweden (817), Finland (510) and Spain (447). This information only provides us a snapshot of inflows of non-EU researchers in 2011 but it confirms that countries like France, The Netherlands, Sweden, Finland and Spain are important destination countries for non-EU researchers. Data for the United Kingdom and Denmark are missing.⁷⁶

Comparing this to the estimated information of the HEI, we observe that these missing countries are important destination countries for mobility towards the EU. Another observation is the major significance of Germany as a destination country which is not specifically observed in the Eurostat data. Considering the mobility pattern of the 220,000 students and researchers originating from outside the EU

⁷² http://europa.eu/rapid/press-release_IP-13-275_en.htm

⁷³ The provided estimates are purely empirically based.

⁷⁴ Country refers to the panel country of the respondent which was identified during the data collection process of the survey on HEI and is closely related to the country of current employment.

⁷⁵ Purpose of research in general, not HEI specific.

⁷⁶ The Eurostat data does not include Denmark and the UK as these countries are not bounded by the 'Researchers Directive'.

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:289:0015:0022:EN:PDF>

in 2011, the countries which received the highest number of inward student mobility were France (64,794), Spain (35,037), Italy (30,260), Germany (27,568) and the Netherlands (10,701). Results from CDH 2009 data (OECD, 2012) also indicate that France, Germany and the United Kingdom appear among the favourite destinations for EU mobility.

Also when looking into the distribution of non-EU researchers in Europe by citizenship, non-EU researchers in the EU are, again, highly concentrated in a small number of countries. 78.8% of all the non-EU researchers come from 20 countries with the largest share coming from China (13%), India (12%) and the US (11%).

5.2.4.2 Non-EU researchers in the EU by field of science

The shares of non-EU researchers in EU27 by field of science are shown in Table 16. The largest share of non-EU researchers in the EU (62%) is working in natural sciences followed by 21% in Social Sciences.

Table 16: Non-EU researchers in the EU27 by field of science

Natural		Health		Social		Total	
8.80%	n = 43,270	3.70%	n = 11,126	3.40%	n = 15,460	5.60%	n = 69,856

Source: Estimations based on the MORE2 EU Higher Education Survey (2012)

5.2.4.3 Non-EU researchers in the EU by career stage

An estimation of the shares of non-EU researchers in EU27 by career stage based on the HEI survey are shown in Table 17. About 46% of the non-EU researchers in the EU are first stage researchers (R1). R2 and R3 researchers respectively account for a share of 25% and 18%. Foreign R4 researchers are least represented in the EU.

Table 17: Non-EU researchers in the EU27 by career stage

R1		R2		R3		R4		Total	
46.1%	n = 32,176	25.3%	n = 17,640	18.4%	n = 12,842	10.3%	n = 7,197	n = 69,856	

Source: Estimations based on the MORE2 EU Higher Education Survey (2012)

The total number of *doctoral candidates* in 2004 in the EU, according to EUROSTAT data, is approximately 433,000. About 73,000 of these doctoral candidates are from outside the EU. The share of non-EU doctoral candidates as a percentage of all doctoral candidates in the EU is thus 16.9%.⁷⁷ In 2010, there were around 735,000 doctoral candidates in the EU, of which about 20% are from outside the EU (Table 18).⁷⁸ The UK, France and Norway have the largest amount of non-EU doctoral students. In terms of share of non-EU doctoral students as a percentage of all doctoral students, Switzerland takes up the largest share followed by France, the UK and Norway.

Results of the survey of young researchers in *life sciences* in Europe⁷⁹ indicate that in 2003 there are about 37,000 doctoral candidates (R1 researchers) in the EU25. About 6,000 of these doctoral candidates are from third countries (16%).

⁷⁷ http://ipts.jrc.ec.europa.eu/docs/iiser_intra-eu.pdf: Based on EUROSTAT data for 16 EU countries

⁷⁸ The Researchers report (2013), based on Eurostat data. This breakdown of the doctoral candidates in EU27 by citizenship is based on the 535,000 doctoral candidates for which information on citizenship was available. Germany estimates its number of doctoral candidates at 200,400 for 2011. This number was integrated in the 2010 total. But this information was not included in this figure as for no breakdown by country of citizenship was possible.

⁷⁹ http://ipts.jrc.ec.europa.eu/docs/iiser_intra-eu.pdf

This share of 16% non-EU doctoral candidates for life sciences is very similar to the overall share of non-EU doctoral candidates (16.9% in 2004). The same survey indicates that there are about 19,000 post doctorates (R2 researchers) in life sciences, of which 4,800 (24%) originate from third countries.

Focusing on the *doctorate holders* (R2, R3 and R4 researchers), Table 19 gives an overview of the share of non-EU doctorate holders (relative to the total amount of doctoral holders per EU country) per EU country (CDH 2009 data)⁸⁰. The highest share of foreign doctorate holders is in Poland (14%), followed by Sweden (7%), Germany (3%), Finland (3%), Portugal (3%) and Denmark (2%). EU12 countries mainly have a share of non-EU doctorate holders of 1% or lower (exception Poland).

Table 18: Share of non-EU doctorate candidates by country (%)

	2006	2007	2008	2009	2010
Switzerland	44.2	45	45.9	47	48.2
France	29.2	31.2	33.1	34.3	35.4
UK	28.5	30.6	31.1	31.6	31.4
Norway	22.3	23.4	25.0	29.1	30.9
Ireland	22.3	22.3	22.3	22.3	22.3
Iceland	12.2	14.4	17.4	23.0	20.8
Luxembourg	20.4	20.4	20.4	20.4	20.4
Sweden	13.9	14.7	16.2	18.3	20.0
Belgium	19.8	18.2	19.0	19.3	19.7
Spain	14.9	16.8	19.0	17.1	17.3
Demark	12.1	14.1	8.9	10.5	15.4
Portugal	6.0	7.8	9.1	10.0	10.6
Austria	8.2	8.5	10.5	11.1	8.8
Serbia	8.5	8.5	8.5	4.1	7.1
Macedonia	3.4	3.4	3.4	1.3	7.0
Slovenia	4.2	4.6	5.8	6.6	6.5
Italy	3.4	4.1	5.0	6.2	6.2
Finland	4.0	4.2	4.5	5.1	5.9
Malta	1.6	2.8	4.5	4.1	4.1
Bulgaria	4.1	4.0	3.5	3.9	4.1
Czech Republic	3.0	3.1	3.7	3.7	4.0
Hungary	3.2	3.0	3.4	2.8	2.6
Turkey	2.7	2.6	2.7	2.8	2.5
Croatia	2.1	2.5	2.5	2.5	2.2
Romania	2.6	2.0	1.7	2.1	2.0
Poland	2.3	2.3	2.2	2.0	1.9
Cyprus	1.3	1.4	1.1	1.8	1.6
Estonia	1.2	1.8	2.4	3.0	1.5
Slovakia	0.5	0.7	1.3	1.4	1.4
Greece	1.0	1.0	1.0	1.0	1.0
Latvia	0.2	0.3	0.3	0.5	0.6
Lithuania	0.1	0.0	0.8	0.6	0.2
EU27	17.0	18.4	19.9	20.5	20.0

Source: Eurostat⁸¹

⁸⁰ CDH survey, Auriol L., B. Felix, M. Schaaper (2010) Mapping careers and mobility of doctorate holders: draft guidelines, model questionnaire and indicators – second edition – the OECD/UNESCO institute for statistics/Eurostat careers of doctorate holders project, STI working paper 2010/1.

⁸¹ DG Research and Innovation; Innovation Union Scoreboard 2013 based on EUROSTAT data.

Table 19: Share of non-EU doctorate holders by country (%)

Country	2006	2009
Bulgaria	0.00	0.33
Denmark	n.a.	2.42
Germany	n.a.	3.36
Estonia	0.60	n.a.
Cyprus	0.93	n.a.
Latvia	0.53	n.a.
Lithuania	0.33	0.31
Hungary	n.a.	1.14
Malta	n.a.	0.47
Poland	n.a.	14.28
Portugal	2.35	2.52
Finland	n.a.	2.78

Source: CDH 2009 survey (Eurostat)

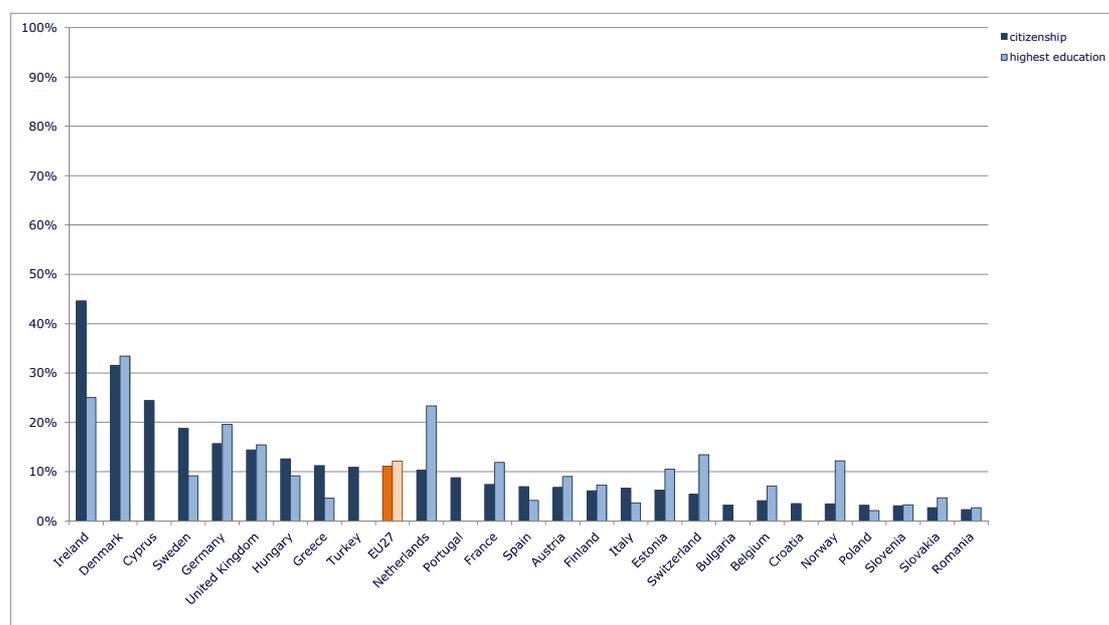
5.2.5 To what extent do researchers return to the EU after an overseas experience (return mobility)?

23% of the (non-representative) sample of EU researchers who are currently mobile outside the EU were considering moving back to the EU in the coming 12 months. Of this 23%, around 4 in 5 had taken concrete steps for 'return' mobility.

Of the mobile researchers who currently work in the EU, 11% return at least once to their country of citizenship and 11% to their country of most recent highest education.

The highest shares of this latter type of 'return' mobility are observed in Ireland (39% according to citizenship and 25% according to highest education) and Denmark (28% and 30%). Of the researchers who obtained their highest education in the Netherlands, 22% returns at least once in their post-doctoral career while only 11% of mobile Dutch citizens return. A similar proportion is observed in France, Estonia, Switzerland, Belgium and Norway.

Figure 33: Return mobility to country of citizenship or country of highest education



Source: MORE2 Higher Education Survey (2012)

- Note: - Share of >3 month internationally mobile R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers that returned to their country of citizenship or country of highest education in at least one move during their post-PhD career stage. (n=1,679 for citizenship and n=1,541 for highest education)
- With '>3 month internationally mobile researchers' defined as those researchers who have worked abroad for 3 months or more at least once in the last ten years.
 - Countries with less than 30 observations are omitted. In the definition with citizenship: Czech Republic, Iceland, Latvia, Lithuania, Luxembourg, Macedonia (FYROM) and Malta; in the definition with highest education: Bulgaria, Croatia, Cyprus, Czech Republic, Iceland, Latvia, Lithuania, Luxembourg, Macedonia (FYROM), Malta, Portugal and Turkey

5.2.6 To what extent do they maintain links with EU while living abroad? And do non-EU researchers maintain links with EU after leaving?

5.2.6.1 Extra-EU survey: EU researchers working outside the EU

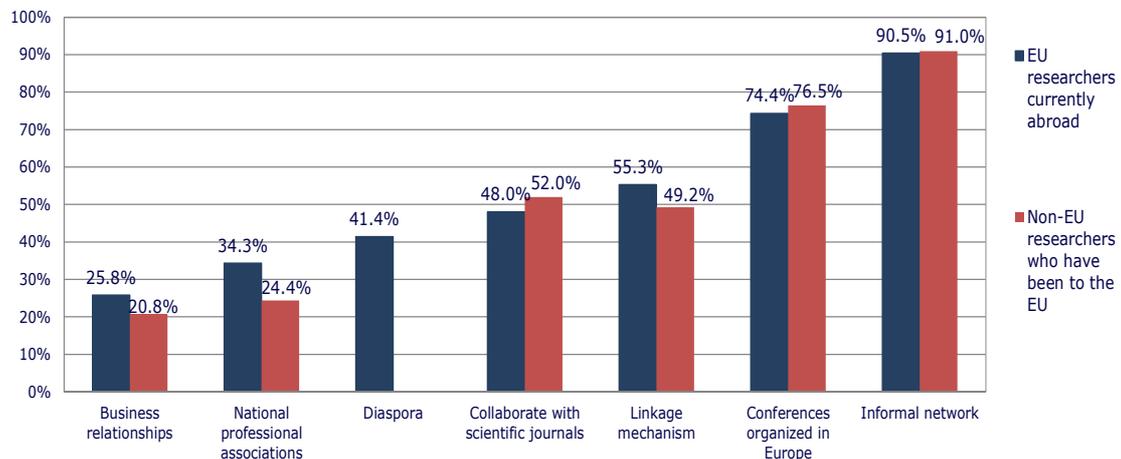
91% of the (non-representative) sample of European researchers working abroad maintains links with European research or researchers. Not surprisingly, the most popular link is via informal networks (91%, see Figure 34). Attendance at conferences organized in Europe is the second most common way to stay connected (74% of respondents). Furthermore, 55% of researchers maintain links with Europe via linkage mechanisms (visits, training, joint projects, mentoring, fundraising), 48% via report collaboration with scientific journals from their country or Europe (48%). 41% remain connected through the official “Diaspora” networks defined as networks of nationals from their own country/Europe or origin living abroad (41%). The links made via national professional associations (34%) or business relationships (26%) are less frequent.

5.2.6.2 Extra-EU survey: non-EU researchers having worked previously in the EU

94% of the respondents in the (non-representative) sample of non-EU researchers who have been to the EU in the past are still ‘connected’ to European research or researchers.

The pattern of networking is similar to the pattern of EU researchers currently abroad: informal networks (91%) and conferences organized in Europe (77%) are the most popular ways of connecting. Linkage mechanisms are slightly less important and collaboration with scientific journals slightly more important (compared to the EU researchers abroad). A much lower share of respondents maintained connections with Europe via professional associations or business relationships (24% and 21%, respectively).

Figure 34: Links maintained with the home country



Source: MORE2 Extra-EU survey (2012)

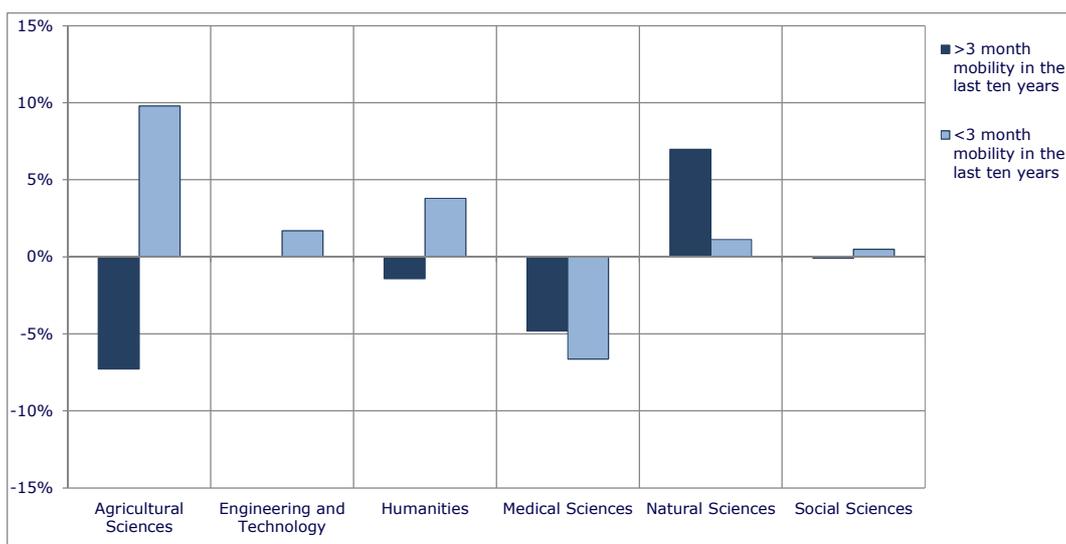
5.2.7 To what extent are researchers <3 month internationally mobile?

41% of post-doctoral researchers in the EU27 have worked abroad for less than 3 months at least once in the last ten years. Another 13% were only <3 month mobile over than 10 years ago. This means that more than half (54%) of researchers have worked abroad for under 3 months.

When comparing the various scientific disciplines, Agricultural Sciences has the highest degree of researchers undertaking short term international mobility in the last ten years. 61% have been <3 month mobile. Medical Sciences are below average, with 34% of researchers <3 month mobile during the last ten years⁸². The percentage of researchers who were <3 month mobile only over ten years ago is, however, highest in this field (16%).

In combination with the long term mobility rates per field of science, it is noted that in the Social Sciences and Humanities, and particularly in the Agricultural Sciences, >3 month mobility occurs relatively less often than the average, while <3 month mobility is more common (Figure 35). For Social Sciences and Humanities this was to be expected from existing studies, yet is only confirmed by the MORE2 data to a limited extent. Both the Natural Sciences and Engineering & Technology are the fields with relatively high rates of both <3 month and >3 month mobility, whereas the Medical Sciences have lower rates than average for both.

Figure 35: Comparison of <3 month and >3 month international mobility rates in post-PhD career stages per field of science (EU27)



Source: MORE2 Higher Education Survey (2012)

- Note:
- Difference between percentage of researchers who were short term respectively >3 month mobile per field of science and the total share of short term respectively >3 month mobile researchers. (n=7,131)
 - With '<3 month mobility' defined as international steps in the last ten years of R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers to work abroad for under 3 months.
 - With '>3 month mobility' defined as international steps in the last ten years of R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers to work abroad for 3 months or more.
 - Reading note: The share of <3 month mobile researchers in the Agricultural Sciences exceeds the total share of <3 month mobile researchers by 12 pp. The total share is 40.9% whereas the share in the Agricultural Sciences is 52.9%.

⁸² This is broadly (despite difference in scope and definition) consistent with the results of Cañibano et al. (2011) for Andalusian researchers, where the largest proportion of <3 month mobile researchers is found in the social sciences and humanities and the lowest clearly in science and technology of health.

At country level, it is noted that differences are not pronounced, with most countries around the 41% EU average. Yet several countries have over 50% of <3 month mobile researchers in the past ten years, with a number of East-European countries on top of the list: Hungary and Romania, followed by Iceland, Belgium, Denmark and Austria. Romania also has the lowest relative share of researchers who were only <3 month mobile more than ten years ago as compared to the share of researchers <3 month mobile in the last ten years. <3 month mobility thus appears to be a rather recent phenomenon in Romania.

At the other end of the spectrum, less than 50% of post-doctoral researchers in Poland, France and the United Kingdom have ever been <3 month mobile. This was also the case in Malta, Turkey and Cyprus but in these countries the <3 month mobility in the last ten years is closer to the EU27 level. In Czech Republic, Italy and Spain, a relatively large group was only <3 month mobile more than 10 years ago.

With respect to gender differences, it is observed that female researchers are less inclined to undergo <3 month international mobility during post-doctoral career stages during the last ten years than their male counterparts (37% versus 43%). Variations also occur across countries. Male researchers are more <3 month mobile in Romania, Finland (around 20 percentage points difference) and also in Sweden, Slovakia, Spain and the United Kingdom (more than 10 pp difference). On the other hand, female researchers are more frequently <3 month mobile than their male counterparts in Portugal, Norway, Malta, Croatia and Macedonia (FYROM) (more than 5 pp difference).

In terms of family status, there is no evidence of differences in <3 month mobility in the last ten years between single researchers and researchers in couple (41% both) and only a small difference occurs between researchers with or without children (40% versus 43%). In general, no clear evidence can be derived from the data to support the hypothesis that family status or gender would influence the <3 month mobility profile.

Virtually all <3 month mobile researchers (96%) have attended international conferences during their post-doctoral career. This corresponds to 40% of all researchers. 84% of the <3 month mobile have made short international visits (35% of all researchers) and 83% (35% of all researchers) have been to short international meetings in the last ten years. Comparing these shares per citizenship to check for potential language or other issues in interpreting the question produces no large differences, except for Bulgaria (overall lower than other citizenships), Germany (62% for visits) and Romania (48% for meetings).

5.2.8 To what extent are researchers intersectorally mobile?

5.2.8.1 During PhD

23% of these researchers indicated that they have been mobile to a sector outside academia, in or outside their country of PhD. Eastern and Southern European countries have relatively high levels of intersectoral mobility during doctoral research. The most frequent type of mobility is to the public or government sector (10% of all R1 and R2 researchers), followed by the private not-for-profit sector (9%) and private industry (4%).

5.2.8.2 Post PhD⁸³

30% of EU27 researcher population has been 'intersectorally' mobile (Table 20). Most have been active in the public or government sector (15% of all R2, R3 and R4 researchers). A smaller share has been active in the private, not-for-profit sector (7%) or in private industry (12%). Combining the private industry and private not-for-profit sector into one private destination sector (19%) yields results comparable to the MORE1 estimate of 17% of all EU27 researchers having been employed as a researcher in both the public and the private sector during their research career.

In the total EU27 sample, female researchers are slightly below their male counterparts (28% versus 31% of the male researchers).

There is no significant difference in intersectoral mobility in terms of long term international mobility profiles.

Comparing the destination sectors between fields of science shows that mobility to private industry is below average for the Natural Sciences and Engineering & Technology during the PhD, while it is substantially above during post-PhD mobility. The Medical and Agricultural Sciences researchers frequently go to the private not-for profit sector during their PhD, while their main destination sector in post-PhD stages is the public or government sector.

⁸³ With respect to post-PhD intersectoral mobility, the survey asked whether the respondent had ever worked as a researcher outside of the university/higher education sector (e.g. companies, NGOs, charities, non-university research institutes, governmental bodies/agencies). This question is concerned with determining the level of intersectoral mobility, regardless of whether it was international or not. However, as the sample focuses on researchers currently working in HEI in Europe, the share of researchers who have moved to the non-university sector and have not returned to EU academia up to now, is not included in the analysis.

Table 20: Intersectoral mobility per country and destination sector

	Intersectoral mobility	To public/ government sector	To private not- for-profit sector	To private industry
Austria	33%	16%	10%	12%
Belgium	29%	12%	8%	13%
Bulgaria	50%	32%	22%	16%
Switzerland	33%	14%	5%	15%
Cyprus	38%	13%	18%	16%
Czech Republic	37%	22%	8%	12%
Germany	33%	18%	8%	11%
Denmark	38%	25%	9%	13%
Estonia	28%	14%	6%	11%
Spain	28%	15%	6%	12%
Finland	30%	16%	4%	12%
France	17%	4%	3%	10%
Greece	42%	23%	13%	16%
Croatia	33%	19%	7%	14%
Hungary	44%	28%	14%	18%
Ireland	31%	12%	8%	16%
Iceland	49%	34%	6%	23%
Italy	24%	15%	9%	6%
Lithuania	42%	25%	14%	10%
Luxembourg	38%	18%	9%	15%
Latvia	45%	29%	12%	14%
Macedonia (FYROM)	47%	24%	23%	19%
Malta	34%	20%	12%	12%
Netherlands	38%	20%	12%	12%
Norway	32%	19%	8%	10%
Poland	40%	23%	8%	15%
Portugal	24%	12%	11%	6%
Romania	31%	17%	12%	11%
Sweden	30%	20%	3%	11%
Slovenia	37%	19%	10%	14%
Slovakia	28%	17%	9%	9%
Turkey	25%	18%	7%	5%
United Kingdom	30%	13%	6%	14%
EU27	30%	15%	7%	12%

Source: MORE2 Higher Education Survey (2012)

Note: - Percentage of researchers who have been intersectorally mobile (to one of the destination sectors). (n=1,999)

- With >3 month mobility during PhD only for R1 doctoral candidates and R2 (post-doctoral or equivalent) doctorate holders and post-PhD only for R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers.
- Multiple destination sectors per respondent are possible.

Interviews with HR managers

A very important and very robust result which can be derived from the explorative interviews with business representatives responsible for recruiting researchers is a clear relationship between experience and mobility. The older the university researchers are or, more precisely, the longer the researchers stay in the academic career path, the less often they switch to the private sector. The companies report that the recruitment of university researchers who had already worked for several years at the university only rarely occurs. This holds in particular for in those cases where the researchers still undertake research at their new work place. The interviewees could not name one case where a researcher holding a full professorship at the university switched to a company to work there 'at the bench'. Whenever professors or other experienced university researchers become mobile working in the non-academic sector, they become

members of the management board or found their own companies. Their new field of activity is then prevalently management and sometimes supervision of research, but not undertaking research themselves.

Most of the researchers recruited by companies are young graduates. However, there are differences across sectors and technology fields, but also across companies. In some industries or companies it is not even necessary to have a university degree to do research, in other industries a few years experience as a post-doc at the university are a precondition for working in industry research. The more similar the tasks in academic and non-academic research (for example working in a biotechnology laboratory), the most higher rated the value of academic work experience for companies. However, as we will discuss below, too much academic experience is not considered to be beneficial by industry. Moreover, companies value highly newly recruited researchers, as they have already gained some work experience in industry. On the other hand, the interviewed companies maintained that they usually do not headhunt researchers from competitors or other companies because this is too expensive. For this reason the interviewees were not aware of such a case. It might be expected that this occurs in cases where there exist only a few experts worldwide in a specialised technology field. Companies are, however, bound by their financial resources. Hence, we might expect that company size might play a role here.

It is important to verify that researchers decide to work in companies because they think that their skills might be better suited there than at a university. Interviewees highlighted the lack of career / job fairs for post-docs or more experienced researchers in Europe, which are needed in order to increase intersectoral mobility. While in the US it is common that more senior researchers attend these fairs (probably related to the more prevalent alumni culture), there only exist job fairs for graduates in Europe. Furthermore, programmes to foster partnerships between industry and academia (e.g. Industry-Academia Partnerships and Pathways – IAPP) have been stressed as being important to filter out reasonable chances for switching jobs across sectors.

5.3 Mobility and collaboration profiles

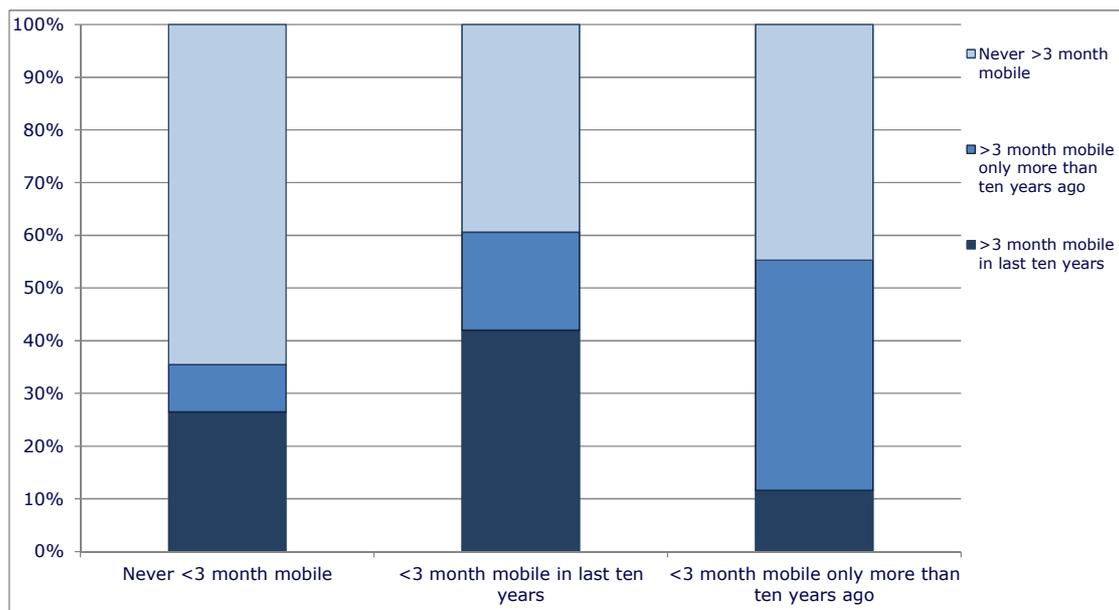
5.3.1 Is there a relation between different types of mobility (long, short, intersectoral, and virtual)?

5.3.1.1 <3 month and >3 month mobility

The shorter (<3 month) and longer (>3 month) term mobility profiles, defined according to the three parallel categories (mobile in last ten years, more than ten years ago, never), are strongly interrelated (Figure 36). 64% of researchers who have never been <3 month mobile have never been >3 month mobile either. Of those who were <3 month mobile only more than ten years ago, 42% were also >3 month mobile only more than ten years ago, and 45% have never been >3 month mobile. The one striking exception is that 27% of the researchers who were never <3 month mobile have been >3 month mobile in the last ten years.

Alternatively, the researchers who were >3 month mobile, both in the last ten years or before, are also more inclined to undertake <3 month mobility than the never-mobile (Figure 37).

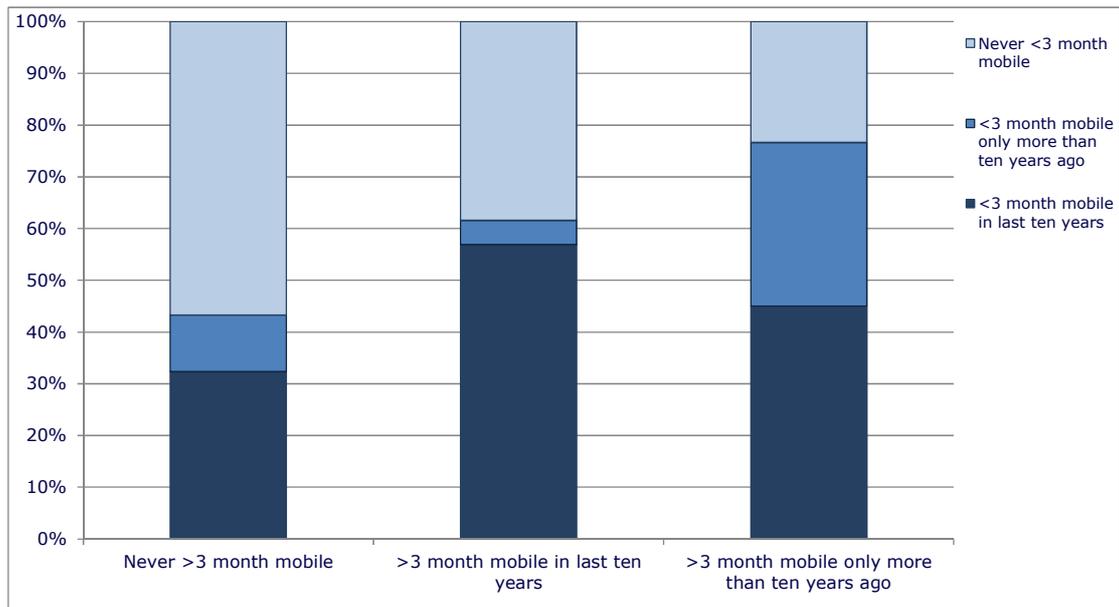
Figure 36: International >3 month mobility in post-PhD career stages per <3 month mobility profile (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: Distribution over >3 month mobility categories of R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers per <3 month mobility category. (n=7,131)

Figure 37: International <3 month mobility in post-PhD career stages per >3 month mobility profile (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: Distribution over <3 month mobility categories of R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers per >3 month mobility category. (n=7,131)

5.3.1.2 >3 month international post-PhD mobility - collaboration

For the researchers who were at least once >3 months internationally mobile in the last ten years, the effect of their overall mobility experience is higher than in general. This confirms the findings, based on the CDH 2009 data (OECD working paper on micro data, 2012), that international mobility during the last ten years has a positive effect on international collaboration.

5.3.1.3 Virtual mobility in the EU

Virtual mobility is increasingly conceived of as an additional tool in international research collaboration and new technologies enable researchers in many fields to collaborate with foreign researchers without it being necessary to travel.

59% of internationally collaborating researchers indicate that web-based or virtual technology influences their mobility behaviour, as compared to 35% who state that it does not influence their mobility at all. 50% of respondents reported that virtual technologies in international research collaboration (IRC) influenced their mobility behaviour and decisions, as it helped to reduce (or even replace) their short term visits (of less than 3 months). In contrast, only 9% think that it helps to reduce (or replace) their long term visits (3 months or more).

The more experienced the respondent, the more influence is attributed to virtual technologies. Furthermore, R1 researchers do not feel that their short term visits are reduced or replaced as a consequence of using virtual technologies as much as do researchers at a more senior career stage. While >3 month mobile researchers (who spent three months or more abroad in the last ten years) are more likely to take the view that virtual technologies do not influence mobility behaviour, short term mobile researchers (spent less than 3 months abroad in the last 10 years) are more likely to see virtual technologies as facilitators of short term visits. However, little evidence is found that virtual technology would affect researchers differently according to their long or <3 month mobility profile.

No major differences about perceptions of the role of virtual technology on mobility behaviour are identified based on the respondents' gender.

5.3.1.4 Virtual mobility outside the EU

The figures are slightly different for the EU researchers currently abroad. While the majority of the (non-representative) sample of EU researchers working abroad think that the use of web-based or virtual technology does not influence their mobility behaviour or decisions at all (52%), 41% indicate that it helps to reduce (or even replace) their short term visits (of less than 3 months), and only 4% indicate that it helps to reduce (or even replace) their long term visits (of more than 3 months).

6 MOBILITY FLOWS OF RESEARCHERS

Comparing across indicators of international mobility shows that main destination countries for EU researchers are the United States, the United Kingdom, Germany, France and Italy. Historical, cultural or linguistic links also strongly determine mobility flows. In post-PhD career stages, mobility is frequently originating from countries which are suffering badly under the current economic crisis (Greece, Italy, Spain) or from Eastern European countries.

Among the destination countries for PhD mobility, the preferred timing as to when researchers move there varies: we find evidence that moves to the United Kingdom and Ireland take place before PhD stage whereas moves to other countries like the Scandinavian countries, Germany, France or Italy attract researchers mainly during PhD stage. Similarly, outflow takes place before PhD stage in Eastern European countries.

6.1 Pull: destination

6.1.1 What are main destination countries for EU researchers (within and outside EU)?

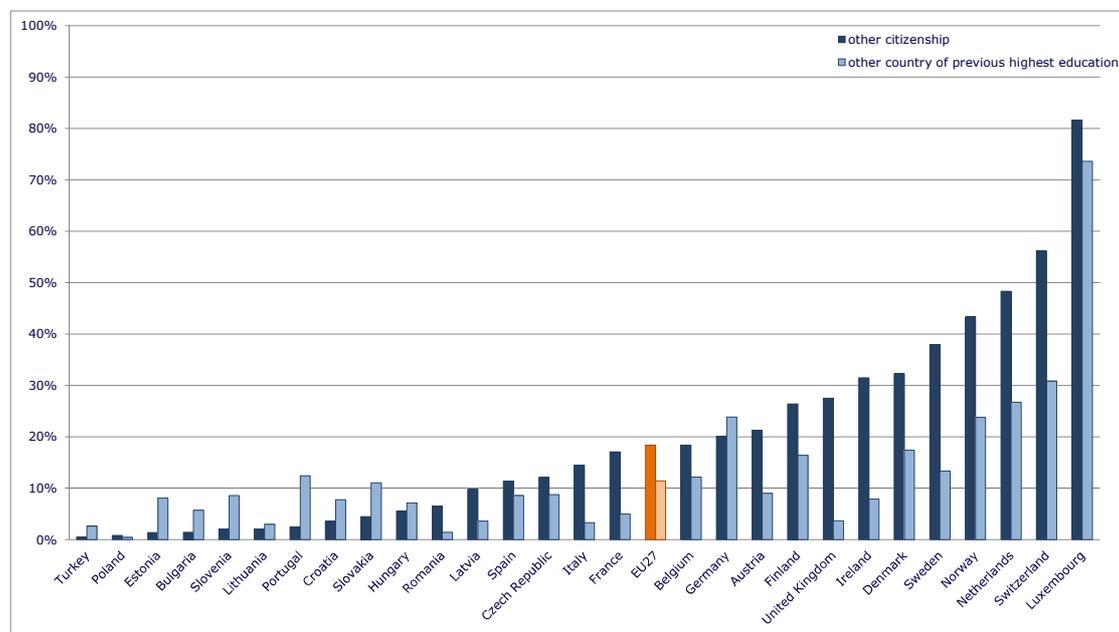
6.1.1.1 PhD degree mobility

The EU HEI survey data allow us to estimate what proportion of researchers did or will obtain their PhD in a specific country, while being citizens of (or having obtained their highest education in) another country.

As shown in Figure 38, small and open economies (Luxembourg, Switzerland, Austria, and Belgium), Scandinavian countries and Anglo-Saxon countries are the most common destinations to obtain a PhD for those with other citizenships. When comparing with moves to a country other than the country of their highest educational qualification, the most pronounced differences are found in the United Kingdom and Ireland. One interpretation is that mobility to these countries takes place before PhD stage, e.g. during the bachelor or masters phase. In this case, the country where the PhD was undertaken is the same as the country of the researcher's previous education, but they are still counted as 'foreign' citizens.

Even though there are differences in the proportions and subsequent ranking of countries, and even if the IISER indicator includes not only degree mobility but mobility during PhD, findings with respect to receiving countries are generally in line with Eurostat Education statistics (as processed in the MORE1 IISER update). There too, the United Kingdom, Austria, Belgium, and to a lesser extent Denmark and Sweden, rank high for this type of indicator (Percentage of doctoral candidates (ISCED 6) with the citizenship of another EU27 Member State in the reporting country in the EU27).

Figure 38: International PhD degree mobility of R1 and R2 researchers per country of PhD (destination)



Source: MORE2 Higher Education Survey (2012)

- Note:
- Share of PhD degree mobile researchers in current R1 (doctoral or equivalent) and R2 (post-doctoral or equivalent) career stages per country of PhD (n=3,892).
 - With 'PhD degree mobility with respect to citizenship' defined as undertaking the PhD in a country other than that of citizenship
 - And 'PhD degree mobility with respect to previous 'highest education' defined as having another country of PhD than the country of previous highest education
 - Countries with less than 30 observations are omitted: Cyprus, Greece, Iceland, Macedonia (FYROM) and Malta.

6.1.1.2 Mobility during PhD (>3 months)

66% of destination countries for >3 month mobility during PhD – departing from EU27 – are within the EU27. Yet, at country level, the United States is the most important destination (16%). The most significant destinations are the US and UK, followed by Germany, France and Italy.

Of the 121 researchers moving for 3 months or more to the United States during their PhD, around 1 in 8 came from Denmark, the Netherlands or Spain. 6 to 7% came from Belgium, France, Italy, Portugal and Sweden. In the case of moves to the United Kingdom, the main departure countries for PhD are Denmark, Italy and Spain. 6% came from studying a PhD in Ireland and Portugal.

When interpreting these data it is important to note that, given the nature of the survey, it presents only a partial picture of EU doctoral candidates going abroad during their PhD, as it only includes those who currently work as a researcher in the EU. For example, doctoral candidates who left to do their PhD training in the US and did not return are not included in the data.

6.1.1.3 Mobility in post-PhD career stages (>3 months)

The main destination country of EU27 researchers who have been mobile in the last ten years of their post-doctoral career is the United States. The countries which follow are mainly European, with the United Kingdom, Germany and France ranking the highest. The first non-EU country after the USA is Canada, in 9th place.

Table 21: Main destination countries for >3 month post-PhD mobility (EU27 citizens)

	Share (%)	Cumulative share (%)	Origin1 (citizenship)	Origin2	Origin3
United States	18%	18%	Greece (11%)	Italy (11%)	Germany (10%)
United Kingdom	11%	29%	Greece (13%)	Italy (11%)	Spain (11%)
Germany	11%	40%	Germany (20%)	Austria (9%)	Italy (7%)
France	8%	47%	Romania (17%)	Italy (10%)	Greece (9%)
Italy	4%	51%	Italy (14%)	Slovenia (13%)	Bulgaria (11%)
Switzerland	4%	55%	Germany (36%)	France (11%)	Italy (9%)
Netherlands	4%	59%	Germany (14%)	Greece (10%)	Belgium (10%)
Austria	3%	62%	Germany (31%)	Slovenia (13%)	Austria (11%)
Canada	3%	65%	Spain (13%)	Austria (9%)	France (9%)
Spain	3%	68%	Spain (17%)	Italy (10%)	Greece (9%)
Belgium	3%	71%	Greece (13%)	Germany (12%)	Italy (10%)
Sweden	2%	73%	Estonia (17%)	Germany (13%)	Spain (9%)
Denmark	2%	75%	Germany (19%)	Denmark (16%)	UK (8%)
Ireland	2%	77%	Ireland (27%)	UK (21%)	Italy (13%)
Norway	2%	79%	Germany (26%)	Lithuania (13%)	Denmark (11%)

Source: MORE2 Higher Education Survey (2012)

Reading note: Of the total number of EU researchers who were mobile to the US for more than three months during post-doctoral career stages and subsequently returned to the EU and currently work as researcher in the EU: 11% are Greek, 11% are Italian and 10% are German citizens.

For many destinations, most EU27 researchers are from Greek, Italian, Spanish and German countries (citizenship). Given the structure of the survey, this only includes moves by researchers currently working in the EU.

The flows are also interesting to interpret:

- The United Kingdom appears to be an important destination for all regions in Europe.
- Germany, on the other hand, receives mainly East-European and Spanish researchers. The data also include researchers returning to their country of origin: for Germany 20% of the incoming researchers are German citizens.
- France is also an important destination for East-European and Spanish researchers, but also to those from Germany and the Benelux.
- German and Baltic researchers form the most important flows to northern Europe.
- Important flows also go from Germany to Switzerland and Austria and in the case of Austria, also back again.
- Finally, there is also an exchange between the United Kingdom and Ireland. Moreover, 27% of the incoming researchers in Ireland are Irish citizens.
- After the German and Irish, Spanish and Italian citizens often return to their country of origin (17% and 14% of the incoming researchers respectively).

These observations are in line with and confirm the three main findings on destination countries, based on the CDH 2009 data (OECD, 2012) which indicate that:

- Europe (as a whole) is the main destination region but that the United States is systematically among the three first destination countries;
- the three largest European countries (France, Germany and the United Kingdom) appear among the favourite destinations;
- in addition to those countries which have strong historical, cultural or linguistic links with the reporting country.

6.2 Push: departure/origin

6.2.1 Which EU citizens are more inclined to become mobile researchers?

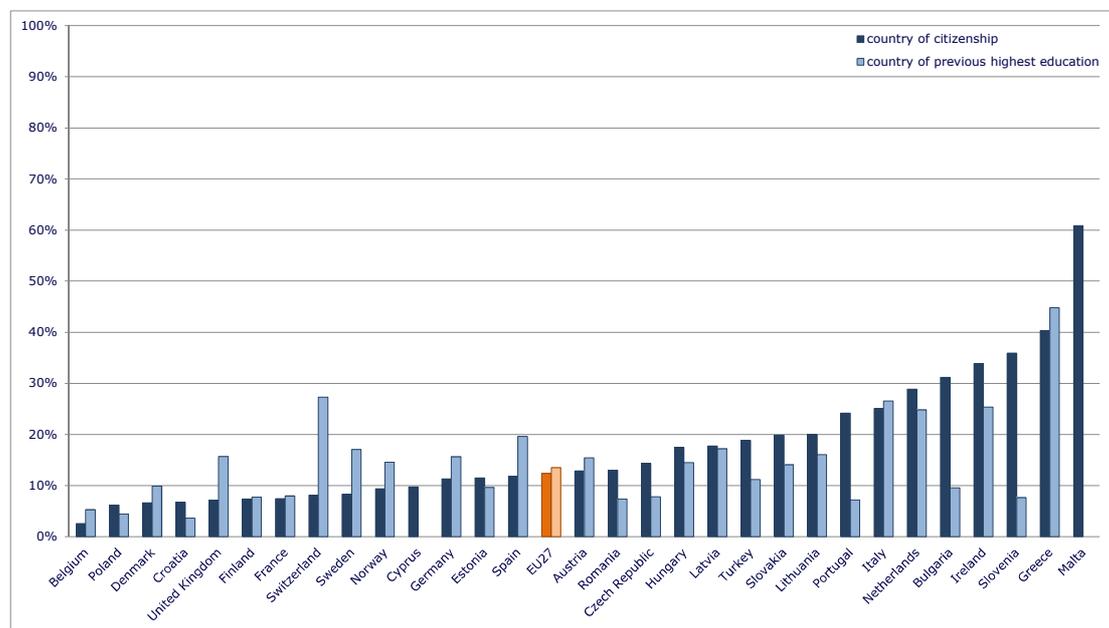
6.2.1.1 PhD degree mobility

12% of EU27 citizens indicate that they are PhD degree mobile (did or will obtain their PhD in a country other than the country of their citizenship). Figure 39 shows that citizens from Malta, Greece, Slovenia, Ireland and Bulgaria are most PhD degree mobile (30% or more). Belgium, Poland, Denmark, Croatia, the United Kingdom and France have 7% or less PhD degree mobile citizens.

13% of those who obtained their highest previous degree in one country are PhD mobile. After completing their undergraduate studies (e.g., such as a bachelors or masters degree), researchers in Greece, Switzerland, Italy, Ireland and the Netherlands are more likely (20% or more) to move to another country to obtain a PhD. This share is lowest in a number of East European countries, Belgium, Portugal, Finland and France (8% or less).

When comparing both the analysis at the level of citizenship and highest education, one can observe that in Eastern Europe, researchers who are citizens of the country are more likely to be PhD degree mobile than the researchers obtaining their highest education there. Outflow thus happens before the highest educational phase. The opposite is true of the United Kingdom, Nordic countries and particularly Switzerland. For example, in the United Kingdom, 16% of researchers obtaining their highest education there are PhD degree mobile, while only 7% of citizens are.

Figure 39: International PhD degree mobility of R1 and R2 researchers per country of citizenship and previous highest education (departure)



Source: MORE2 Higher Education Survey (2012)

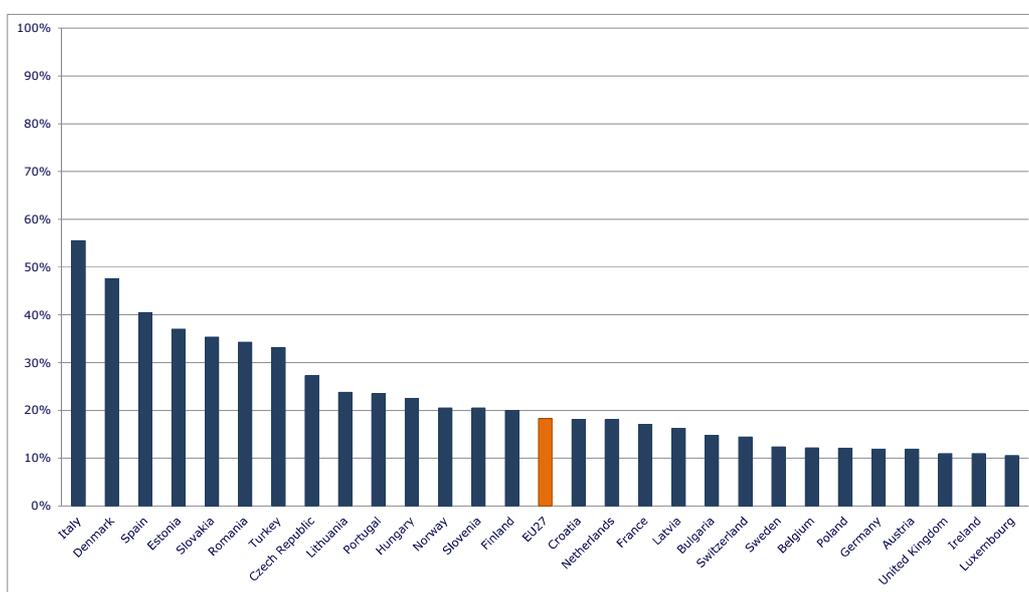
- Note:
- Share of PhD degree mobile researchers in current R1 (doctoral or equivalent) and R2 (post-doctoral or equivalent) career stages per country of PhD (n=3,892).
 - With 'PhD degree mobility' defined as obtaining or having obtained a PhD in a country other than the one in which they obtained their previous degree.
 - Countries with less than 30 observations are omitted: Iceland, Luxembourg and Macedonia (FYROM) for both and Cyprus and Malta also for country of highest previous education.

6.2.1.2 Mobility during PhD

Around 18% of doctoral candidates and recent doctorate holders move for a limited period (3 months or more) to another country during their PhD.

Comparison over countries shows that shares of >3 month mobility during a PhD ranges from just over 10% in Luxembourg to more than 55% in Italy (Figure 40). No clear geographical pattern is observed, except that 10 out of EU15 countries are below the EU27 average. After Italy, only Denmark and Spain have a PhD mobility rate higher than 40%. Furthermore, Estonia, Slovakia, Romania and Turkey all have a PhD mobility rate of higher than 30%. Low rates are observed in Luxembourg, Ireland, United Kingdom, Austria, Germany, Poland, Belgium and Sweden (all 11-12%), which are in some cases countries with high levels of PhD degree mobility (Luxembourg, Ireland, Sweden) or are popular destinations for PhD mobility (United Kingdom, Germany).

Figure 40: International mobility for a limited period during PhD of R1-R2 researchers per country of PhD



Source: MORE2 Higher Education Survey (2012)

- Note:
- Share of researchers >3 month mobile during PhD and in current R1 (doctoral or equivalent) and R2 (post-doctoral or equivalent) career stages per country of PhD. (n=3,892)
 - 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, Greece, Iceland, Macedonia (FYROM) and Malta.

6.2.1.3 Mobility in post-PhD career stages (>3 months)

When analysing the countries of departure (defined as country of citizenship in the maps below), countries which are suffering badly under the current economic crisis stand out. 7% of all moves are by Greek citizens, another 7% by Italians and 6% by Spanish researchers. Eastern European countries such as Slovenia, Romania, Hungary, Bulgaria and Poland are around 2-3%. It is also worth noting that German citizens are highly mobile (11%).

6.3 Extra-EU flows

6.3.1 What are the main EU destinations for the (non-representative) sample of non-EU researchers?

About 21% of non-EU researcher EU mobility goes to Germany. France and the UK each represent 16%. EU-12 countries are generally less a destination country for mobility originating outside the EU.

The US is an important country of origin for mobility in the extra-EU survey sample: 54% of the inwards EU mobility occurs from the US. Another large region from which mobility towards the EU takes place is Eastern Europe (e.g. Ukraine and Croatia). Russian, Indian, Turkish and Australian researchers also take a fraction of EU mobility for their account in the sample.

6.3.2 What are the main non-EU destinations for the (non-representative) sample of EU researchers currently abroad?

About 60% of the non-EU mobility of the sample of EU researchers abroad takes place towards the US and Canada. Australia also accounts for a large share of extra-EU mobility. In Asia, the most popular destinations are China, Japan and Singapore.

Extra-EU mobility originates more frequently from West and Southern European countries than from Central and Eastern European countries. Specifically, the sample of German researchers takes up a large share of the extra-EU mobility.

6.3.3 What are the main non-EU destinations of the (non-representative) sample of mobile researchers who have never been to the EU?

Here again we observe that the US is a popular destination country for mobility; about 32% of mobility occurs towards the US. Australia and Canada account for respectively 9% and 6% of these moves. Asia also takes up a share of the non-EU mobility but this is mainly for US researchers and, to a lesser degree, Australia.

The US is generally the largest departure country for non-EU mobility. Mobility towards Africa and South-America (although limited) and Australia also originates most frequently from the US.

7 MOTIVES FOR INTERNATIONAL MOBILITY

Career progression is most frequently identified as being an important motive for international mobility, followed by access to leading experts, facilities and equipment, available funds and positions. Social and job security are less important. There is a similar emphasis on research and career-related motives in both PhD degree mobility and post-PhD mobility.

When the move includes a change of employer, the availability of positions becomes more important, working with leading experts less so.

An important factor determining the motivations for international mobility is the career stage of the researcher. The importance attached to varying motives during different career stages reveals changing priorities. R2 and R3 researchers primarily seek availability of funds and positions to increase job security. For R2 researchers, career progression and remuneration are also important motives for post-PhD mobility.

Family status and gender have only limited effects on the motivations for mobility. A researcher who has been mobile does not consider personal or family reasons an important barrier. However, those who have not been mobile do so.

Motivations differ depending on the origin of the researchers. Non-EU researchers tend to give more value to working with leading experts and personal/family reasons than mobile EU researchers who, in turn, tend to value remuneration more than non-EU researchers.

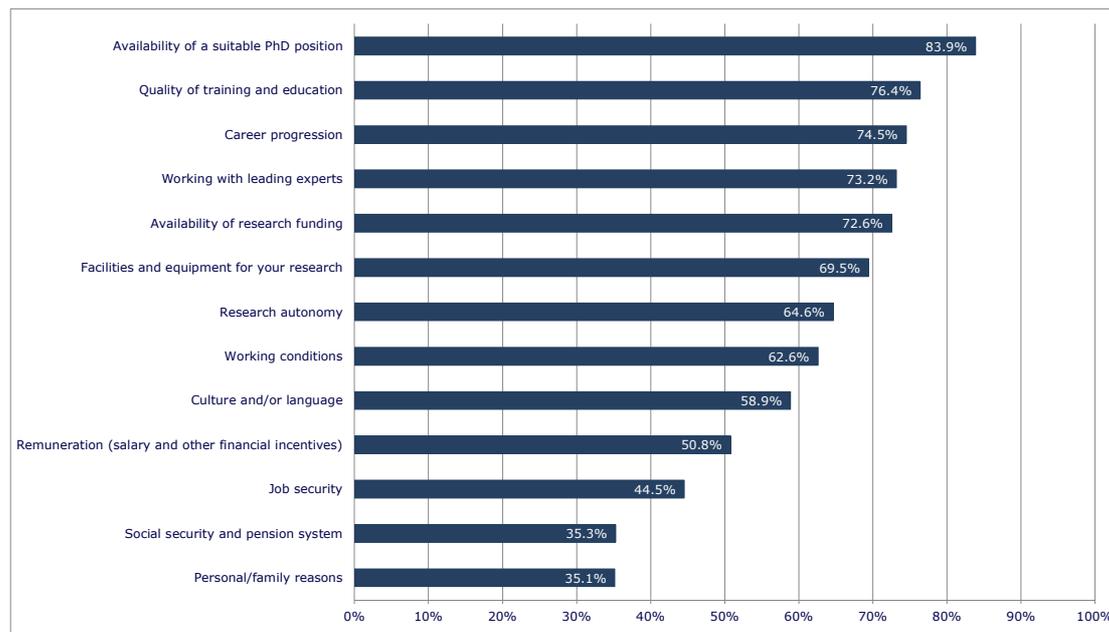
7.1 Motives

7.1.1 What are the main motives for international mobility?

7.1.1.1 PhD degree mobility

For PhD degree mobility, virtually all the intrinsic motives are deemed important, particularly the availability of a PhD position (84% of the R1 and R2 researchers find this important); quality of training and education (76%); and career progression (75%).

Figure 41: Importance of motives for international PhD degree mobility (EU27)



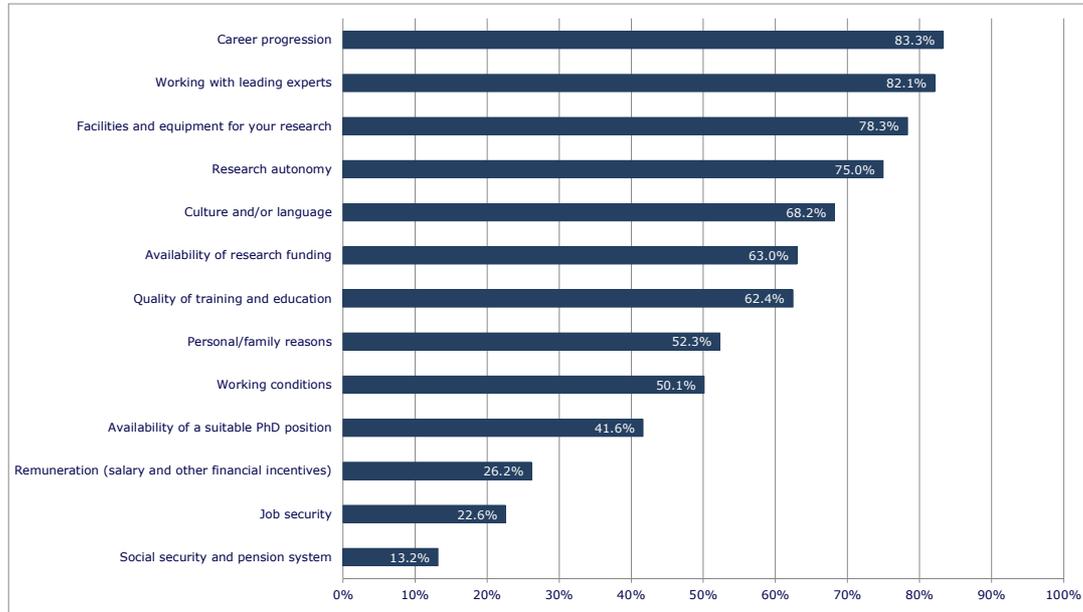
Source: MORE2 Higher Education Survey (2012)

Note: - Share of PhD degree mobile researchers in current R1 (doctoral or equivalent) and R2 (post-doctoral or equivalent) career stages who feel the reason important (versus not important) for their PhD degree mobility (n=653).
 - With 'PhD degree mobility' defined as obtaining or having obtained a PhD in another country.

7.1.1.2 Mobility during PhD (>3 months)

Mobility during PhD training is also largely motivated by intrinsic factors such as career progression (83%); working with leading experts (82%); and facilities and equipment (78%). Employment-related motives are by definition less important for this type of move.

Figure 42: Importance of motives for >3 month international mobility during PhD (EU27)



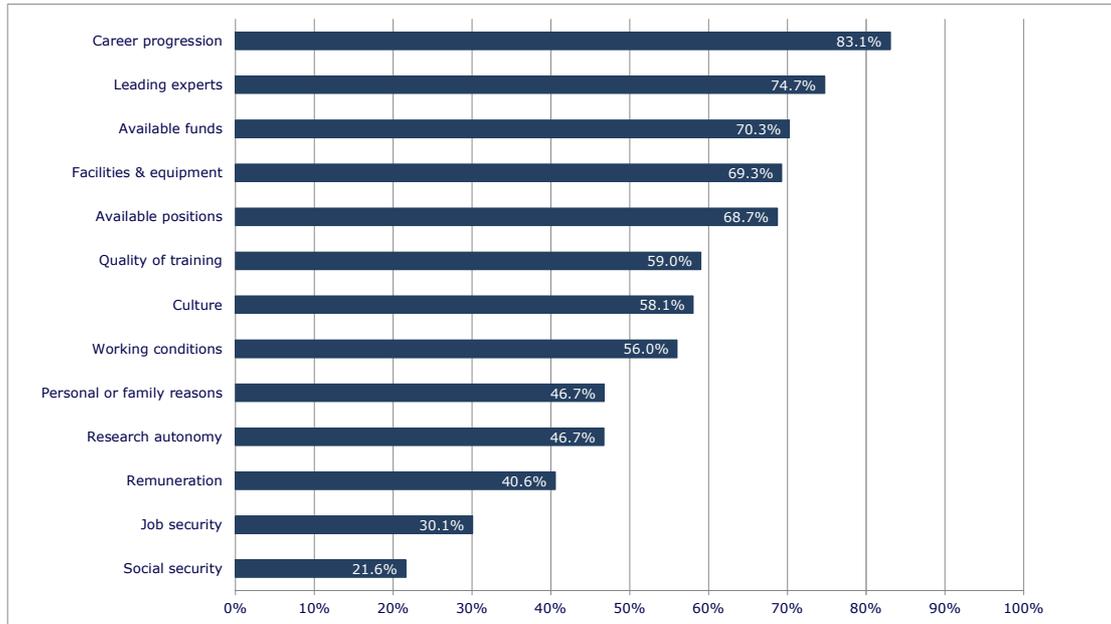
Source: MORE2 Higher Education Survey (2012)

Note: - Share of researchers who have been mobile during their PhD in current R1 (doctoral or equivalent) and R2 (post-doctoral or equivalent) career stages that find the motive important (versus not important) for their >3 month mobility during PhD (n=552).
 - With '>3 month mobility during PhD' defined as moving to another country than the country of PhD for three months or more.

7.1.1.3 Mobility in post-PhD career stages (>3 months) to EU destination

For post-PhD career mobility, the patterns of motives reflect those for PhD degree mobility. For their most recent EU move, researchers most frequently cite career progression as being an important motive (83%); followed by working with leading experts (75%); available funds (70%); facilities & equipment (69%) and positions (69%).

Figure 43: Importance of motives for the last >3 month EU move of the respondent in post-PhD career (EU27)



Source: MORE2 Higher Education Survey (2012)

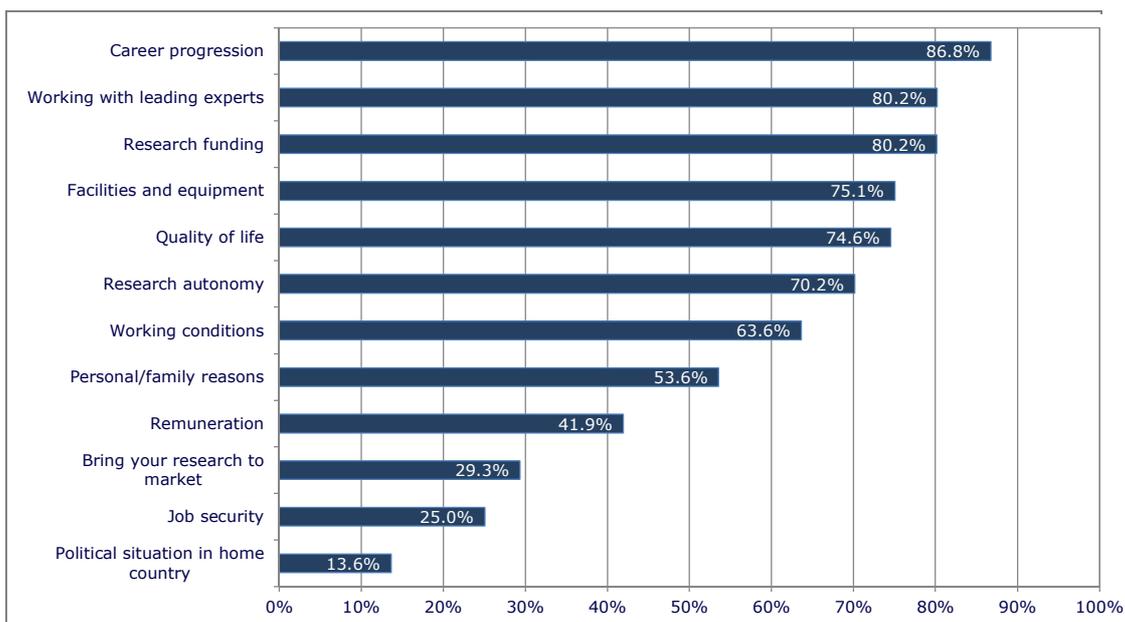
Note: Share of researchers who have been >3 month mobile in the EU in post-PhD career that find the motive important (versus not important) for their most recent EU move (n=1,002).

7.1.2 What are the main motives for mobility to the EU by non-EU researchers?

87% of the (non-representative) sample of non-EU researchers indicates that career progression is an important motive for mobility towards the EU, closely followed by the option to work with experts and the availability of research funding. The extrinsic factors such as remuneration (42%) and job security (25%), are considered less important for mobility.

Due to the low number of responses for most countries, we can only compare the differences in motives between Australia, Brazil, Russia, Turkey and the US (n>30). Career progression is, for Australian, Brazilian, Russian, Turkish and US researchers, the most important motive to move to the EU, although for the US, the importance of this motive was slightly lower (81%) (versus 89-96%) than for the other countries. The option to work with experts is indicated as being an important motive for EU mobility by 96% of the Russian researchers but only for 74% of the US researchers. Obtaining research funding appears to be more frequently a motive for EU mobility for Russian (97%) and Turkish (93%) researchers than for Australians (79%), US (75%) and Brazilians (78%). The political situation at home is generally ranked as the least important motive for EU mobility. Comparing the different countries shows that the political situation was still an important motive for 25% of the Brazilians, 30% of the Russians and 32% of the Turkish researchers, although only for 4% of the US and 6% of the Australian researchers.

Figure 44: Motives for mobility of non-EU researchers



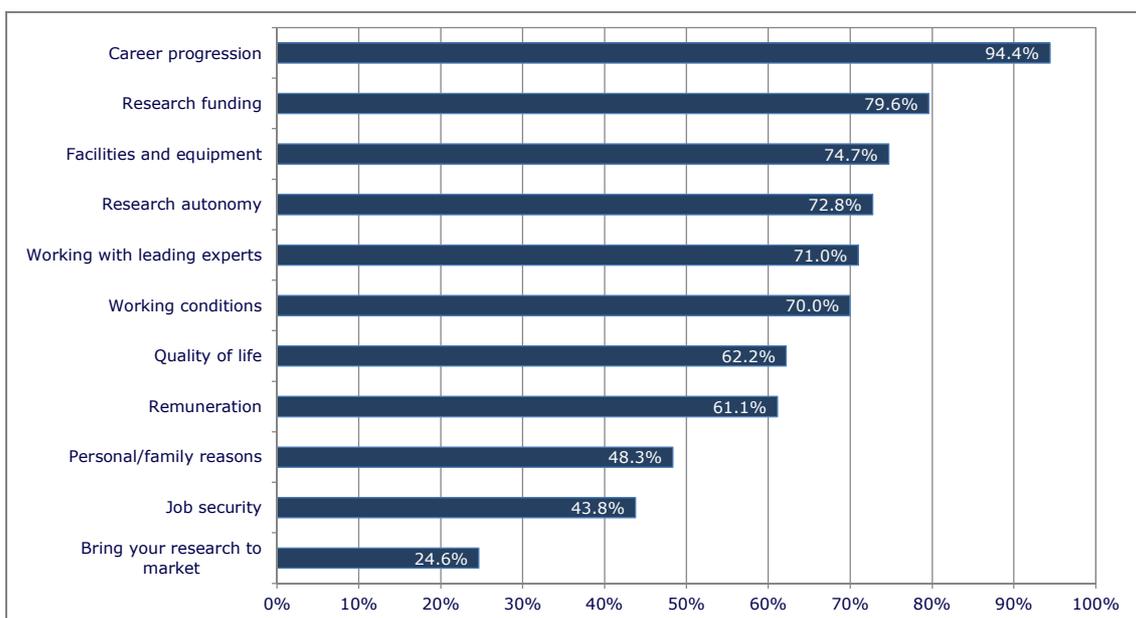
Source: MORE2 Extra-EU Mobility Survey (2012)

Note: Share of non-EU researcher who have been to the EU that find certain motives important (versus not important) for their most recent EU move (n=738).

7.1.3 What are the main motives for mobility to non-EU countries by EU researchers?

94% of the (non-representative) sample of EU researchers indicates that career progression is an important motive for mobility outside the EU. The other intrinsic motives such as the availability of facilities and equipment (75%), research autonomy (72%) and working with lead experts (71%) are also ranked highly. The extrinsic factors are considered less important for mobility outside the EU, with the exception of the availability of researcher funding, which 80% of the researchers indicate to be important. In contrast with the high share of EU researchers who consider career progression important, we find the low share of EU researchers who indicate job security and the option to bring research to the market as important motives for mobility.

Figure 45: Motives of EU researchers for moving abroad



Source: MORE2 Extra-EU Mobility Survey (2012)

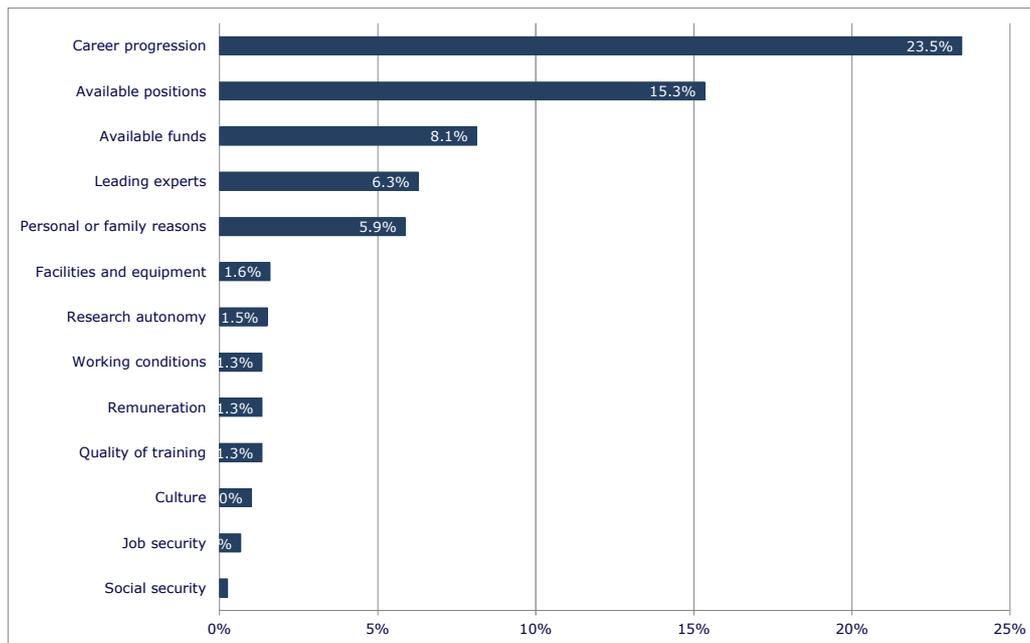
Note: Share of EU researcher currently mobile outside the EU that find certain motives important (versus not important) for their most recent non-EU move (n=625)

As the number of respondents only exceeds 30 for France, Germany, Austria, the Netherlands, Italy and the UK, we will only compare the motives for mobility for the researchers originating from these countries. Career progression is the main motive for mobility for EU researchers from these countries. When looking at the option to obtain research funding, this appears to be less important for researchers from the Netherlands (62%) than for Italian (94%), Austrian (87%), French (87%), German (78%), and UK researchers (74%). The availability of facilities and equipment for Dutch researchers is also less frequently a reason for mobility outside the EU (56%) than for Italian (78%), Austrian (77%), French (76%), German (76%), and UK researchers (70%). Job security is generally ranked quite low as a motive for non-EU mobility (44%) but 61% of the UK researchers indicated that it was an important motive for their mobility outside the EU.

7.1.4 What main differences are observed when mobility includes a change in employer?

Figure 46 shows that working with leading experts (6% versus 11%) is seen less as a main reason for an international move of more than 3 months with a change in employer than without a change of employer. Availability of positions, on the other hand, becomes more important (15% versus 8%). Interestingly, job security or social security are regarded equally as being of minimal importance.

Figure 46: Distribution of individual post-PhD career mobility steps over motives mentioned as main motive for this specific step (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: - Share of individual post-PhD career mobility steps with a change of employer for which the motive is indicated as main motive (n=1,193).

- Only for R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers.

7.2 Factors determining motives

7.2.1 How do different dimensions (gender, family status, career stage, field of science) affect researchers' motives for mobility?

7.2.1.1 PhD degree mobility

When asked about the reasons for PhD degree mobility, the post-doctoral researchers (R2) attach more value to intrinsic motives such as research autonomy, leading experts and quality of training and education, in addition to culture and language. This may be a reflection on their past experience, which differs to their original reason for PhD degree mobility. For the current doctoral candidates, most other reasons are more important, and the differences are most strikingly visible in terms of extrinsic motives such as available positions, remuneration, job security and social security and the pension system. This could imply that job security is becoming more of an issue now than previously, or that priorities change after researchers move to the post-PhD stage.

7.2.1.2 Mobility during PhD (>3 months)

For a move of over 3 months during PhD, the R1 type of researcher attaches relatively more value to PhD position, social security, research funding, quality of training and education and remuneration. For the R2 type of researcher, personal/family reasons, research autonomy, and access to leading experts are more important. Although both groups were asked for their motives for mobility during their PhD, these differences may point to the different current career stages: those in the post-doctoral career stage are more interested in developing their own research area, where some research autonomy and contact with leading researchers is quite important.

7.2.1.3 Mobility in post-PhD career stages (>3 months) to EU destination

In terms of mobility in post-PhD career stages to EU destinations, the importance attached to varying motives during different career stages also reveals changing priorities. R4 researchers tend to have confidence in their research and position and find research autonomy, personal or family reasons and quality of training and culture more important than the average researcher. R2 and R3 researchers primarily seek availability of funds and positions to increase job security. For R2 researchers, career progression and remuneration are also important motives for post-PhD mobility.

Women consider most of the motivational aspects to be more important than do men. Women are more motivated by available funds (10 pp difference between female and male researchers); career progression (+9pp); culture (+7pp) and available positions (+6pp). This pattern follows that of the R3 and particularly R2 researchers, as female researchers are more highly represented in earlier career stages.

The family status of the researcher does not seem to determine motives for mobility much, although researchers living in a couple attach more importance to all aspects, with the exception of career progression. It might well be that the age factor plays a role here. The variable with or without children does not really matter. Yet on the other hand, among the non-mobile researchers personal and family reasons are an important barrier to mobility (cf. *infra*).

7.2.1.4 Employer mobility

Across career stages, similar patterns in main motives for employer mobility exist. Only the availability of positions and research funding become less important for R4 researchers (5% versus 9% in R3 and 10% in R2 for funding and 11% versus

14% and 23% for positions). Personal and family reasons are less important for R2 researchers (2% versus 8% in R3 and 6% in R4).

Across genders and family status, the motives are also very similar. The only observations we can make here are that researchers who live in a couple and researchers without children are more likely to move for reasons of career progression than others; and that researchers without children are also more likely to move for reasons of finding a suitable position.

7.2.2 To what extent does country of origin/destination influence the mobility decision?

Non-EU researchers tend to give more value to working with leading experts (80%) and personal/family reasons (54%) than do mobile EU researchers (71% and 48% respectively) who, in turn, tend to value remuneration (61%) relatively more highly than non-EU researchers (42%).

Job security is relatively more important for EU researchers currently mobile abroad (44%) and for non-EU researchers mobile towards non-EU countries (40%) than for the non-EU researchers who had been to the EU in the past (25%). Bringing one's research to the market appears to be more important for non-EU researchers who were mobile towards non-EU countries (40%) than for the other non-EU researchers who had been mobile to the EU (29%) and the EU researchers mobile abroad (25%).

Also important to mention is that Southern European countries which have been severely struck by the economic crisis appear as the more important departure countries. This therefore points to the important 'push' factor of the economic situation of a country and, by extension, the availability of research positions.

7.2.2.1 Employer mobility

When comparing motives per citizenship of the researchers as a proxy of origin, we find that intrinsic motives are most frequently mentioned by Swiss, Finish and Belgian citizens, whereas extrinsic motives are noted by French, Dutch and Italian citizens. Personal reasons also play a dominant role for more than 20% of researchers with citizenship in Ireland, Spain, the United Kingdom or Cyprus.

Conversely, when looking at the country of destination, moving to the United Kingdom, the Netherlands or Austria is driven more by intrinsic motives than other moves (more than 75%). Extrinsic motives play a role in moving to Norway, Belgium and Greece (more than 30%) and personal reasons are more commonly mentioned for moves to Greece and Cyprus (more than 20%).

7.2.2.2 European researchers currently mobile outside the EU

As discussed earlier, career progression is the most important motive for EU researchers from Austria, France, Germany, Italy, the Netherlands and the United Kingdom working outside the EU. For researchers from these countries, the second most important motive is research funding, except for Dutch researchers who give more value to research autonomy (69%), and researchers from the UK who give more value to quality of life (80%). To Austrian and German, the third most important reason to move outside the EU is working with experts (78% and 74% respectively); for the French it is research autonomy (81%); for Italians it is access to facilities and equipment; and for Dutch and UK researchers the most important motive is access to research funding. To bring one's research to market is the least important motive for Europeans moving outside of the EU, and Job security is generally ranked quite low as a motive for all, except for those from the UK.

Figure 47: Motives of EU researchers for moving abroad by citizenship

	Austria	France	Germany	Italy	Netherlands	United Kingdom	Total
Research funding	87.1%	87.2%	78.1%	94.2%	62.5%	73.7%	79.6%
Career progression	87.5%	97.8%	96.9%	98.2%	90.9%	89.8%	94.4%
Facilities and equipment	77.4%	75.6%	75.7%	78.2%	56.3%	69.9%	74.7%
Working with experts	78.1%	76.1%	74.2%	74.5%	57.6%	58.1%	71.0%
Research autonomy	66.7%	80.9%	72.2%	77.4%	68.8%	70.5%	72.8%
Bring your research to market	10.7%	30.2%	25.1%	23.4%	17.9%	16.9%	24.6%
Personal/family reasons	32.1%	57.8%	43.3%	45.8%	45.2%	68.5%	48.3%
Quality of life	60.0%	65.2%	58.7%	55.8%	53.3%	80.4%	62.2%
Remuneration	50.0%	68.9%	52.6%	78.2%	56.7%	61.3%	61.1%
Job security	37.0%	47.5%	41.5%	32.7%	20.0%	61.3%	43.8%
Working conditions	76.7%	77.8%	71.6%	72.2%	56.7%	68.1%	70.0%
N =	32	47	228	55	33	98	625

Source: MORE2 Extra-EU Mobility Survey (2012)

Note: Only countries with more than 30 responses were considered.

7.2.2.3 Non-EU researchers outside the EU with previous experience in the EU

As discussed earlier, career progression is the most important motive to move to the EU for Australian, Brazilian, and US researchers. By contrast, this is not the case for Russians, who give more value to accessing research funding (97%); working with leading experts (97%); and having access to facilities and equipment (93%), and for Turkish researchers, who give more value to having access to facilities and equipment (98%). The option to bring one’s research to market is more important for Turkish (69%) than for the others, and remarkably, is less important for US and Australian researchers than for the rest. While remuneration is important for Russian and Turkish researchers, it is less important for USA and Australian researchers. The political situation at home is generally ranked as the least important motive for EU mobility.

Figure 48: Motives for EU mobility of non-EU researchers by citizenship

	Australia	Brazil	Russia	Turkey	United States	Total
Research funding	78.9%	78.4%	96.7%	92.5%	75.3%	80.2%
Career progression	89.3%	94.7%	89.7%	95.0%	82.0%	86.8%
Facilities and equipment	73.7%	71.1%	93.1%	97.6%	70.5%	75.1%
Working with leading experts	85.0%	86.8%	96.7%	85.4%	74.3%	80.2%
Research autonomy	64.8%	69.4%	67.9%	79.5%	71.0%	70.2%
Bring your research to market	28.8%	39.4%	50.0%	69.2%	18.1%	29.3%
Personal/family reasons	45.1%	47.1%	42.9%	45.0%	58.6%	53.6%
Quality of life	60.0%	67.6%	76.7%	65.9%	78.4%	74.6%
Remuneration	36.0%	48.6%	71.4%	64.3%	32.3%	41.9%
Job security	27.1%	28.1%	44.4%	57.5%	14.4%	25.0%
Working conditions	50.9%	70.3%	86.7%	85.7%	58.3%	63.6%
Political situation in home country	6.7%	25.0%	29.6%	32.5%	4.6%	13.6%

Source: MORE2 Extra-EU mobility survey (2012)

Note: Only countries with more than 30 responses were considered.

7.2.2.4 Non-EU researchers outside the EU with no previous experience in the EU

Comparing the responses of researchers from the US with the total responses of non-EU researchers who had never been to the EU but who had been mobile to non-EU countries, showed that only research autonomy and the possibility to bring research to the market were slightly more important motives for mobility for US researchers moving towards Japan, China, India, Singapore, Russia, South Africa and Brazil. Working with experts, remuneration, job security and the political situation at home were less important motives for mobility.

Figure 49: Motives for mobile non-EU researchers who have never been to the EU for mobility towards non-EU countries by citizenship

	US citizenship	non-US citizenship	Total
Research funding	75.8%	80.3%	79.3%
Career progression	88.2%	92.6%	91.7%
Facilities and equipment	72.7%	81.7%	79.7%
Working with experts	61.3%	89.2%	83.4%
Research autonomy	90.6%	78.3%	81.0%
Bring your research to market	44.4%	37.5%	38.9%
Personal/family reasons	63.3%	65.5%	65.1%
Quality of life	67.7%	74.8%	73.3%
Remuneration	34.5%	59.5%	54.3%
Job security	25.9%	43.4%	39.7%
Working conditions	48.4%	75.9%	70.1%
Political situation in home country	7.7%	25.3%	21.6%
N =	34	122	156

Source: MORE2 Extra-EU mobility survey (2012)

Note: Only the USA was considered as it is the only country in this group with more than 30 responses.

8 BARRIERS TO INTERNATIONAL MOBILITY

It appears that barriers are ranked very similarly for mobility during the PhD or during post-PhD career stages. Obtaining funding for the move/research is the most frequently cited barrier for both PhD mobility (by the non-mobile) and post-PhD mobility (by the mobile and the non-mobile).

Larger differences are observed between barriers experienced during mobility: (mobile) versus barriers preventing mobility (non-mobile). Personal and family reasons are particularly important as barriers for the non-mobile in post-PhD career stages. This barrier is higher for non-mobile researchers with children than for those without children.

Women perceive more barriers to their last move in all areas than their male counterparts. The female non-mobile researchers specifically indicate funding issues as being more important in preventing mobility.

Perceived barriers are also determined by the career stage of the researcher: R3 researchers do not seem to experience many barriers, particularly when compared to those at lower career stages.

Main barriers to mobility to the EU by non-EU researchers include language, obtaining a visa or work permit and finding adequate accommodation.

8.1 Barriers

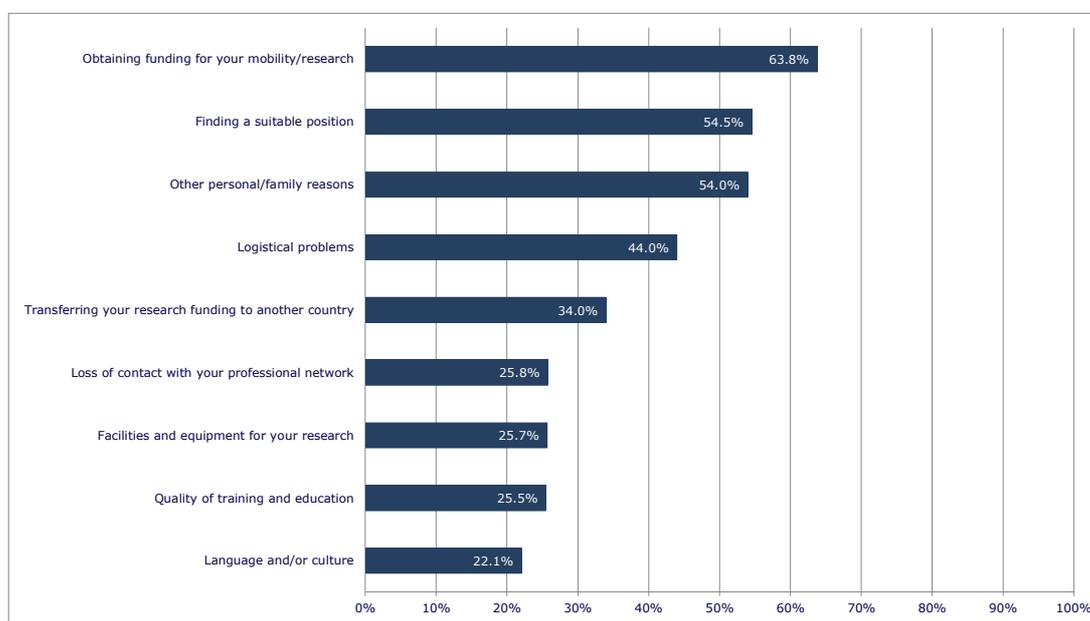
8.1.1 What are the main barriers to international mobility?

8.1.1.1 PhD non-mobility

The list of possible barriers was presented to R1 and R2 researchers who have not worked abroad to undertake their PhD degree, or travelled during their doctorate but did consider a move to some extent. This analysis is thus based on those barriers indicated which might actually prevent the researcher from completing part or all of their PhD in another country.

For mobility during the PhD phase, obtaining funding is the most significant barrier to mobility (64% of researchers). Finding a suitable position follows for more than half of the cases.

Figure 50: Importance of barriers to non-PhD-mobility (PhD degree and during PhD) (EU27)



Source: MORE2 Higher Education Survey (2012)

- Note:
- Share of never-mobile R1 doctoral candidates and R2 (post-doctoral or equivalent) doctorate holders with some consideration of PhD mobility that indicate the barrier as important for non-PhD-mobility. (n=825)
 - With 'non-PhD-mobile' defined as never having been PhD degree mobile nor mobile during their 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; having considered it and searched and having turned down a concrete offer).

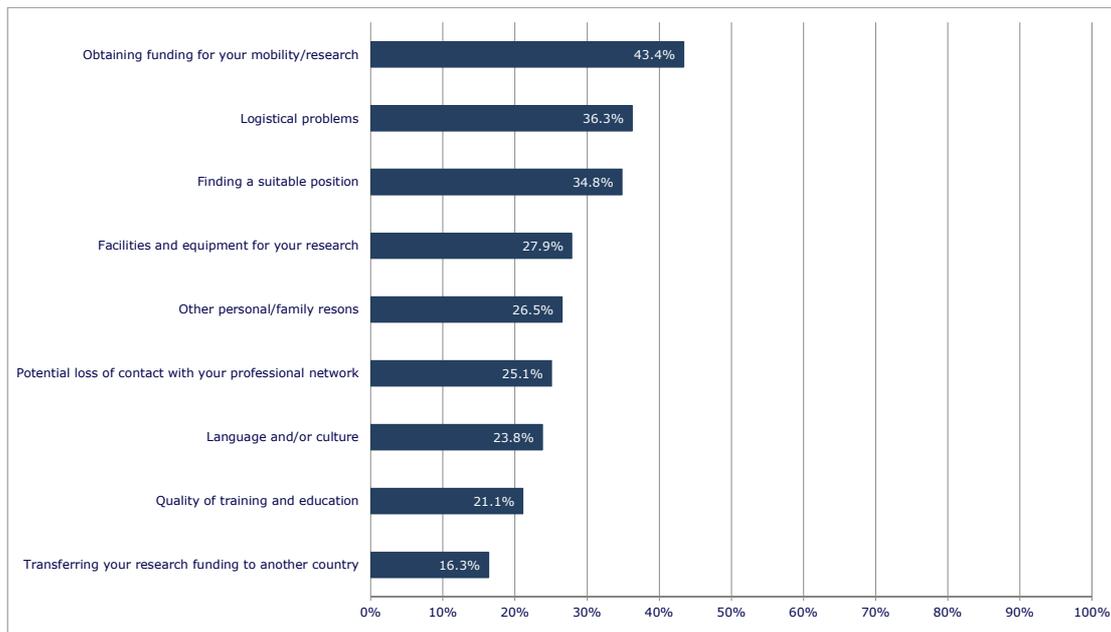
There is considerable agreement about the barriers between those who considered mobility but never looked for a concrete opportunity and those who underwent some effort to find a position. There is only a difference for personal and family reasons: these reasons may pose a sufficient barrier to prevent researchers from searching for an international research opportunity.

8.1.1.2 Mobility in post-PhD career stages (>3 months)

Figure 51 illustrates the perceived importance of barriers to mobility for internationally mobile researchers during the post-PhD career stages (R2, R3 and R4) who have worked abroad for more than three months at least once in the last ten years. These barriers apply to the last move of the respondent.

Obtaining funding for mobility/research is the most oft-mentioned barrier for the researcher’s most recent move (43%). For around 35% of researchers, finding a suitable position and logistical problems are barriers to international mobility. The least frequently mentioned barriers are transferring research funding, quality of training and education and language/culture (important to between 16% and 24% of researchers).

Figure 51: Importance of barriers to last move in post-PhD career mobility (EU27)



Source: MORE2 Higher Education Survey (2012)

Note: - Share of mobile researchers who indicate the specific barrier as being important to their last move. (n=2,003)

- With 'mobility' defined as having worked abroad for more than three months at least once in the last ten years.

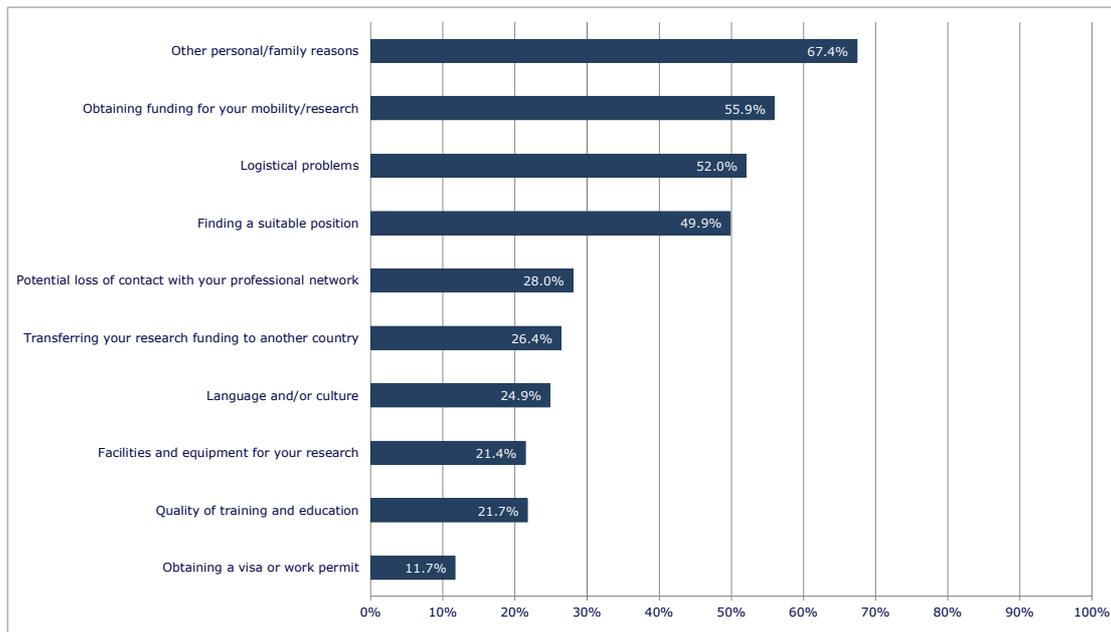
- Only for R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers.

8.1.1.3 Non-mobility in post-PhD career stages

When asked for explicit reasons for their non-mobility, researchers rank personal and family reasons as being most important (Figure 52). While this is an important barrier to overcome when embarking upon an international research period, it is an even more important factor which convinces researchers not to travel.

Funding and logistical problems again appear in the top 3 barriers. Facilities for research appear to be less important for non-mobility as when it was a barrier to overcome in mobility. For transferring research funding to another country, the opposite is observed.

Figure 52: Importance of barriers as reasons for international non-mobility in post-PhD career (EU27)



Source: MORE2 Higher Education Survey (2012)

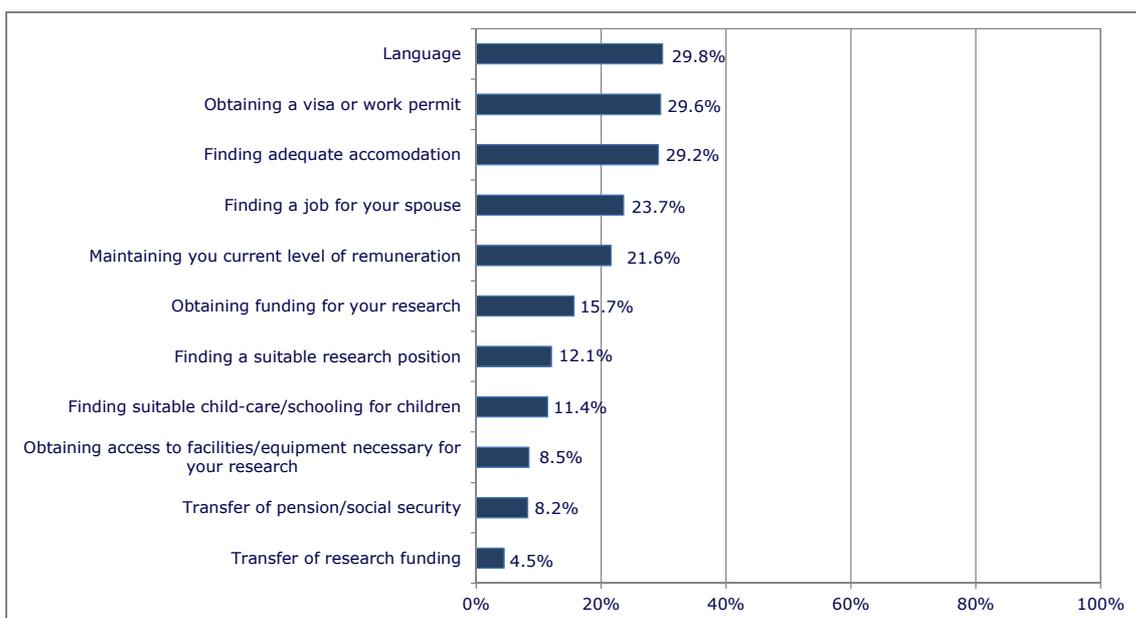
- Note: - Share of never-mobile researchers who indicate that the specific barrier is important in discouraging them from becoming internationally mobile and pursuing this path further. (n=2,303)
- With 'non-mobility' defined as never having worked abroad for more than 3 months (not even more than ten years ago).
 - Only for R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers who have considered working abroad as a researcher for more than 3 months since completing higher education (PhD or other) but never were mobile.

8.1.2 What are the (perceived) barriers to mobility to the EU by non-EU researchers?

8.1.2.1 Extra-EU survey: Non-EU researchers who have been to the EU

30% of the (non-representative) sample of EU researchers state that language, obtaining a visa or work permit and finding adequate accommodation are some of the problems they had to deal with. The transfer of researcher funding and pension/social security, as well as access to facilities/equipment, are mentioned by less than 10% of the non-EU researchers as a difficulty when moving to the EU. 29% of the non-EU researchers who moved to the EU did not face difficulties when moving to Europe.

Figure 53: Difficulties faced by non-EU researchers when moving to the EU



Source: MORE2 Extra-EU mobility survey (2012)

8.1.3 What main differences are observed when mobility includes a change in employer?

When a change in employment is involved, a shift can be noted from obtaining funding for mobility (relatively less important) towards personal/family reasons, finding a suitable position and potential loss of contacts with the professional network (relatively more important).

8.2 Factors determining perception of barriers

8.2.1 Which dimensions (gender, family status, career stage, field of science) affect researchers' barriers to mobility?

8.2.1.1 PhD non-mobility

The main differences between the R1 and R2 researchers concern professional factors (apart from logistical problems). For the doctoral candidates, the barriers are higher regarding the quality of training and education, the facilities and equipment for the research, finding a suitable position, and obtaining funding for mobility/ research (generally a 16-22 point percentage difference with R2).

The gender factor does not matter for most of the perceived barriers. There are a few differences: men find the potential loss of contact with their professional network and language and/or culture an important barrier for non-PhD mobility (respectively 8 and 9 pp. difference) than women, who see more barriers regarding personal and or family reasons (17pp difference).

8.2.1.2 Mobility in post-PhD career stages (>3 months)

On comparing the barriers, as stated by the three research groups R2, R3 and R4, the established R4 researchers experience a higher barrier on obtaining funding for their research as compared to R3 researchers who see this as much less of a barrier (50% versus 38%). R3 researchers do not seem to experience many barriers, particularly when compared to those in lower career stages.

The gender factor shows a very consistent pattern: women perceive more barriers to their last move in all areas than their male counterparts. There is an overall upward shifted curve for female researchers, with the highest percentage differences being for facilities and equipment; the potential loss of contact with their professional network; transferring research funding to another country, and finding a suitable position.

Family status reveals a very coherent pattern. Only regarding personal/family reasons and logistical issues do researchers in a couple experience more barriers than singles.

There is no difference between researchers with children and those without children regarding the barriers posed by personal/family reasons and logistical problems. One might expect that researchers with children would experience more barriers in these areas. A major difference is the fact that those without children find the potential loss of contact with their professional network and finding a suitable position as representing important barriers than do those without children.

8.2.1.3 Non-mobility in post-PhD career stages

Differences between the non-mobile researchers in different career stages are within a +9 to -12 pp deviation range. R2 non-mobile researchers appear more inclined to identify funding issues (both obtaining and transferring) and job positions as reasons for non-mobility, whereas R4 researchers attach more importance to facilities and equipment, language and/or culture and transferring funding. R3 researchers appear to regard the different barriers as generally less important, aside from personal/family reasons and logistical problems.

Female researchers find obtaining funding or transferring funding a more important discouraging factor for mobility than do their male counterparts. Male researchers only find the potential loss of contact with the professional network slightly more discouraging.

Researchers with children find logistical problems and personal/family reasons more important, whereas those without children indicate the potential loss of professional network, but also quality of training and finding a suitable position as reasons for discouraging mobility.

8.2.2 Does country of origin/destination influence the barriers perceived to mobility?

8.2.2.1 Mobility in post-PhD career stages (>3 months)

When analysing the difference per destination region between EU27 and non-EU27 countries, it appears that the largest difference concerns obtaining a visa or work permit (18 pp difference). As can be expected for non-EU27 destination countries, this is felt to be a major barrier. EU27 destination respondents perceive the potential loss of contact with their professional network (11pp), facilities and equipment for research (10pp), and finding a suitable position (9pp) as being relatively more important barriers.

The perceived barriers to mobility experienced by non-EU researchers varied depending on their destination (EU versus non-EU). Non-EU researchers perceived language (30%), obtaining a visa/work permit (30%) and finding adequate accommodation (29%) as difficulties to be handled when moving to the EU. Non-EU researchers who moved to non-EU countries indicated difficulties concerning finding a job for their spouse (13%), language (10%) and finding adequate accommodation (8%). Language and adequate accommodation were thus barriers for EU as well as non-EU mobility, but the percentages suggest some minor differences in importance. Language barriers and accommodation problems were apparently higher for non-EU researchers who move to the EU rather than to non-EU countries. Obtaining a visa/work permit was also indicated as an important difficulty for EU mobility. This seems to be an important issue for future EU policy making.

8.2.2.2 Non-EU researchers outside the EU with previous experience in the EU

The difficulties faced when moving to the EU appear to be quite similar among US, Australian, Turkish, Brazilian and Russian researchers. For Turkish researchers, obtaining a visa or work permit was a larger barrier than for the other nationalities. Language was also a more frequent difficulty faced by Australian and Brazilian researchers when being mobile towards the EU, while Russian researchers faced difficulties most when looking for accommodation. A comparison with other countries is not meaningful given the small number of observations ($n < 30$).

Table 22: *Difference in barriers to mobility by country of citizenship*

	Australia	Brazil	Russia	Turkey	United States
Language	36.5%	34.2%	16.7%	23.8%	28.8%
Maintaining you current level of remuneration	23.8%	13.2%	13.3%	14.3%	25.3%
Obtaining a visa or work permit	34.9%	26.3%	20.0%	45.2%	27.6%
Obtaining access to facilities/equipment necessary for your research	6.3%	10.5%	6.7%	14.3%	9.6%
Obtaining funding for your research	12.7%	18.4%	16.7%	14.3%	12.9%
Transfer of research funding	4.8%	0.0%	0.0%	7.1%	3.5%
Transfer of pension/social security	14.3%	7.9%	10.0%	14.3%	4.0%
Finding a job for your spouse	25.4%	23.7%	20.0%	19.0%	22.0%
Finding a suitable research position	11.1%	7.9%	16.7%	21.4%	8.7%
Finding adequate accommodation	33.3%	34.2%	40.0%	35.7%	27.2%
Finding suitable child-care/schooling for children	14.3%	5.3%	13.3%	21.4%	11.5%

Source: MORE2 Extra-EU mobility survey (2012)

Note: Only countries with more than 30 responses were considered.

8.2.2.3 Non-EU researchers outside the EU with no previous experience in the EU

Overall, there were no major barriers observed regarding the mobility of non-EU researchers towards the US, Japan, China, India, Singapore, Russia, Brazil or South Africa. 39% of the researchers even indicated that they faced none of the difficulties listed. 27% of the researchers indicated that finding a job for their spouse was a difficulty they faced in moving. Language was for 22% of the researchers also a problem. Transfer of funding and finding of a suitable research position was not often a difficulty.

US researchers mobile towards China, India, Singapore, South Africa and Brazil mainly faced barriers concerning language, remuneration, visa/work permits and finding a job for their spouse. Non-US researchers less frequently indicated barriers to mobility towards China, India, Singapore, South Africa and Brazil. The main barrier for them was finding a job for their spouse.

Table 23: Barriers of mobility towards non-EU countries by mobile non-EU researchers who have never been to the EU by citizenship

	US citizenship	non-US citizenship	Total
Language	45.7%	15.1%	21.7%
Maintaining your current level of remuneration	28.6%	12.7%	16.1%
Obtaining a visa or work permit	22.9%	12.7%	14.9%
Obtaining access to facilities/equipment necessary for your research	11.4%	6.3%	7.5%
Obtaining funding for your research	17.1%	10.3%	11.8%
Transfer of research funding	2.9%	6.3%	5.6%
Transfer of pension/social security	8.6%	12.7%	11.8%
Finding a job for your spouse	17.1%	29.4%	26.7%
Finding a suitable research position	2.9%	7.1%	6.2%
Finding adequate accommodation	17.1%	16.7%	16.8%
Finding suitable child-care/schooling for children	0.0%	17.5%	13.7%

Source: MORE2 Extra-EU mobility survey (2012)

Note: Only the USA was considered as it is the only country of this group with more than 30 responses.

The largest differences in perception of barriers to EU mobility between US researchers and non-US researchers occur for finding adequate accommodation; the transfer of pension/social security rights; for obtaining a visa/work permit; maintaining current level of remuneration and for finding a suitable research position. These factors are perceived less as barriers to EU mobility by US researchers than by non-US researchers. Only when it comes to maintaining their current level of remuneration do US researchers consider it more frequently as a barrier to EU mobility than non-US researchers.

Table 24: Perceived barriers to EU mobility by mobile non-EU researchers who have never been to the EU by citizenship

	US citizenship	non-US citizenship	Total
Finding a suitable research position	46.8%	54.2%	51.1%
Language	21.7%	26.2%	24.3%
Maintain current level of remuneration	44.9%	37.9%	40.9%
Obtaining a visa or work permit	21.7%	31.2%	27.2%
Obtaining access to facilities/equipment necessary for your research	11.9%	9.5%	10.5%
Obtaining funding for your research	51.8%	51.6%	51.7%
Transfer of your pension/social security rights	38.9%	50.5%	45.8%
Finding a job for your spouse	65.0%	63.3%	63.9%
Finding adequate accommodation	13.6%	29.2%	22.6%
Finding suitable child-care/schooling for children	24.1%	31.8%	29.4%
Obtaining a suitable position and funding for your return home	39.7%	42.3%	41.3%

Source: MORE2 Extra-EU mobility survey (2012)

Note: Only the USA was considered as it is the only country of this group with more than 30 responses.

8.2.2.4 Non-mobile non-EU researchers

Only a small percentage of researchers from Croatia (3%), Switzerland (8%) and Israel (11%) consider language as a possible barrier to mobility to EU27 countries. Researchers from Australia (46%), India (43%), the US (31%) and Canada (30%) in particular, consider language as a possible barrier to EU mobility. Obtaining a visa or work permit is raised as a possible barrier to EU mobility more frequently by Indian (28%), Mexican (28%), Russian (30%) and Turkish (27%) researchers. Only a small fraction of Israeli, Norwegian and Swiss researchers consider a obtaining a visa as a possible barrier to EU mobility. Australian (58%), Canadian (64%) and Swiss (62%) researchers in particular, consider obtaining a suitable position and funding for their return home as a barrier to EU mobility.

Table 25: Perceived barriers of non-EU researchers to EU mobility by citizenship

	Australia	Brazil	Canada	Croatia	India	Israel	Mexico	Norway	Russia	Switzerland	Turkey	United States	Total
Finding a suitable research position	57.1%	44.1%	56.8%	52.9%	53.2%	40.5%	53.5%	29.0%	58.1%	72.2%	43.8%	55.4%	53.6%
Language	46.3%	20.4%	29.7%	2.9%	42.6%	10.5%	23.3%	15.6%	16.1%	8.3%	16.8%	30.9%	28.3%
Maintain current level of remuneration	54.5%	34.0%	60.0%	20.6%	30.0%	22.2%	34.9%	50.0%	36.1%	72.2%	34.2%	54.3%	46.8%
Obtaining a visa or work permit	18.3%	21.8%	18.9%	11.8%	27.9%	2.7%	27.9%	6.5%	30.0%	5.9%	27.2%	17.0%	20.3%
Obtaining access to facilities/equipment necessary for your research	12.6%	10.8%	22.2%	11.8%	11.5%	5.9%	9.5%	12.5%	8.3%	22.9%	13.5%	11.2%	11.9%
Obtaining funding for your research	62.9%	42.6%	58.3%	55.9%	40.0%	44.4%	42.9%	51.6%	56.7%	69.4%	44.3%	51.7%	51.0%
Transfer of your pension/social security rights	43.8%	43.9%	52.8%	35.3%	28.1%	58.8%	44.2%	38.7%	34.4%	51.4%	36.5%	42.7%	41.4%
Finding a job for your spouse	75.8%	61.7%	61.3%	51.9%	48.0%	70.6%	68.6%	76.0%	59.3%	72.4%	50.9%	66.9%	63.8%
Finding adequate accommodation	29.4%	29.4%	18.9%	17.6%	29.0%	19.4%	32.6%	21.9%	21.7%	33.3%	24.1%	23.1%	24.9%
Finding suitable child-care/schooling for children	43.4%	18.6%	7.7%	31.8%	30.2%	38.1%	28.6%	44.4%	31.1%	38.1%	27.6%	26.7%	29.0%
Obtaining a suitable position and funding for your return home	57.2%	21.6%	63.3%	38.2%	33.9%	18.2%	32.6%	26.7%	47.5%	61.8%	31.2%	42.5%	41.2%
N =	177	103	37	34	62	38	43	32	62	36	194	1,197	2,284

Source: MORE2 Extra-EU mobility survey (2012)

Note: Only countries with more than 30 responses were considered.

9 EFFECTS OF INTERNATIONAL MOBILITY

The MORE2 project is the first to explicitly survey and study the effects of mobility on researchers and their careers. Overall data indicate that researchers consider international mobility during the post-PhD career stages to have largely positive effects. However there is also a significant minority for whom mobility has not been so beneficial, possibly explained by 'forced' mobility due to a lack of opportunities in the home country.

Output effects are regarded as being the most important factor influenced by researchers' entire mobility experience, particularly building up advanced research skills. Career-related effects receive lower scores overall, but a more positive view of the career possibilities is held by non-Europeans who are currently working in the EU. Surprisingly, job options in academia (33% increase versus 48% decrease) or outside (27% increase versus 47% decrease) as well as progression in remuneration (17% increase versus 43% decrease) tend to have decreased for more researchers than increased.

When a change in employer is involved for at least one of the researcher's moves, the effects (of the entire mobility experience) are more pronounced in terms of output, financial and career-related effects.

Differences occur between researchers at different career stages, but patterns vary widely and are hardly consistent. Researchers in the independent research stage (R3) do show overall scores below the average. Gender also influences the perception of effects, as women are much more positive in recognizing the effects of their mobility experience than men.

Destinations as seen over the entire mobility experience also affect how the effects of mobility are perceived. It seems that the higher the number of research trips made to different locations both inside and outside the EU, the greater the exposure to larger groups of active researchers in different places, thus resulting in higher mobility effects.

9.1 Effects

9.1.1 What are the main effects of international mobility?

9.1.1.1 HEI survey: Mobile researchers currently working in the EU

Figure 54 presents the R2, R3 and R4 researchers' perceptions as regards the effects of their overall mobility experience. Overall data indicate that researchers consider international mobility in post-PhD career stages to have largely positive effects. However there is also a significant minority for whom mobility has not been so beneficial, possibly explained by 'forced' mobility due to a lack of opportunities in the home country.

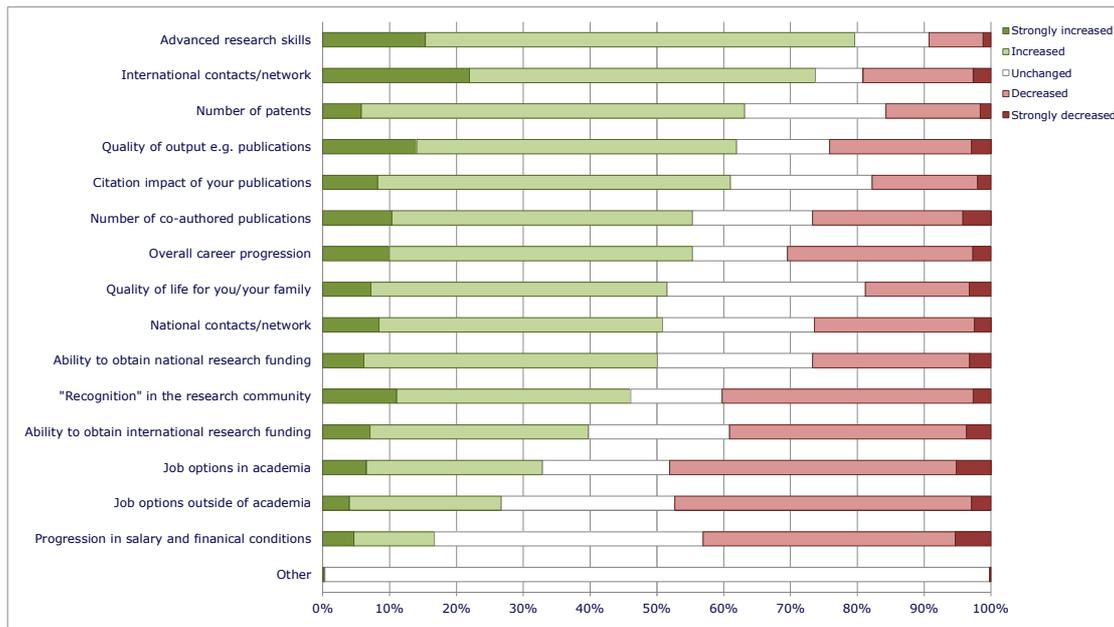
It shows that the output and effects (quality of output, citation impact, patents, number of co-authored publications) are the most important factors induced by researchers' entire mobility experience. On average, 60% perceive these factors as having (strongly) increased. However, a significant share of around 25% of researchers still perceive the quality and the number of co-authored publications as (strongly) decreased and 15-17% cite patents and citation impact as (strongly) decreased. This leaves around 14-21% of researchers who see no change in these factors.

Other important effects are the advancement of research skills (80% increased, 11% unchanged and 9% decreased) and the development of international contacts and networks (74% increased, 7% unchanged and 19% decreased).

Although overall career progression has increased according to 55% of researchers, again, a significant group of 31% see a decrease in career progression as an effect of mobility (compared to 14% unchanged). Other career-related factors show a smaller increase. For example, the ability to obtain international research funding has increased and decreased for the same share of researchers (39-40%). Surprisingly, job options in academia (33% increase versus 48% decrease) or outside (27% increase versus 47% decrease) as well as progression in remuneration (17% increase versus 43% decrease) tend to have decreased for more researchers than increased. Finally, around 40% of researchers consider their recognition in the research community to have decreased (compared to around 45% who consider it increased). The pattern is very similar for the recently mobile (researchers who were >3 month internationally mobile in the last 5 years).

Even though most researchers are positive about the effects of their mobility, for a significant minority - for some aspects even close to half of the researchers - indicates that mobility has negatively affected them in their research career. A possible explanation for this may lie in different motives or push factors for mobility. A researcher who is 'forced' into mobility because there are no other opportunities in the home country (push) may benefit less from the international research environment and collaboration than other so 'choose' their destination for the benefit of their career (pull).

Figure 54: Effects of the entire mobility experience on the researcher's career (EU27)



Source: MORE2 Higher Education Survey (2012)

- Note:
- Share of mobile researchers who indicate that the effect of the entire mobility experience on a specific aspect of her career to be a (strong) increase, (strong) decrease or unchanged. (n=1,660)
 - With 'mobility' defined as having worked abroad for more than three months at least once in the last ten years.
 - Only for R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers.

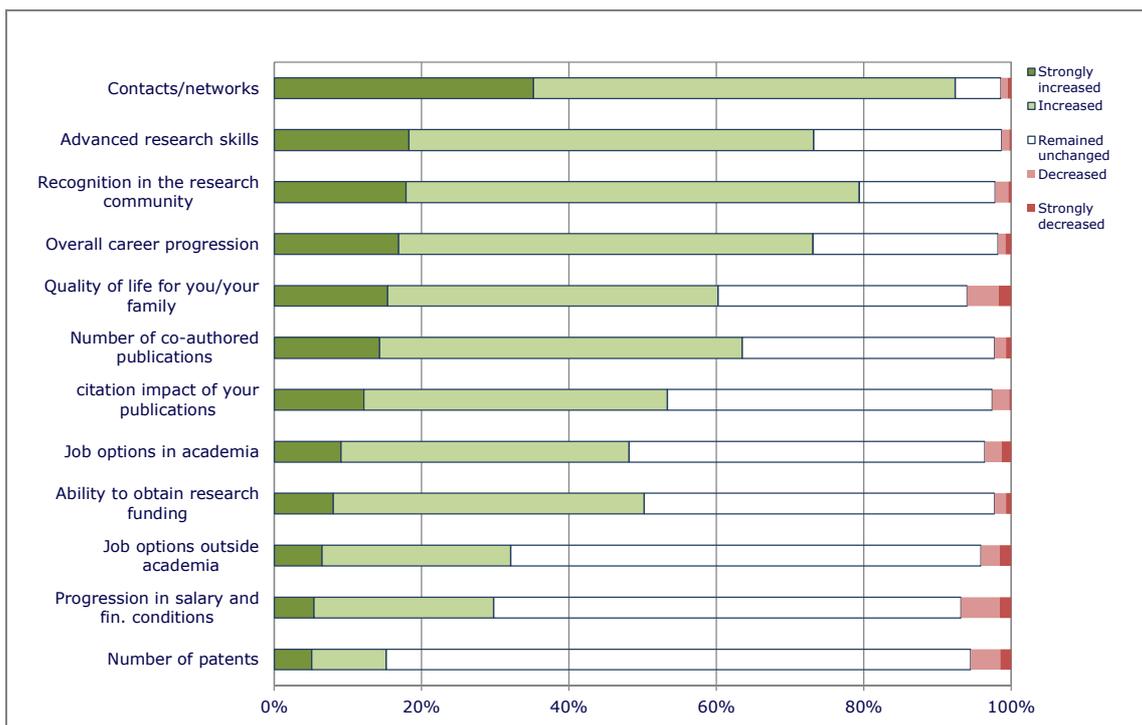
9.1.1.2 Non-EU citizens currently mobile to/working in the EU

The non-EU citizens assess their mobility experience as having a higher positive effect in most areas. Most notable are the career effects such as job options both in academia and beyond: salary progression; recognition in the research community and national contacts/network show substantially higher increases. Only in a few areas, such as the ability to obtain international or national research funding and – significantly – the number of patents, non-EU citizens indicate that the effects are lower than for the overall group of mobile researchers. This tends towards a positive view of the career possibilities for non-Europeans who are currently working in the EU.

9.1.1.3 Extra-EU survey: Mobile non-EU citizens who have worked in the EU in the past (concerning their EU mobility)

The (non-representative sample) of non-EU citizens who have been to the EU in the past assess their mobility experience to the EU as having had a positive effect in most areas. Figure 55 gives an overview of these effects. The most positive impact occurs with regards to contacts/networks, recognition in the research community, advanced researcher skills and overall career progression. The number of patents, job options outside academia and the progression in salary and financial conditions are largely perceived as having remained unchanged when moving to the EU.

Figure 55: Effects of EU mobility experience for non-EU researchers



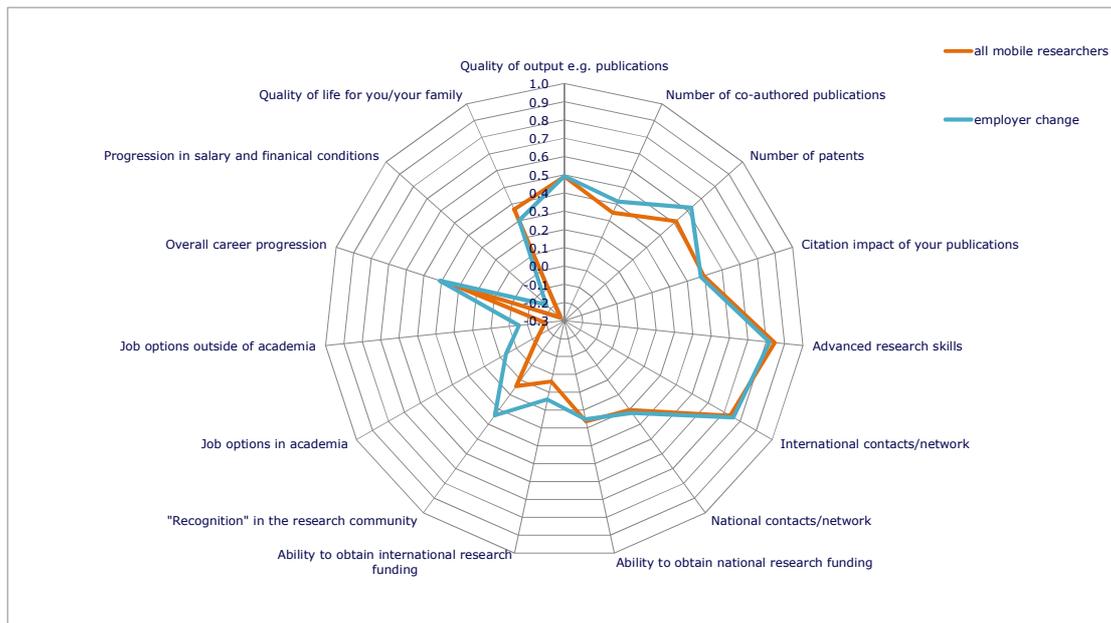
Source: MORE2 Extra-EU mobility survey (2012)

Note: Share of non-EU researchers who have been mobile towards the EU in the past that indicate the effect on the specific aspect of their career to be a (strongly) increase, (strongly) decrease or unchanged due to their past stay in the EU (n=759).

9.1.2 What main differences are observed when mobility includes a change in employer?

When a change in employer is involved for at least one of the researcher’s moves, the effects (of the entire mobility experience) are more pronounced in terms of output, financial and career-related effects. Specifically, the job options in and outside academia, as well as the ability to obtain funding and the recognition in the research community are rated more highly by this subgroup of researchers. Only quality of life and advanced research skills are considered to be less positively affected by those experiencing a change in employer.

Figure 56: Effects of the entire mobility experience on the researcher’s career when at least one change in employer (EU27)



Source: MORE2 Higher Education Survey (2012)

- Note:
- Average effect on the specific aspect of the career for the groups of all researchers versus researchers with at least once employer mobility. (n=797)
 - With average calculated by assigning values to each category: 2= strongly increased; 1=increased; 0=unchanged; -1=decreased; -2=strongly decreased.
 - With mobility defined as having worked abroad for more than three months at least once in the last ten years and employer mobility as mobility involving a change in employer.
 - Only for R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers.

9.2 Factors determining effects

9.2.1 Which dimensions (gender, family status, career stage, field of science) affect researchers' perception of effects of mobility?

The available data do not allow analysis of mobility experience effects during a specific career stage. However, the data do enable us to analyse researchers' opinions on the effects of their entire past mobility experience according to the stage they are currently in. The overall pattern varies widely and there are hardly any consistent patterns visible between the three types of researchers.

The leading researchers (R4) score above average on most of the factors. They score higher on quality of output; recognition in the research community; career progression; salary and financial conditions and the ability to secure international research funding. We therefore see a mix of output, career-related and network effects. The number of patents, however, is remarkably low and some career-related items are below average, such as job options in or outside academia. This might be related to other personal factors such as age or the nature and motives for mobility.

The R2 researchers score relatively lower on output items such as quality of output, number of co-authored publications, citation impacts as well as recognition in the research community. It can be expected that R2 researchers would score lower as regards these kinds of issues than R3 and R4 academics, who are much further ahead in their career. It is quite interesting to note that R2 researchers are above average as far as career-related effects are concerned, namely job options in and outside of academia. The network effects and financial effects (the ability to obtain national and international research funding) are also positive.

Researchers in the independent research stage (R3) show overall scores below the average. They seem to benefit less from the effects of international mobility when compared to the two other groups of researchers. The financial mobility effects are relatively low, such as progression in salary and financial conditions and the ability to obtain national and international research funding. Only a few output effects (number of co-authored publications, citation impact and number of patents) are above average.

The gender factor makes a difference in terms of mobility effects. Overall, women are much more positive in recognising the effects of their mobility experience than men. Men only score more highly in terms of the citation impact of publications and quality of life, but the difference for these issues is very marginal. For all the other factors, women seem to benefit more from international migration than men. Most notably, women score higher on network effects such as 'recognition' in the research community, international and national contacts/ networks. Other differences in favour of women are the ability to obtain national research funding, salary, job options in academia, patents, and advanced research skills.

9.2.2 To what extent does the geographic region influence the perceived effects of mobility?

Analysis of destination and origin is not possible with the available data (the effects are surveyed for the entire mobility experience instead of one specific move). Geographic patterns in the EU HEI survey data are thus analysed 1) for the current country of employment and 2) for the combination of destination regions (in EU, outside EU or both) over the entire mobility experience.

9.2.2.1 Current country of employment

In the analysis of effects per country, two factors play a role. First, it is possible that researchers answer in a generally more positive or negative way when considering the effects that individual countries' had upon their research career. The overall level of effects indicated per country thus shows the countries' reference level. Second, the pattern of different types of effects compared to each country's reference level shows the relative importance of each type of effect in that country.

The overall reference level is highest in Cyprus, Greece, Romania and Hungary. The lowest reference level is found in Austria, Germany, France and the United Kingdom.

When compared to the country average of each individual country, output, personal and network effects are important in the majority of countries, whereas career-related effects and financial effects are below average in most countries. Exceptions are:

- Personal effects are below average in the United Kingdom, Croatia, Denmark, Slovenia, Romania and Greece.
- Career-related effects are above average in Turkey.

Furthermore, the output effects are highest in Spain, Italy, Portugal and France and lowest in Sweden and Cyprus. The network effects are highest in Greece, Sweden, Slovenia, Belgium and Ireland and lowest in Switzerland and Hungary. The career-related effects are highest in Turkey, Slovakia and Hungary and lowest in Spain and France. The personal effects are highest in Switzerland, Estonia, France, Austria and Germany and lowest in Slovenia and Greece. The financial effects are highest in Luxembourg and Cyprus and lowest in Greece and Croatia.

9.2.2.2 Combination of destination regions over the entire mobility experience

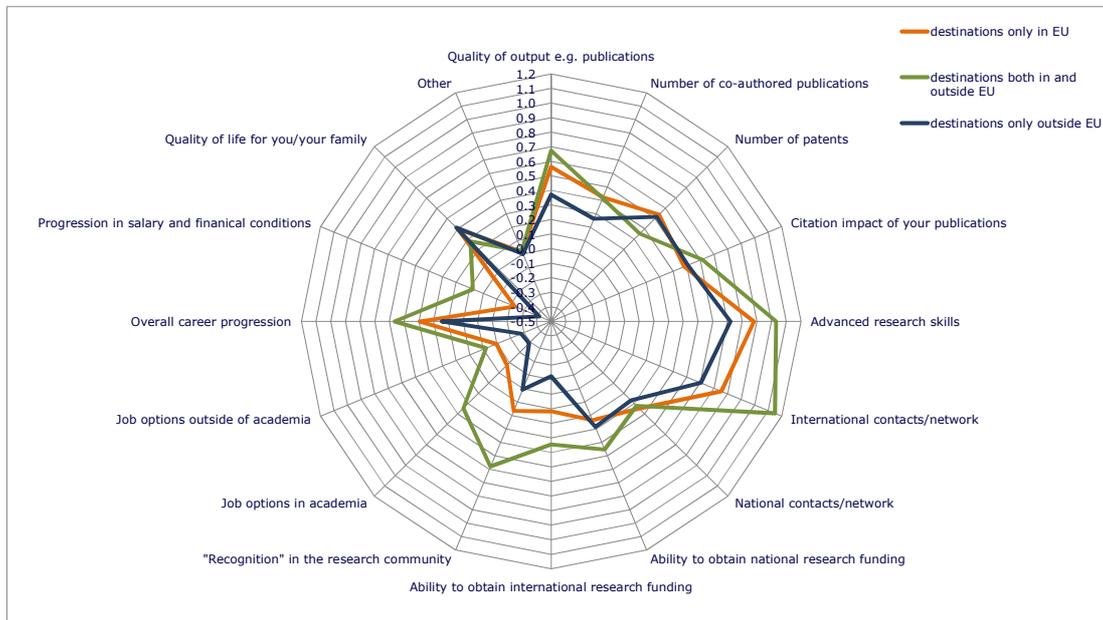
To analyse the influence of destinations on the effects of the mobility experience, we compare three categories of respondents (those being mobile only in EU, those mobile both in and outside EU and those only mobile outside EU⁸⁴). This shows a rather consistent picture: those who are mobile both in and outside EU show higher levels of recognition of the effect of their mobility experience than do the other two groups. There are also substantially higher scores for the network effects such as recognition in the research community, and access to international contacts/network. It seems that the higher the number of research trips made to different locations both inside and outside the EU, the greater the exposure to larger groups of active researchers in different places, thus resulting in higher mobility effects. The difference in terms of job options - particularly in academia - is substantial as well as in terms of researchers' overall career progression.

The score is only negative for 2 items when compared to the total, namely the number of patents and quality of personal life.

⁸⁴ The data analysed in this section include the full sample and thus refers to EU27+6.

On comparing the other two groups, it appears that those only mobile in the EU regard their mobility effects more favourably than their counterparts who are only mobile outside the EU. This relates to the output effects, the network effects such as recognition in the research community and career effects.

Figure 57: Effects of the entire mobility experience on the researcher's career per destination region



Source: MORE2 Higher Education Survey (2012)

- Note:
- Average effect for mobile researchers on the specific aspect of the career due to the entire mobility experience per destination region. (n=1,213 for destination only within EU, n=237 for destinations in and outside EU and n=550 for destinations only outside EU)
 - With average calculated by assigning values to each category: 2= strongly increased; 1=increased; 0=unchanged; -1=decreased; -2=strongly decreased.
 - With 'mobility' defined as having worked abroad for more than three months at least once in the last ten years.
 - Only for R2 (post-doctoral or equivalent), R3 (established) or R4 (leading) researchers.

9.2.2.3 Non-EU researchers outside the EU with previous experience in the EU

In the Extra-EU survey, the perception of mobility effects also varies amongst the researchers working outside the EU. The non-EU researchers who previously moved to the EU perceive their mobility experience positively, in most respects. The most positive impact occurs with regards to contacts/networks, recognition in the research community, advanced researcher skills and overall career progression. The number of patents, job options outside academia and the progression in salary and financial conditions were largely perceived as remaining unchanged when moving to the EU.

Country-wise, the effects of moving to the EU are, on average, perceived as highest by Brazilian researchers. They experience a (strongly) increased effect on their research skills, recognition in the research community, job options in academia and outside it, and career progression. Turkish researchers experience a (strongly) increased effect on network, job security and career progression (Table 26). A comparison with other countries is not meaningful given the small number of observations (n<30).

Table 26: Mobility effects of non-EU mobility by country of citizenship

	Australia	Brazil	Turkey	United States	Total
Number of co-authored publications	67.8%	72.7%	65.0%	60.1%	63.5%
Citation impact of your publications	54.4%	73.5%	62.5%	45.7%	53.3%
Number of patents	13.3%	9.1%	11.1%	10.4%	15.2%
Advanced research skills	73.7%	91.2%	78.0%	66.2%	73.2%
Contacts/networks	95.1%	91.7%	81.0%	93.5%	92.4%
Ability to obtain research funding	49.1%	66.7%	47.2%	43.3%	50.2%
Recognition in the research community	78.3%	97.2%	77.5%	77.0%	79.5%
Job options in academia	63.6%	67.6%	65.8%	38.9%	48.1%
Job options outside academia	43.5%	60.7%	38.9%	18.8%	32.1%
Overall career progression	74.6%	91.7%	82.9%	67.5%	73.1%
Progression in salary and financial conditions	30.9%	34.3%	35.0%	24.3%	29.8%
Quality of life for you/your family	31.6%	57.6%	51.2%	66.2%	60.2%

Source: MORE2 Extra-EU mobility survey (2012)

Note: Only countries with more than 30 responses were considered.

9.2.2.4 Non-EU researchers outside the EU with no previous experience in the EU

Interestingly, overall, there were numerous (strongly) decreasing effects attributable to mobility among this group. Progression of salary and financial conditions as well as quality of life were most often negatively affected by a move. The number of patents and job options outside of academia, however, did not appear to be affected by geographical mobility in most of the cases. Advanced research skills, contacts and networks and overall career progression were the most important (positive) effects of mobility.

Here again, only the US had a sufficiently high response rate (n>30). For both US citizens as well as non-US citizens, contacts and networks is the largest effect of a move towards China, India, Singapore, South Africa and Brazil. US researchers on average indicate less effects of non-EU mobility than non-US researchers, except in the area of contacts/networks. The largest difference is the progression in salary and financial conditions which is larger for non-US citizens than US citizens when moving to China, India, Singapore, South Africa and Brazil.

Table 27: *Effects of mobility towards non-EU countries by mobile non-EU researchers who have never been to the EU by citizenship*

	US citizenship	non-US citizenship	Total
Number of co-authored publications	45.5%	63.6%	59.7%
citation impact of your publications	45.2%	65.0%	60.8%
Number of patents	20.0%	22.7%	22.4%
Advanced research skills	67.6%	83.3%	79.9%
Contacts/networks	94.3%	87.8%	89.2%
Ability to obtain research funding	39.4%	60.2%	55.6%
Recognition in the research community	71.4%	75.2%	74.4%
Job options in academia	42.4%	67.5%	61.9%
Job options outside academia	28.6%	40.9%	38.0%
Overall career progression	68.6%	81.8%	78.8%
Progression in salary and fin. Conditions	17.6%	47.5%	40.8%
Quality of life for you/your family	55.9%	57.0%	56.8%

Source: MORE2 Extra-EU mobility survey (2012)

10 ATTRACTIVENESS OF THE RESEARCH ENVIRONMENT

Of the researchers currently working in the EU (HEI survey), most are satisfied with their current employment but researchers in the target group for direct comparison of research systems (both EU citizens who previously worked outside the EU and non-EU citizens who currently work inside the EU) appreciate the non-EU research system as being better than the EU system. A substantial group of one third to one half of the researchers appreciate both systems equally.

On the other, more positive side, the effects of mobility to the EU for non-EU researcher are high and three quarters of them indicates they wanted to stay (longer) in the EU. 93% of those researchers would furthermore recommend the EU as research environment to their colleagues.

Also, non-EU researchers coming into the EU reflect rather similar motives than their EU counterparts leaving the EU. This shows that researchers are globally driven by similar perspectives but, at the same time, that the different contexts of origin and destination combined with fields and personal motives make it difficult to reach one general conclusion.

Finally, after to the academic factors, quality of life is highly valued in the European research system. When relating this to the finding that preserving quality of life is an important condition for changing one's research position, this is an important observation with respect to the attractiveness of the EU as research environment.

Caveat: Measuring the attractiveness of the EU as research environment is a complex matter. Both surveys only refer indirectly to the topic and are thus to be interpreted with care. Nevertheless, a number of interesting indications and insights can be derived from e.g. the interest or intent to return to or move to the EU, the experienced effects or motives of mobility to different regions etc. However, only being able to distinguish the EU from non-EU destinations does not allow for important nuances. The non-EU destinations in particular are a collection of highly different destinations in all kinds of ways. It would be necessary to isolate e.g. the USA as destination from other non-EU countries in order to provide more detailed insights.

10.1 How attractive is the EU as a research environment?

10.1.1 EU HEI survey: EU and non-EU researchers who are currently in the EU and have previously worked in both research systems

Of the researchers currently working in the EU (HEI survey), most are satisfied in their current post. Furthermore, in the analysis of the mobility effects as perceived by non-EU citizens who currently work in the EU (cf. supra), a rather positive view is presented as regarding the career options for this group. This is most notably the case with respect to career-related effects.

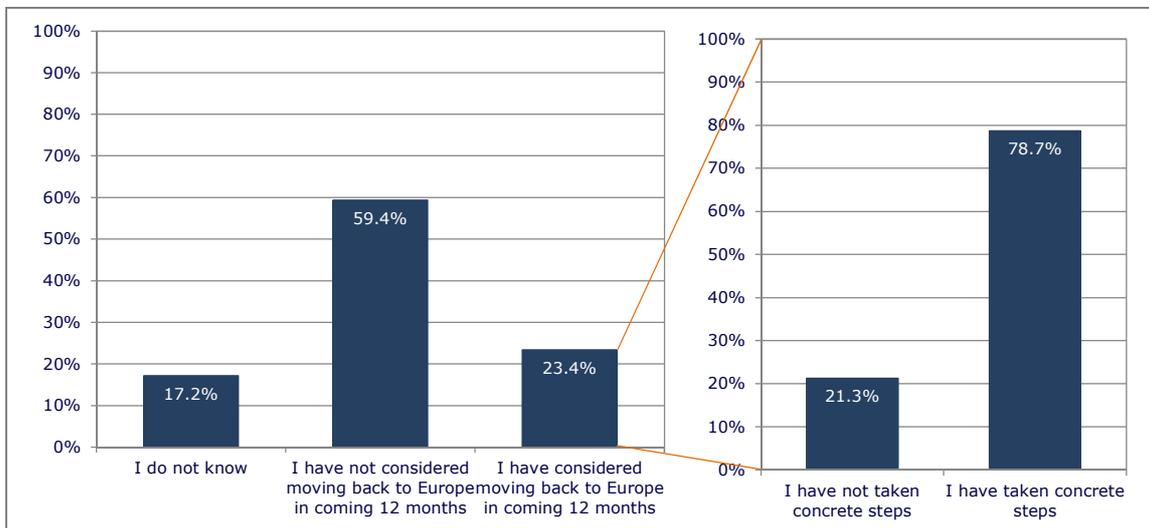
However, when comparing the response patterns for the direct questions on comparing research systems in and outside the EU, this picture is not quite so clear-cut. Overall, researchers in the target group for direct comparison of research systems (both EU citizens who previously worked outside the EU and non-EU citizens who currently work inside the EU) appreciate the non-EU research system as being better than the EU system. A substantial group of one third to one half of researchers appreciate both systems equally.

R3 and R4 researchers have a more pronounced appreciation of the research system outside the EU than their R2 counterparts.

10.1.2 Extra-EU survey: EU researchers

Furthermore, 23% of the (non-representative) sample of EU researchers who are currently mobile outside the EU were considering moving back to the EU in the coming 12 months. Of this 23%, around 4 in 5 had taken concrete steps towards 'return' mobility.

Figure 58: Return potential prospects of EU researchers abroad



Source: MORE2 Extra-EU Mobility Survey (2012)

Note: Share of EU researchers currently mobile outside the EU who indicated that they have considered moving back to Europe in the coming 12 months (n=641) AND when the considered moving back to Europe whether they had already taken concrete steps or not (n=150)

Comparing the return potential of EU researchers by country of citizenship, researchers from the UK less frequently considered moving back to the EU (9%) than did Italian (20%), Dutch (21%), Austrian (28%), German (31%) and French (31%) researchers.

10.1.3 Extra-EU survey: non-EU researchers

72% of the (non-representative) sample of non-EU researchers who had been to the EU in the past would have liked to stay in Europe. The main reason for leaving the EU was, paradoxically, that they never intended to stay longer. 93% would recommend that other colleagues work in Europe as researchers, which suggests that they really valued their stay in the EU.

In general, there was a major interest in mobility towards the EU by the (non-representative) sample of non-EU researchers who had never worked in the EU. Of the (non-representative) sample of non-EU researchers who had moved to non-EU countries, 90% would be interested in working in Europe as researchers. More than half of the non-EU researchers who had never been to the EU but were mobile to non-EU countries and were interested in EU mobility had already investigated the possibilities of moving to the EU. However, one has to keep in mind that this result might be biased as respondents might be more open minded and/or more interested in research outside their own country.

10.2 Which aspects of the EU research environment are particularly appreciated by researchers?

10.2.1 EU HEI survey: EU and non-EU researchers who are currently in the EU and have previously worked in both research systems

Professional factors are regarded as being better outside the EU, according to over 40% of the respondents⁸⁵, with between 30 and 40% of researchers considering them to be the same, and between 20 and 25% regarding them as worse. Specifically, these statistics relate to: remuneration (with a difference of 24 pp between those indicating 'better' versus 'worse'); research excellence (20 pp difference and 41% similar); career progression (19 pp. difference and 35% similar) and availability of suitable positions (18 pp. difference and 40% similar). Furthermore, availability of funding, teaching load and industry collaboration are more highly appreciated in the non-EU research system (17 pp. difference each and 33%, 47% and 41% similar respectively).

One strength of the EU research system lies in its social security provisions, recognised as being worse outside the EU by more than 40% of the respondents – a 13 pp difference for 'better outside the EU'. Job security is also slightly better in the EU (2 pp difference).

Table 28: Comparison appreciation of the non-EU and EU research systems

	Better	Similar	Worse
Research funding	42.5%	32.5%	25.1%
Availability of suitable positions	39.1%	39.9%	21.0%
Career progression	42.0%	34.7%	23.3%
Job security	27.0%	44.3%	28.7%
Industry collaboration	38.3%	40.7%	21.0%
Research facilities and equipment	41.3%	35.5%	23.2%
Quality of training and education	28.7%	49.4%	21.9%
Teaching obligations	35.1%	46.6%	18.3%
Research excellence	39.3%	40.9%	19.8%
Independence (autonomy) as a researcher	34.0%	46.7%	19.3%
Quality of life	35.0%	39.7%	25.3%
Remuneration (salary and other financial incentives)	47.2%	29.7%	23.1%
Social security and pension plan	27.1%	32.6%	40.4%

Source: MORE2 Higher Education Survey (2012)

Note: - Percentage of researchers who indicate a factor to be better when working outside the EU than when working inside the EU as a researcher (as compared to the researchers indicating either better, worse or similar). (n=435 for non-EU researchers and n=756 for EU researchers)
 - For the subgroup of both non-EU researchers currently working in the EU and EU researchers having previously worked outside the EU.

Comparison between the response patterns of EU versus non-EU citizens can also be made, but has to be interpreted with care as regards features which are not equally accessible to the different subgroups. For example, EU social security is

⁸⁵ This share is compared to the total number of respondents who answered either better, worse or similar. The answering category NA (not applicable) is thus not included in this analysis.

appreciated more highly by EU citizens, but this also relates to the fact that not all non-EU researchers can benefit equally from it. The emphasis placed on this issue is therefore smaller for non-EU researchers.

However, the largest differences occur for the same professional factors which are generally appreciated as being better outside the EU: remuneration; career progression; availability of suitable positions; industry collaboration and teaching obligations. EU citizens more frequently consider these factors to be better outside the EU, which does confirm the earlier findings. These findings can subsequently be interpreted as relevant 'push factors' which encourage EU researchers to work outside the EU.

Variations also occur across career stages. Although the number of observations is limited per career stage, a number of differences are observed:

- As mentioned earlier, the professional aspects of the research system are generally appreciated as being better outside the EU and it appears that this is increasingly so during subsequent career stages.
- Personal and formal/legal areas such as quality of life, job security and social security are less often appreciated as being better by those researchers in the later career stages.

10.2.2 EU HEI survey: satisfaction in current EU employment

The HEI survey shows that researchers currently working in the EU are generally satisfied in their current employment. Salary and other benefits rank low as features of the current academic position but, on the other hand, over half of researchers (who indicate either satisfied or dissatisfied) are still satisfied with these aspects. The factor ranked third lowest is opportunities for advancement. On the other hand, satisfaction with independence and responsibility is rather high (87% and 89%). Satisfaction levels regarding openness, transparency and the degree of merit-based recruitment is between 61-66%.

10.2.3 Extra-EU survey: non-EU researchers

The sample of non-EU researchers who have worked in the EU highly value the quality of life in Europe. This, as well as opportunities for career progression and working with experts, was an important motive for non-EU researchers to come to Europe.

Due to low number of responses for most countries, we can only compare the differences in motives between Australia, Brazil, Russia, Turkey and the US ($n > 30$). Career progression was for Australian, Brazilian, Russian, Turkish and US researchers the most important reason to move to the EU, although for the US, the importance of this motive was slightly lower (81%) (versus 89-96%) than for the other countries. The option to work with experts was indicated as being an important motive for EU mobility by 96% of the Russian researchers, but only for 74% of the US researchers. Obtaining research funding appears to be more frequently a motive for EU mobility for Russian (97%) and Turkish (93%) researchers than for Australian (79%), US (75%) and Brazilian (78%) researchers. The political situation at home is generally ranked as the least important motive for EU mobility. Comparing the different countries indicates that the political situation was still an important motive for 25% of the Brazilians, 30% of the Russians and 32% of the Turkish researchers, although only for 4% of the US and 6% of the Australian researchers.

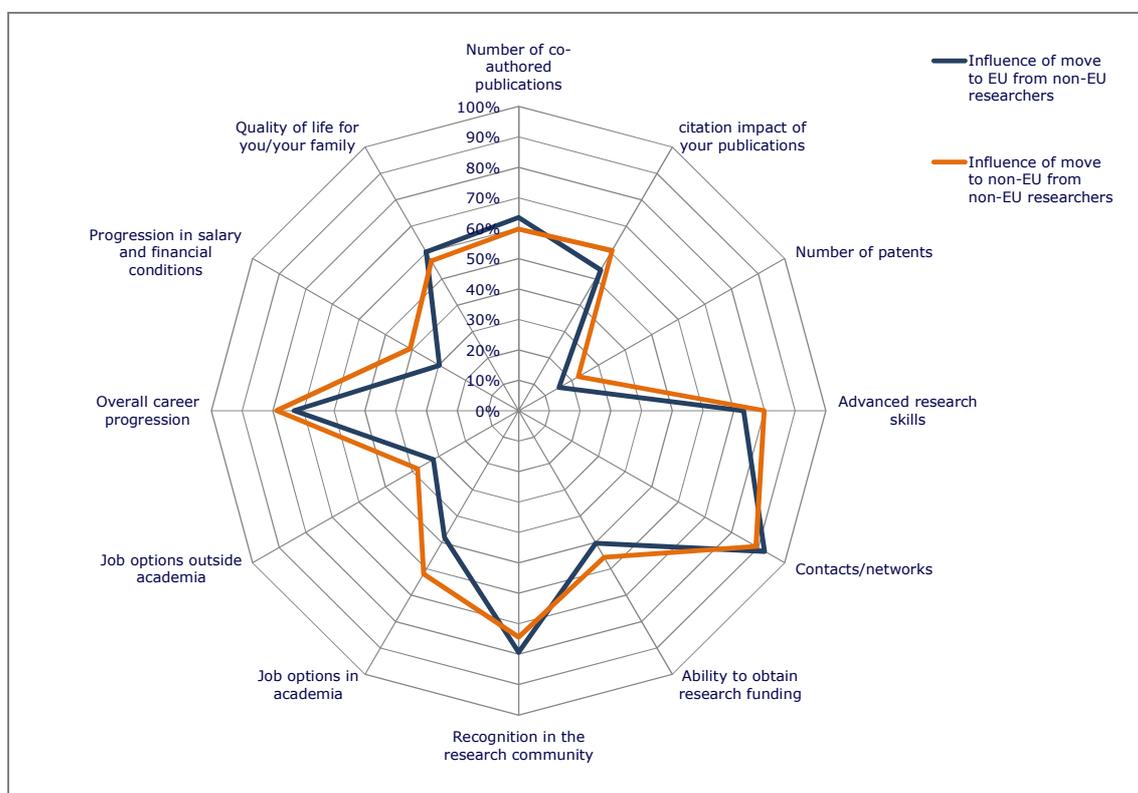
Table 29: Motives for EU mobility of non-EU researchers by citizenship

	Australia	Brazil	Russia	Turkey	United States	Total
Research funding	78.9%	78.4%	96.7%	92.5%	75.3%	80.2%
Career progression	89.3%	94.7%	89.7%	95.0%	82.0%	86.8%
Facilities and equipment	73.7%	71.1%	93.1%	97.6%	70.5%	75.1%
Working with leading experts	85.0%	86.8%	96.7%	85.4%	74.3%	80.2%
Research autonomy	64.8%	69.4%	67.9%	79.5%	71.0%	70.2%
Bring your research to market	28.8%	39.4%	50.0%	69.2%	18.1%	29.3%
Personal/family reasons	45.1%	47.1%	42.9%	45.0%	58.6%	53.6%
Quality of life	60.0%	67.6%	76.7%	65.9%	78.4%	74.6%
Remuneration	36.0%	48.6%	71.4%	64.3%	32.3%	41.9%
Job security	27.1%	28.1%	44.4%	57.5%	14.4%	25.0%
Working conditions	50.9%	70.3%	86.7%	85.7%	58.3%	63.6%
Political situation in home country	6.7%	25.0%	29.6%	32.5%	4.6%	13.6%

Source: MORE2 Extra-EU mobility survey (2012)

Moreover, in light of the analysis of effect, the EU research environment is regarded positively: comparing non-EU researchers who have been mobile to the EU with non-EU researchers who have only moved outside the EU shows that several effects were higher for the first type of experience (to the EU): a higher number of co-authored publications, more recognition in the research community and a better quality of life.

Figure 59: Comparing effects of mobility of non-EU researchers towards EU versus non-EU countries



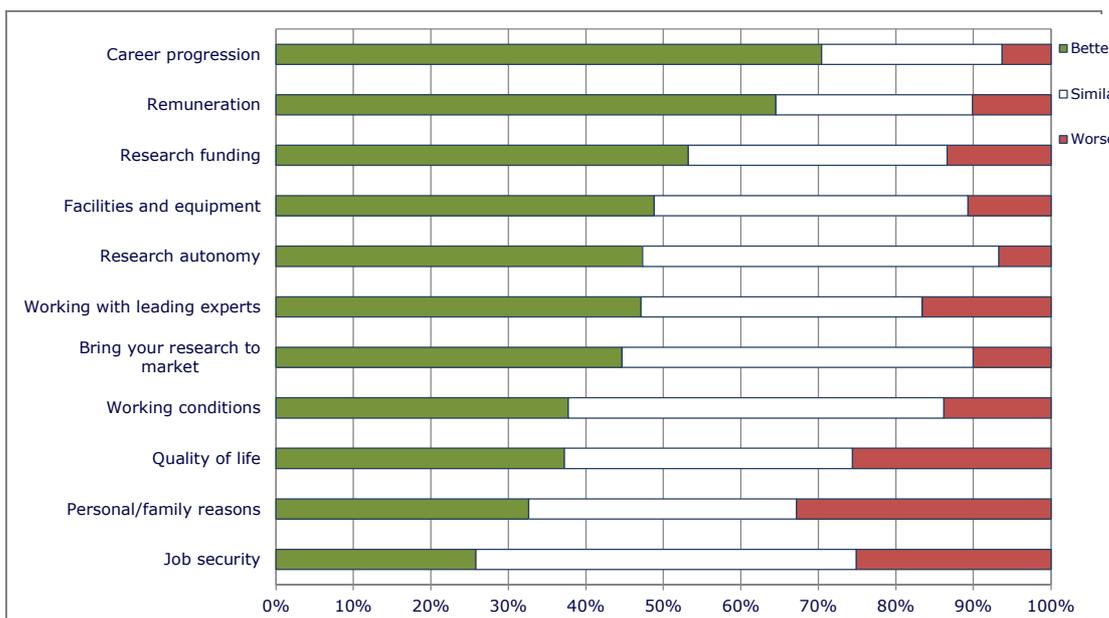
Source: MORE2 Extra-EU mobility survey (2012)

10.3 How can the attractiveness of Europe as a destination for researchers be improved?

10.3.1 Extra-EU survey: EU researchers

The (non-representative) sample of EU researchers abroad finds the possibilities for career progression, remuneration and research funding better in their current employment outside the EU than inside the EU. Subsequently, these are also important reasons why EU researchers move outside the EU. Improvements to the EU research system in this respect could thus also help keep EU researchers within the EU research system.

Figure 60: Comparing factors important for EU researchers to move abroad with their previous EU experience change title



Source: MORE2 Extra-EU mobility survey (2012)

Furthermore, EU researchers who want to return after a mobility experience outside Europe experience difficulties related to the following job aspects: finding a suitable position (including a position for the spouse), obtaining funding for research, and maintaining current levels of remuneration.

10.3.2 Extra-EU survey: non-EU researchers

Non-EU researchers who moved to the EU faced administrative/formal difficulties: obtaining a work permit, language, finding accommodations and finding a job for the spouse.

The difficulties faced when moving to the EU appear to be similar among US, Australian, Turkish, Brazilian and Russian researchers. For Turkish researchers, obtaining a visa or work permit was a larger barrier than for the other nationalities. Language was also more frequently a difficulty that Australian and Brazilian researchers faced when being mobile towards the EU while Russian researchers faced most difficulties when looking for accommodation. A comparison with other countries is not meaningful given the small number of observations (n<30).

10.3.3 Stated choice experiment

Another relevant source to answer this research question is the stated choice experiment, included in the EU HEI survey. This experiment shows that what countries need for attractive ESR jobs are career perspectives and research autonomy, early independence with a career path purely dependent on research performance and on nothing else. Such careers are more easily realised within department-style universities rather than in the chair-based system.

Attractive LSR jobs have a higher material component and salaries matter more; LSR want attractive grants systems, little administrative burden and ease of starting new lines of research. Both ESR and LSR jobs require a fair balance between teaching and research. The different European countries differ a lot with regard to their system of higher education and in terms of the possibilities for universities to offer attractive and competitive jobs.

It is safe to say, however, that reform in many EU countries requires structural changes to research organisations and career paths as well as long-term funding increases. Current trends in the US (declining funding, restrictions on visas...) should be used to initiate a change in fortune.

10.4 How does this compare to the non-EU research environment?

10.4.1 Extra-EU survey: non-EU researchers

We can explore the attractiveness of the EU and non-EU research environments for non-EU researchers by comparing their motives for mobility:

- Quality of life, career progression and working with experts are important motives for non-EU researchers moving to Europe.
- Mobility of non-EU researchers to other parts of the world is mainly driven by research autonomy, availability of facilities and equipment, working with experts, career progression and availability of research funding.

The motives for mobility are thus different when it comes to quality of life (attractive aspect of EU environment) and research autonomy, availability of facilities and equipment, and research funding (attractive aspects of non-EU environment).

Another way to explore the attractiveness of the EU research environment is to look at the effects of EU mobility and non-EU mobility:

- Non-EU researchers who moved to Europe more frequently indicated a positive effect of mobility on the numbers of co-authored publications, higher recognition in the research community and a higher quality of life than those who moved to non-EU destinations
- Non-EU researchers who moved to non-EU destinations more frequently indicated a positive effect of mobility on the citation impact of publications, advanced research skills, job options in and outside academia, and overall career progression than those who moved to the EU.

Part 3 OVERALL CONCLUSIONS AND POTENTIAL POLICY IMPLICATIONS

1 INTRODUCTION

In the third and final part of this report, we synthesize results, processes and lessons of the entire project into methodological considerations (section 2, p.197), the key findings embedded in a broad theoretical context (section 3, p.202), potential policy implications (section 4, p.216) and suggest a number of topics for further research (section 5, p.219).

2 METHODOLOGICAL CONSIDERATIONS

To collect the type and level of detail of information that the MORE2 project aimed for resulted in several methodological challenges. Each time, the approach was adapted to the specific purpose and method and aimed to optimize the quality and quantity of the data. Overall, the resulting datasets and indicators prove to be of high quality and reveal a richness which allows us to formulate answers to the main research questions as in Part 2 of this Final Report. However, we draw a number of lessons from the different processes that led to the methodological considerations described in this chapter.

2.1 Related to the EU HEI survey

2.1.1 Data collection process

The multichannel approach in the EU HEI Survey, combining the CATI and CAWI to collect information, has proven to be the right approach, with high and balanced response as a result. The approach allowed correcting for differences in time zones or working schedules, holiday periods and language issues to a large extent.

On the other hand, it is recommended that the processes are planned sequentially (CAWI before CATI) rather than simultaneously. The simultaneous set-up, implementation and data collection processes lead to substantial coordination efforts.

Another recommendation would be to implement both CATI and CAWI through the same platform in order to increase efficiency during the set-up process.

Finally, the timing of the survey partly interfered with summer breaks at HEI, which required additional efforts to increase response rates and find new sources.

2.1.2 Sampling strategy

The sampling strategy for the EU HEI survey has led to the desired results of accurate measures at country level for the key indicators on mobility. On the other hand, the experience of the MORE2 surveys of both the EU HEI researchers and Extra-EU researchers entail a number of suggestions on how to increase quality of estimates and information gleaned from surveys on researchers. We shed light particularly on modalities to increase response rates and to increase the quality of the frame of the target populations. Though the lack of auxiliary information is still a barrier to enlarge the scope of the surveys in terms of target population, some lessons are considered useful as recommendations in future surveys.

2.1.2.1 EU HEI survey target population and stratification variables

The lack of a register of researchers is the main obstacle to manage a generalized survey. In the MORE2 project, this barrier was overcome through the integration of sources such as EUMIDA with the MORE1 data.

The inclusion of researchers in the private sector is still problematic as there is no inclusive information available on these researchers and the private sector treats this information as private. However, in the future and with supplementary

efforts, researchers in the main public research organizations could be included into the scope of the survey.

Furthermore, a number of stratification variables such as the career stages (R1-R4) and the EU versus non-EU origin of the researchers would potentially increase the degree of precision of the resulting estimates. Nevertheless the lack of auxiliary information on these variables for the majority of countries is still a barrier to any improvement of this kind.

2.1.2.2 Supplementary survey strategy

A supplementary survey was carried out to add to the EU HEI survey. The questionnaires included only 3 questions on the key issues of mobility based on yes/no answers. High response rates were recorded, even though they were solely managed through web based collection. The implementation of this supplementary survey therefore shows other opportunities and suggests a different strategy for the future. For example, a preliminary email survey on the key issues (up to 5 items) can be launched in order to have high response rates for key topics (and low self-selection effects). After this initial survey and only in a second step, the large and detailed survey - based on the multichannel approach with CATI and CAWI - can be launched with the main goal to acquire more detailed information of the researchers who responded and to acquire additional information on critical strata. This strategy may ensure a lower bias due to low response rates and a focus on the key topics.

2.1.3 Panel strategy

The survey on mobility created a sample of respondents (more than 10,000 units) that can be assessed as a panel population to survey again in order to collect also dynamic information on some key issues (e.g. career progress, working conditions and mobility). In this case, the information coming from MORE2 will be the benchmark for calculating estimates. The adoption in a future survey of the MORE2 respondents as panel will increase response rates though it will most likely also mean a decrease of total observations and information due to the outflows of researchers from the reference population.

2.1.4 Retrospective items and comparison with Extra-EU survey

The EU HEI survey could furthermore include some retrospective information on the researchers in order to increase matching and comparing with the Extra-EU survey. Some subpopulations of the HEI surveys are also equally relevant to the Extra-EU survey and additional information on the recent past could help increase the number of observations for analysis in the Extra-EU chapter.

2.2 Related to the Extra-EU survey

2.2.1 Sampling strategy

The lack of auxiliary information for the subpopulations of the extra EU mobility survey is a barrier to select samples that can be considered representative. Even though some auxiliary information is available or specific countries (e.g. visas in the US), it is not realistic to provide accurate estimates.

The suggested integration with the HEI survey may help to increase information for two subpopulations (out of four) of the Extra-EU mobility survey, namely:

- EU researchers currently working outside the EU

The HEI survey may include also Extra-EU survey items for EU researchers who returned from outside the EU in the last 3 months. In this case, their information is a proxy of the population outside the EU during the survey period.

- Non-EU researchers who have previously worked in the EU

In this case, the Extra-EU survey could also integrate additional items from the EU HEI survey, namely non-EU researchers that currently work in the EU.

For both groups, this information is collected and gathered in the EU HEI survey, but not integrated fully in the Extra-EU analysis.

2.2.2 Panel strategy

Although there is a lack of auxiliary information for the subpopulations of the extra EU mobility survey, the sample of Extra EU survey could also be assessed as a panel in order to define a benchmark and to estimate variations over time for some key features.

2.2.3 Statistical comparison mobility attitude of EU and non-EU researchers

Another suggestion would be to survey the group of non-EU researchers who have never previously worked in the EU (both mobile and never mobile) according to an aprioristic scheme aimed to increase the information coming from the more relevant countries balanced to reach a proportion of career stage, field of study and genre equivalent to EU average (results of MORE2 can be the benchmark). The aim would be to compare the attitude to mobility under the hypothesis of equivalent population characteristics - the research question being whether the researchers' population in non-EU countries has the same features as the EU researchers, on average, with respect to the attitude to mobility.

2.3 Related to the case studies on career paths, working conditions and remuneration

The experience with the data collection set-up, including country correspondents covering all countries and filling in the online tool as input for the country fiches is twofold.

On the one hand, this was an efficient set-up to collect information in a very broad geographical range, on a very broad range of topics and with a high level of detail. This has been a unique exercise and delivers a rich and extensive set of information in the field.

On the other hand, the data collection process did not include a full validation of the information by means of a second expert validation, for example. Even though the experts were selected with care and all show relevant references in the field for their country, this means that the information cannot be presented as validated and representative. This type of validation process was outside the scope of the project, while the focus was on the collection of this large and detailed set of information.

However, by integrating the fiches in the validation process of an existing initiative which addressed the Steering Group on Human Resources and Mobility for validation, it was possible to verify the factual information in the remuneration fiches and receive feedback on the fiches on career paths and working conditions. It is important to take into account that this was not a full validation process, but does allow for identification of potential issues and correction/omission of critical contradictions. This process thus further increases the reliability of the findings.

As a recommendation for future research, we could suggest inclusion of a formal validation in the process, particularly for a limited set of key topics to focus the efforts. Another option is to select a team of more than one expert per country to implement the 'four-eye-principle' and increase reliability without the immediate need for further validation.

Finally, we would like to highlight that the experiment collecting information on which job positions the universities would offer a researcher with a standardized CV profile could be a good way to procure comparable data across countries in future data collection exercises. Without the university-specific parts asked in this project, the questionnaire is short enough to allow the respondent to complete it in a short period of time. Therefore, we would like to recommend this experiment for further studies in order to construct an index on the remuneration of university researchers. The major advantage of this index lies in its comparability across countries and it could be easily reconstructed every year (or with another frequency). When the survey includes a broad set of universities, the index could easily become representative and other research fields could also be included. The experiment using standardized CVs carried out in this report has been a good pilot exercise for a potential future indicator on the comparability of researcher remuneration across countries.

2.4 Related to the Researcher Indicators

Most of the data for the Researcher Indicators were available from official sources and others were obtained from the collection process through specific surveys realized within the MORE 2 project. This last source of data in particular should be considered as a basis for the systematic collection of data on specific aspects of the research profession. However, a number of issues were encountered during the data collection to update existing indicators and to propose new ones. These issues can be grouped into three categories: outdated, missing or differently defined data.

The first issue occurs because in a number of countries, information is outdated. In this case we used the latest available data. This is also applied, where possible, when data are completely missing. For example, the number of European researchers currently employed in countries outside EU27 is not available. Data used refer to the year 2000 and have been extracted from the OECD immigration database. In as far as the outdated or entirely missing data are concerned, we would suggest that the data that are needed to construct the key indicators are registered on a more regular basis in order to provide a more detailed and updated picture of the research system.

The third problem relates to the comparability of the data, specifically in Indicators 4 and 5. This issue is due to the fact that some of the EU27 countries allow students to enrol for two or more degrees at the same time, which results in the fact that, when collecting data for graduated (ISCED 5 and 6) for those countries, the number of graduates might differ from the number of graduations. Another problem of comparability relates to the different definition of "foreign students" that countries adopt. This is a very well-known problem for all of those working migration issues. More thorough coordination among national statistical institutions is necessary in order to consistently define a foreign student (or person).

2.5 In summary

Generally in the MORE2 project, consistency between work packages was strived for in all phases of the project and across all work packages. Definitions were agreed upon in the initial stages and continuous interaction has avoided divergence in the course of implementation. The conceptual framework has been the umbrella structure for all work packages, further enhancing consistency and efficacy.

One recommendation for the overall project methodology would be to build on the substantial samples of the surveys to implement a panel strategy with an additional time-component. Where the interpretation of differences between career stages requires necessary caution (e.g. does the researcher speak of events taking place in the career stage he is currently in or before? Can we interpret differences between current career stages as evolutions?), adding a time scale would allow for more in-depth analysis of these kind of developments in the working conditions and mobility behaviour of researchers.

3 KEY FINDINGS IN A THEORETICAL CONTEXT

The Executive Summary to this report gives an overview of the key findings and conclusions from all MORE2 work packages. In this section, we put the key findings in the context of the theoretical literature on the respective topics of the career paths of researchers; working conditions; international research collaboration, visits and virtual mobility; motives for researcher mobility; barriers for mobility; effects of mobility; the flows of researchers and the attractiveness of popular destinations.

3.1 Career paths of researchers

In the research literature, researcher career paths are described as differing according to particularities of national research systems, the functioning of national labour markets for scientists, and disciplinary cultures and features. Typically, peers have a decisive influence on recruitment and careers; promotion occurs through the ranks and is based upon research performance. There is considerable variation between the length of the different vertical stages and the number of hurdles which exist to move researchers from one stage to another.

Several studies point out how recruitment and promotion procedures, remuneration, workloads, career paths and working conditions differ considerably from one country to another⁸⁶. MORE2 confirms such diversity across Europe. As sections 3.1.1 (Part 2, p74) and 3.2.1 (Part 2, p90) show, research paths are highly atypical, non-linear, involving both short-term and long-term contracts, linked with non-academia, dual positions, etc. Academic careers develop in stages but they are not comparable in all countries because at the first career stage it already appears that doctoral education or early research training phases are organized differently in different countries. Moreover, as the cluster analysis in section 0 (Part 2) reveals, a notable variation is the degree of HEI autonomy in setting employment conditions. Another notable difference is the predominant career stages at which independence in terms of pursuing ones' own research agenda and employment security is reached. Countries also differ in terms of the financial rewards offered to climb the career ladder, and the impact of disciplinary conditions. The characteristics typical to the identified clusters have a bearing on the sequence, timing and likelihood of academic careers, but the geographic locations of the countries classified in the clusters do not show any meaningful pattern.

Studies on careers assume a relatively linear path, emphasizing vertical progression through positions which have increased responsibility, work complexities and rewards. This corresponds with definitions of vertical success: climbing the corporate pyramid, more attractive working conditions and higher remuneration. From this perspective, progression is based on frequent upward moves entailing international mobility. However, in the literature on careers we observe a major shift away from this traditional conceptualisation of careers towards more 'protean' types of careers involving more flexible and mobile patterns⁸⁷. The results of the MORE2 project confirm this new tendency. In fact, as section 0 (Part 2, p76) shows, not only most of the R1 and R2 researchers are awarded temporary contracts (91% and 80%, respectively), but a non-negligible proportion of R3 and R4 researchers are also awarded these type of contracts (33% and 16%, respectively).

⁸⁶ Farnham, D. (2009): Employment Relations in Europe: a Comparative and Critical Review. In: Enders, J./ de Weert, E. (eds.): *The Changing Face of Academic Life. Analytical and Comparative Perspectives*. Basingstoke: Palgrave Macmillan. p: 195-217.

⁸⁷ Hall D.T. & J.E. Moss (1998). The new protean career contract: Helping organizations and employees adapt. *Organizational Dynamics*, 26(3), pp22-37.

Career models can broadly be distinguished between the 'chair' and the 'department-college' model. In the 'chair' model, there is a sharp distinction between the professoriate holding tenured positions as chair-holders and the large group of other (untenured) academics. The latter go through a rather long contract-style career based on a series of fixed-term appointments after obtaining a stable post. Professorial appointments are seen as big jumps in status, prestige, independence and resources. In the departmental-college model, career progression is regulated more on the internal labour market within the tenure track. Academic faculty from lower ranks to professors essentially have the same tasks, so admission into the regular staff structure of tenured positions comes earlier and further career steps within academia are set more regularly. Academics are eligible for a tenure-track position relatively early on, when they have the opportunity to demonstrate that they are good enough to obtain tenure. The phenomenon of the tenure-track is becoming more accepted in European research systems. **The MORE2 project confirms this trend. In section 0 (Part 2, p76) it shows that although only very few countries offer tenure-track options to early career researchers, more than 70% of the R3 and R4 positions are offered with the tenure track options.**

The balance between internal and external labour markets is also an important factor determining career paths. Labour markets are understood in terms of recruitment procedures, processes allocating individuals to positions and organising career paths. Within internal markets, career trajectories take place within a HE institution where rules and incentives are the determining factors. In external labour markets, career development is dependent on the success in being hired for vacant positions in institutions other than one's own. This balance is not necessarily determined at national level, but can lead to institutional or faculty differentiation within one system, depending on the position of the institution in the national and international market as well as in terms of its history and culture. Some institutions mainly play on the external labour market via international recruitment, while others are linked more to the internal labour market. Science and engineering faculty generally seems to be linked more with the external labour market than other disciplines. **The MORE2 study touches upon the recruitment procedures in section 3.3.1 (Part 2, p95) and finds that around 60-66% of researchers are 'satisfied' with the levels of openness, transparency and the degree of merit-based recruitment at their institution.**

Finally, in recent years, changes to the structure of doctoral education are now underway across Europe and will contribute to the harmonization of researcher careers throughout Europe. In fact, there is no longer any question of whether or not Bologna reforms will be implemented, but rather a shift to consideration of the conditions in which implementation is taking place^{88;89;90}. **MORE2 shows this trend in section 3.1.4 (Part 2, p84). It shows that more than half of PhD candidates and recent PhD holders have received 'structured training' during their PhD (51%). Moreover, it shows a 9 pp difference between R2 doctorate holders (47% received training) and current PhD candidates (56% received training).**

⁸⁸ CHEPS (2002): Science, Training and Career. *Changing modes of knowledge production and labour markets*. Enschede: University of Twente; Crosier, D. et al. (2007): Trends V: Universities shaping the European Higher Education Area. European University Association AREA. Available at: www.eua.be

⁸⁹ The iFQ has initiated a longitudinal survey on doctoral candidates (ProFile – Doctoral Candidates Panel). The project started by addressing the question of whether the introduction of structured doctoral programs at German universities is changing the career patterns of doctorate holders. For further information see:

http://www.research-information.de/Projekte/ProFile/projekte_profile_lang.asp

⁹⁰ The European Commission, DG Research and Innovation, has launched a study with the purpose of exploring the implementation of the Innovative Doctoral Training Principles in Europe in order to identify good practices and recommendations to improve further implementation.

3.2 Working conditions for researchers

The MORE1 study has shown that 'good working conditions' are a very important influencing factor for researchers' job mobility⁹¹. The MORE2 project confirms this claim. As section 0 (Part 2, p116) shows, almost 60% of the respondents point out that working conditions are important motives for both intersectoral and geographical mobility. Furthermore, section 7.1.1 (Part 2, p156) shows that 63% of PhD degree mobile researchers in current R1 and R2 career stages, 56% of researchers who have been >3 months mobile in the EU in post-PhD career, 64% of non-EU researchers who have been to the EU, and 70% of EU researchers currently mobile outside the EU, find that working conditions are important for their mobility decision.

Aside from national funding and performing systems, country-specific forms of employment structures also have an impact on researchers' working conditions. The employment structure defines the social security / pension provisions as well as the researcher's employment status, i.e. the different legal status of researchers (civil servant vs. employee status)⁹². As sections 4.1.1 (Part 2, p101) and 4.3.1 (Part 2, p107) report, although civil servant positions are rarely offered to doctoral candidates, in more than half of the countries R3 and R4 researchers are potentially employed as civil servants, while in the non-EU countries, in particular in the other non-EU European countries, these roles are less frequent. According to Farnham (2009), the role of researchers as civil servants is imbued with duties of loyalty to the state in return for high social status, (relatively) high remuneration and job security.

A multiplicity of studies relates a researcher's working conditions to type of contract (full-time vs. part-time) as well as to the length of contract (fixed-term vs. permanent)⁹³. According to the MORE2 project, section 4.3.1 (Part 2, p107), in the EU today, almost all countries provide permanent contracts at full professor level (R4). Estonia and Latvia are the only EU countries having fixed term contracts (more than 4 years) for their R4 researchers. On the other hand, doctoral candidates have permanent contracts in only two EU countries (Poland and Romania). As section 0 (Part 2, p76) shows, in countries where stable working conditions can be obtained at an earlier career stage, researchers tend to be younger when they obtain their first permanent position.

Another important factor found in the literature to account for high levels of job satisfaction, and hence for 'good working conditions', is remuneration. The MORE2 project found that, as shown in section 4.3.2 (Part 2, p111), job choice increases with the level of salary up to a threshold which is around €45,000 across all early stage researchers (ESR) and female ESR. Yet for male ESR and later stage researchers (LSR) looking back in their career, job choice increases in relative frequency up to a level of €55,000. When analysing best paying countries by position in section 4.3.1 (Part 2, p107), it appears that although the US universities pay relatively low amounts for R1 level researchers (both in terms of stipends but also to less extent in terms of salaries for employed doctoral

⁹¹ European Commission (2010): MORE. Study on mobility patterns and career paths of EU researchers. p: 99.

⁹² Farnham, D. (2009): *Employment Relations in Europe: a Comparative and Critical Review*. In: Enders, J./ de Weert, E. (eds.): *The Changing Face of Academic Life. Analytical and Comparative Perspectives*. Basingstoke: Palgrave Macmillan. p: 195-217

⁹³ e.g.: Enders, J. (ed.) (2001): *Academic staff in Europe. Changing Contexts and Conditions*. Westport, Connecticut/London: Greenwood Press; Kreckel, R. (ed.) (2008): *Zwischen Promotion und Professur. Das wissenschaftliche Personal in Deutschland im Vergleich mit Frankreich, Großbritannien, USA, Schweden, den Niederlanden, Österreich und der Schweiz*. Leipzig: Akademische Verlagsanstalt

candidates) the higher the career level is, the higher the PPP converted salaries are in the US in comparison to all other countries.

When comparing the country groups, the results show that given the high degree of heterogeneity in the salary ranges paid inside the EU, the non-European countries covered in this survey pay, on average, higher salaries in all categories. An outlier in this group is China. However, even taking into account the effect it might have on the averages in the group of non-EU countries, the average salaries across all career stages (R1-R4) are higher in this group than in the EU by 13 to 20 percentage points. When comparing EU countries with European countries that are not EU members, the average salary levels are quite similar. However, the average of the group of other European countries is mainly driven by Norway and Switzerland. When comparing the EU with all non-EU countries, gross annual salary levels are lower by between 4 and almost 7 percentage points across the career stages.

Europe, to a large extent, is also faced with a chronic gender imbalance in terms of working conditions among scientists. The proportion of women entering the higher education system increasingly exceeds that of men, but women are still outnumbered by their male counterparts in more highly ranked positions. There is an increasing drop-out rate of women as they climb higher up the research career ladder – a period which often coincides with the phase of having children. MORE2 confirms this. Other gender differences found include: 91% of men work full-time against 86% for women in EU27; female researchers are generally less satisfied with the recruitment process (between 6 and 9 pp difference with their male counterparts). After opportunities for advancement, women are also less satisfied with mobility perspectives (6 pp difference with male researchers), job security (6 pp difference) and salary (5 pp difference).

Working conditions for early-stage researchers and doctoral candidates differ considerably within national research systems, particularly in terms of the institutional framework (fellowship vs. salary, remuneration, teaching and administrative load).⁹⁴ MORE2 shows in section 0 (Part 2, p76) that with regard to the type of contract and whether or not positions are provided with a tenure-track option, early career researchers are the ones facing most uncertainty. In most countries early researchers are primarily employed on temporary, short term contracts. Only very few countries offer tenure-track options to early stage researchers.

As Sorensen (1992) pointed out, it takes longer to qualify for a permanent position in academia than is the case in other sectors, because the performance and productivity of a candidate are more difficult to measure and to judge. Following from this idea, an early career researcher becomes a permanent member of the academic profession if he or she is evaluated as someone who has the potential to be highly productive and perform well in the future. However, countries differ in how they organize this evaluation process. But as a general rule, it is assumed that academics who are evaluated positively secure a position with a permanent contract and/or a tenure-track-option and that this position is not challenged by a dependency on competitive funding. As can be seen from section 0 (Part 2, p76), only a few countries offer stable employment conditions at the early stage of the early career researchers. Most countries in the sample offer stable working conditions for researchers from R3 career stage onwards.

⁹⁴ For an overview on national specifics of doctoral education see: Maresi, N./ Heggelund, M. (ed.): *Toward a Global PhD? Forces & Forms in doctoral education worldwide*: Washington: Washington Press 2008.

3.3 International research collaboration, visits and virtual technology

Part of the analysis of research careers and mobility involves international research collaboration. The MORE1 survey samples show that researchers are increasingly collaborating with those from other countries, with a higher concentration of internationally mobile researchers among the 'academic' researchers who collaborated with researchers in other countries (62% against 56% in the entire sample). Moreover, MORE2 shows in section 5.3.1 (Part 2, p145) that researchers who were >3 month mobile, both in the last ten years or before, are also more inclined to undertake <3 month mobility than the never-mobile. This confirms the findings based on the CDH 2009 data (OECD working paper on micro data, 2012) that international mobility during the last ten years has a positive effect on international collaboration.

Collaboration can take many practical forms, such as visits or the use of virtual and web-based technologies. The interlinkage with mobility is important but not well documented to date. Increasingly, empirical studies and the academic literature more generally are shifting towards the effects of research collaboration but also its impact on researchers' mobility. The conceptualization of "virtual mobility" as a type of (international) mobility (and not as an outcome of research as is commonly meant) is an interesting and relatively unexplored notion. Although one can intuitively argue that while virtual (electronic) access to research resources or the informal exchange of data between individuals located in two different countries is intrinsically embedded in every research process and therefore should/could not be observable, formal international research collaboration on the production of ideas (co-authorship), products (joint ventures, prototypes, patents) or services (outsourcing, consultancy) leading to actual knowledge exports could, in fact, be of particular interest as a worthwhile area of study. New technologies enable researchers in many fields to gather data remotely, reducing the need to spend extended periods of time in host institutions. Only shorter periods, where researchers operate in a 'shuttle' fashion, would suffice for discussion of projects or findings, thus combining physical mobility with other modes of virtual communication⁹⁵. Inzelt⁹⁶ also states that "virtual mobility is increasingly taking precedence over other forms of mobility". The MORE2 project is pioneering in terms of exploring this aspect. Section 5.3.1 (Part 2, p145) shows that virtual mobility is increasingly conceived as an additional tool in international research collaboration and new technologies enable researchers in many fields to collaborate with foreign researchers without the necessity for travel. 50% of respondents reported that virtual technologies in international research collaboration helped to reduce (or even replace) their short term visits (of less than 3 months). In contrast, only 9% think that it helps to reduce (or replace) their long term visits (3 months or more). Virtual mobility has an enormous potential impact. It adds a new dimension to researcher mobility alongside international travel, and can further broaden our definition and understandings of mobility.

⁹⁵ Ackers H. L., Gill B., 2008, *Moving People and Knowledge: Understanding the Processes of Scientific Mobility within an Enlarging Europe*, Cheltenham, Edward Elgar.

⁹⁶ Inzelt A., Analysis of Researchers' Mobility in the Context of the European Research Area, Evaluation FP7 as supporting expert.

3.4 Motives for researcher mobility

Several studies have examined mobility patterns and the underlying motives of researchers. Ackers (2008)⁹⁷ identifies the existence of scientific networks, individual motive, and willingness to take risks as being the most important factors for mobility. Increased professional autonomy, transparency of employment procedures, the existence of career systems and financial benefits are also important motivating factors. In investigating factors influencing job mobility, the MORE1 survey addressed issues related to professional factors such as job satisfaction, and good working conditions/climate. Personal factors included good work-life balance; job changes of partner/life satisfaction of partner; maintaining family and personal relationships and life satisfaction of children.

It has been traditionally argued that “push factors” include the scarcity of employment opportunities in the national S&T system and (expected) income differentials between what can be earned abroad with respect to the earnings at home; the lack of financial resources and funding system in general (moving from one small research grant to another); limited research facilities and equipment; and limited opportunities for postgraduate education. However, MORE2 partially rejects some of these claims. In fact, section 7.1.1 (Part 2 p156) shows that remuneration is an important motive for mobility, but only for the PhD candidates and not for the more experienced researchers; and job security is not significantly important for any of the researcher profiles surveyed. This pattern differs among type of mobility profiles, however. In fact, sections 0 (Part 2, p159) and 0 (Part 2, p160) show that both non-EU researchers who have been to the EU regard remuneration as a relatively unimportant reason for their most recent EU move and EU researchers currently mobile outside the EU think it an important reason for their most recent non-EU move.

MORE2 shows in section 7.1.1 (Part 2 p156) that career progression is the factor most frequently identified as being an important motive for international mobility, followed by access to leading experts, facilities and equipment, available funds and positions. There is a similar emphasis on research and career-related motives in both PhD degree mobility and post-PhD mobility. When the move includes a change of employer, the availability of positions becomes more important, and working with leading experts less so.

In general, an important factor determining the motives for international mobility is the career stage of the researcher. The importance attached to varying motives during different career stages reveals changing priorities. R2 and R3 researchers primarily seek availability of funds and positions to increase job security. For R2 researchers, career progression and remuneration are also important motives for post-PhD mobility.

In the research literature, personal characteristics are also found to be important for mobility decisions. It is commonly argued, for example, that decisions to go abroad are often motivated by opportunities to improve the lives of family members - particularly educational opportunities for children. Factors involved when deciding whether to stay or to return to the home country include family concerns such as having parents at home and attitudes of spouses or partners⁹⁸. A study among Chinese migrants shows how career pathways follow international businesses linked to their families and family networks⁹⁹. Other reasons include

⁹⁷ Ackers, L. (2008). Internationalisation, mobility and metrics: A new form of indirect discrimination? *Minerva*, 46, 411–435.

⁹⁸ Carr, S. C., K. Inkson, et al. (2005). "From global careers to talent flow: Reinterpreting 'brain drain'." *Journal of World Business* 40(4): 386-398.

⁹⁹ Granrose, C. S., & Chua, B. L. (1996). Global boundaryless careers: Lessons from Chinese family businesses. In M. B. Arthur, & D. M. Rousseau (Eds.), *The boundaryless career: A new*

issues such as personal preferences and aspirations, interest in particular countries, (social, cultural, political) curiosity in understanding other cultures, and personal histories or past experiences in foreign countries, which can be complex and highly individual: whether a researcher has developed intensive international relationships, previous stays abroad for study or personal travel in the past, participation in Erasmus exchange programmes, involvement in international research projects, personal contacts gained during conferences etc.

MORE2 researched some of these issues empirically and found that, as stated in section 7 (Part 2, p155), personal/family issues are relatively important across the different profiles researched - except for PhD mobility. It matters more for non-EU researchers coming to Europe than for EU researchers going abroad who, in turn, tend to value remuneration relatively more than do non-EU researchers. It does not matter too much when considering a change of employer. Researchers living in a couple attach more importance to all aspects, with the exception of career progression, and the variable with or without children does not really matter.

As discussed earlier, the career stage of the researcher largely plays an important role. Reasons to embark on a period of international mobility also differ somewhat according to age and marital status. However, and contrary to common understanding, MORE2 shows that gender per se does not play an important role in explaining mobility decisions but that mobile women in post-PhD career stages to EU destinations consider most of the motivational aspects to be more important than do men (section 7.2.1 - Part 2, p162). Women are more motivated by available funds (10 pp difference between female and male researchers); career progression (+9pp); culture (+7pp) and available positions (+6pp). This pattern follows that of the R3 and particularly R2 researchers, as female researchers are more highly represented in earlier career stages.

Regarding the “pull factors” among the EU27 Member States, there are important differences in terms of their attractiveness for researchers and doctoral candidates. MORE2 shows that main destination countries for EU researchers are the United States, the United Kingdom, Germany, France and Italy. Historical, cultural or linguistic links also strongly determine mobility flows. When considering bachelor, master and PhD mobility, the preferred timing of the researchers to move varies across destinations is as follows: MORE2 finds evidence that mobility to the United Kingdom and Ireland takes place before the PhD stage whereas other countries like the Scandinavian countries, Germany, France or Italy attract researchers mainly during the PhD stage.

employment principle for a new organizational era (pp. 201–217). Oxford: Oxford University Press.

3.5 Barriers to researcher mobility

A report to the EC DG Research and Innovation drafted by a consortium led by IDEA consult in 2004¹⁰⁰ presented evidence on the main factors inhibiting the mobility and career development of researchers in Europe. The study focused on unsatisfactory arrangements and practices concerning social security schemes including statutory and supplementary pension rights and unemployment benefits; unattractive employment conditions; the lack of competition-based internationally open recruitment; the lack of recognition of mobility in recruitment and career development; a lack of trans-national portability of grants/funding; a lack of adequate training and skills development for researchers; lack of funding for mobility; salary; quality and cost of accommodation; personal relationships; child care arrangements; immigration rules; and the nature of contracts. These factors were defined as the result of policy and scholarly debates at EU level and were investigated using a survey administered in eight European countries, which yielded 3,365 valid responses. Based on this analysis, all the aspects identified have a significant part to play in explaining different characteristics and responses obtained from the sample.

In the study published by Ivancheva & Gourova (2011)¹⁰¹, evidence was found referring to the following discouraging factors: family and other personal connections; complex administration of relocation (e.g. formal/legal issues, social and health insurance; employment permit, housing, transportation, etc.); lack of support from home institution (e.g. fear of losing current position, duties at home institution, etc.); lack of available research job opportunities abroad/fellowships for stay abroad; lack of information/uncertainty; language barriers; cultural barriers; age limitations and adaptation problems; and financial problems. Some factors were important for respondents from some countries but not for others.

In investigating practical/personal factors influencing international mobility, the MORE1 study¹⁰² focused on the social security system; the administrative barriers for migration; language; quality and cost of accommodation; child care arrangements; permission for partner to work and social integration at host country. Professional factors observed in MORE1 included obtaining funding, and maintenance of professional and personal network of contacts.

Finally, a recent public consultation on the challenges facing the European Research Area¹⁰³ investigated the following barriers: portability of publicly funded grants; lack of resources to support mobility; lack of diffusion and transparency of recruitment procedures; complexity of immigration rules and procedures; lack of autonomy of universities and research institutions to recruit researchers and set wages; high administrative burdens to settle in a host country; lack of information on social security and pension rights and difficulty of getting recognition for diplomas from other countries. Other factors identified by the study of factors which hamper mobility included fragmentation of the information and procedures to access to mobility grants; lack of harmonization and difficulty in the transferability of social benefits such as retirement and medical and disability benefits, lack of harmonization of the research careers taxonomy; attractiveness; skills; gender balance; disability and mobility. The study refers to progress made

¹⁰⁰ Rindicate (2008), Evidence on the main factors inhibiting mobility and career development of researchers, Brussels.

¹⁰¹ Ivancheva, L. and E. Gourova (2011). "Challenges for career and mobility of researchers in Europe." *Science and Public Policy* 38(3): 185-198.

¹⁰² IDEA Consult et al. (2010) Study on mobility patterns and career paths of EU researchers. FINAL REPORT.

¹⁰³ EC DG Research and Innovation (2012). Areas of untapped potential for the development of the European REsearch Area (ERA). Analysis of the response to the ERA Framework public consultation.

recently in the EU regarding the efforts towards the harmonization of research careers across countries led by SGHRM.

The MORE2 project provides new insights for the understanding of the barriers to mobility. As section 8 (Part 2, p166) shows, it appears that a) barriers are ranked very similarly for mobility during PhD or in post-PhD career stages: obtaining funding for the mobility/research is the most frequently cited barrier for both PhD mobility (by the non-mobile) and post-PhD mobility (by the mobile and the non-mobile); b) larger differences are observed between barriers experienced during mobility (mobile) versus barriers preventing mobility (non-mobile): Personal and family reasons are particularly important as barriers to the non-mobile in post-PhD career stages. This barrier is higher for non-mobile researchers with children than for those without children; c) women perceive more barriers to their last move in all areas than their male counterparts. In particular, the female non-mobile researchers indicate funding issues as more important in preventing mobility; d) perceived barriers are also determined by the career stage of the researcher: R3 researchers do not seem to experience many barriers, particularly when compared to those in lower career stages; and e) main barriers to mobility to the EU by non-EU researchers include language, obtaining a visa or work permit and finding adequate accommodation.

Regarding gender, it is commonly thought that men tend to have left the country during an earlier career phase than women, which is suggestive of women's slightly more cautious approach to international migration. Avveduto et al (2004)¹⁰⁴ noted that women are underrepresented in international mobility, referring to the general notion that women still adhere to the stereotype of having to choose a career or a family. It is possible that the many initiatives taken both at national and international levels will reverse this trend. However, Avveduto suggests that even when the increasing participation of women in higher education and the growth of women in S&T subjects are taken into account, the issue of international mobility remains biased towards male researchers. This questions how the gender factor varies with employment conditions and motivational factors.

MORE2 also researched these issues. It shows in section 5.2.2 (Part 2, p125) that a) the share of currently mobile female researchers is similar to that of currently mobile male researchers; b) the share of PhD degree mobile female researchers in R1 or R2 career stage is below that of their male counterparts (13% versus 18%); c) the share of female researchers mobile in R1 or R2 career stage who were mobile for a limited period during their PhD is similar to that of their male counterparts (18% versus 19%); d) female researchers are less inclined to >3 month international mobility in post-PhD career stages during the last ten years, as compared with their male counterparts (25% versus 34%). The gap is greater for those at the higher career stages: 7 pp difference in R2, 10 in R3 and 11 in R4. Together with the observation that a gender gap concerning >3 month mobility is nearly non-existent during the PhD phase, this may point towards an improvement of the mobility gender gap over time; and e) no real variations between the fields of science or gender are observable for employer mobility, although female researchers are slightly more inclined towards employer mobility than their male counterparts (44% versus 39%).

¹⁰⁴ Avveduto, S. (2004). International Mobility of PhDs. National Research Council. Rome: Institute for Studies on Scientific Research and Documentation.

3.6 The effects of researcher mobility

In principle, researchers' mobility implies both positive and negative effects, both for the individuals themselves and for their families, as well as for the countries involved. Furthermore, there are also opportunity costs associated with not moving for voluntary or involuntary reasons¹⁰⁵. How do we account for the overall effects? Are benefits larger than costs? For whom? When? Why? How?

Many authors have established empirically that international mobility improves researchers' careers in the sense that it increases diversification of their research knowledge and experience^{106;107;108}. From this perspective, Van Bouwel et al. (2011)¹⁰⁹ studied survey responses from 1,576 European-born researchers with PhD degrees and found that researchers who move from Europe to North America or to another European country experience positive effects in terms of their career progression. Ivancheva and Gourova (2011)¹¹⁰ studied survey responses of 869 researchers from eight European countries and found that for 55% of the respondents, being internationally mobile contributed to improving their personal development and professional profile, including an improvement in their language capabilities and job opportunities. Ersoy and Gunel (2011)¹¹¹ studied pre-service teachers who went to Turkey through the Erasmus program. According to the authors, these students stated that "this experience helped them to improve their knowledge of different cultures, increase their self-confidence, change their world view, and become more open-minded individuals". **The MORE2 project shows that, as stated in section 9.1.1 (Part 2, p177), more than 55% of the R2, R3 and R4 mobile researchers currently working in the EU perceive that their overall career progression improved thanks to their entire mobility experience. Furthermore, 80% of the respondents perceive that their research skills improved (15% beliefs it strongly improved).**

In contrast, Cruz-Castro and L. Sanz-Menendez (2010)¹¹² question the assumption that mobility enhances the research career. Based on data from survey responses and publications of 1,583 academic scientists in Spain, they found that home-grown staff does not get tenure with less scientific merits than PhDs from other institutions, and that non-mobile careers are a strong predictor of the timing of rewards in the form of early permanent positions. They warn that their findings "must be interpreted in the context of organizational and institutional features of the Spanish academic system that promote the development of internal academic research job markets". **Interestingly, the MORE2 project supports this claim**

¹⁰⁵ Regets, M. (2007). "Brain Circulation: The Complex National Effects of High-Skilled Migration." Presentation at the OECD Committee For Scientific and Technology (CSTP) and Steering and Funding of Research Institutions (SFRI) Workshop on the International Mobility of Researchers. OECD, Paris. March 28th, 2007 Retrieved Feb. 9, 2012, from <http://www.oecd.org/dataoecd/59/57/38387715.pdf>.

¹⁰⁶ Davenport, S. (2004). "Panic and panacea: brain drain and science and technology human capital policy." *Research Policy* 33(4): 617-630.

¹⁰⁷ Van Bouwel, L., E. Lykogianni, et al. (2011). Mobility of European researchers to the US: student mobility vs. researcher mobility. Science and Technology Indicators Conference 2011 on Actors and networks in European Science. 7-9 September. E. N. o. I. Designers. Rome.

¹⁰⁸ Ivancheva, L. and E. Gourova (2011). "Challenges for career and mobility of researchers in Europe." *Science and Public Policy* 38(3): 185-198.

¹⁰⁹ Van Bouwel, L., E. Lykogianni, et al. (2011). Mobility of European researchers to the US: student mobility vs. researcher mobility. Science and Technology Indicators Conference 2011 on Actors and networks in European Science. 7-9 September. E. N. o. I. Designers. Rome.

¹¹⁰ Ivancheva, L. and E. Gourova (2011). "Challenges for career and mobility of researchers in Europe." *Science and Public Policy* 38(3): 185-198.

¹¹¹ Ersoy, A. and E. Gunel (2011). "Cross-Cultural Experiences through Erasmus: Pre-Service Teachers' Individual and Professional Development." *Egitim Arastirmalari-Eurasian Journal of Educational Research* 11(42): 63-78.

¹¹² Cruz-Castro, L. and L. Sanz-Menendez (2010). "Mobility versus job stability: Assessing tenure and productivity outcomes." *Research Policy* 39(1): 27-38.

somewhat. As section 9.1.1 (Part 2, p177) shows, almost 50% of the R2, R3 and R4 mobile researchers currently working in the EU think that their job options both inside and outside academia decreased due to their entire mobility experience (10% even think that their job options in academia strongly decreased!). Furthermore, nearly 45% of the respondents think that their progression in salary and financial conditions decreased (nearly 10% think that it actually strongly decreased). However, as shown in section 3.3.1 (Part 2, p95), it appears that all mobility profiles are relatively satisfied with their mobility perspectives, but the researchers who were >3 month mobile in the last 10 years are in the highest share (68%).

Moreover, Van Bouwel et al. (2011)¹¹³ found that mobility affects career progress and career opportunities differently, depending on the regions involved. They found that researchers who move from Europe to North America experience considerable positive effects on career progress; that mobility within Europe also has positive career effects, although the perceived effects are not as high as for North America; and that returning from North America to Europe leads to a slight loss of career opportunities. The MORE2 project deepens these results and shows in section 0 (Part 2, p182) that those who are mobile both in and outside the EU show higher levels of recognition of the effects of their mobility experience than do those being mobile only in EU and those only mobile outside EU. There are also substantially higher scores for the network effects such as recognition in the research community, and access to international contacts/network. It seems that the higher the number of research trips made to different locations both inside and outside the EU, the greater the exposure to larger groups of active researchers in different places, thus resulting in higher mobility effects. The difference in terms of job options - particularly in academia - is substantial as well as in terms of researcher's overall career progression. On comparing the other two groups, it appears that those only mobile in the EU regard their mobility effects on their career more favourably than their counterparts who are only mobile outside the EU.

In particular, international mobility is perceived as having positive impacts on researchers' productivity, both in terms of quantity and quality. Jonkers, K. and R. Tijssen (2008)¹¹⁴ studied the performance of 76 PIs in the field of plant molecular life science affiliated with leading Chinese institutions and found that international experience was a strong predictor of scientific output as measured by number of publications indexed by ISI Thompson. De Filippo et al. (2009)¹¹⁵ analysed data from 1,800 researchers affiliated with a Spanish university using an institutional database, three relevant bibliographic databases and a select number of interviews with researchers. They found that mobile researchers have higher levels of productivity and impact factor, a greater number of citations per document and a lower percentage of non-cited documents. MORE2 shows in section 9.1.1 (Part 2, p177) that the majority of the respondents saw an increase in the number of patents, an improvement in the quality of output e.g. publications, more citation impact of their publications, and in the number of co-authored publications as a result of their entire mobility experience.

¹¹³ Van Bouwel, L., E. Lykogianni, et al. (2011). Mobility of European researchers to the US: student mobility vs. researcher mobility. Science and Technology Indicators Conference 2011 on Actors and networks in European Science. 7-9 September. E. N. o. I. Designers. Rome.

¹¹⁴ Jonkers, K. and R. Tijssen (2008). "Chinese researchers returning home: Impacts of international mobility on research collaboration and scientific productivity." *Scientometrics* 77(2): 309-333.

¹¹⁵ De Filippo, D., E. Sanz Casado, et al. (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.

However, it seems that the effect of mobility on productivity varies across countries/regions. Van Bouwel et al. (2011)¹¹⁶ found, in the aforementioned analysis, that European researchers who went to the USA were more likely to perceive an improvement in their career productivity than European researchers who went to another European country and even more so than those returning to Europe from the USA, who actually perceive a decrease in their productivity. Furthermore, Sandstrom (2009)¹¹⁷ claims that the degree of mobility affects research performance differently. According to the author, "while it is clear that the most mobile and the least mobile researchers represent opposites also in citation performance we should acknowledge that for the large majority, with a low and medium mobility, there is no linear pattern of performance". MORE2 shows in section 0 (Part 2, p182) that those only mobile in the EU regard their mobility effects on productivity more favourably than their counterparts who are only mobile outside the EU, but less favourably than those mobile both in and outside the EU. It is also indicated in section 9.1.1 (Part 2, p177) that more than 60% of the R2, R3 and R4 mobile researchers currently working in the EU perceive that their citation impact of their publications improved thanks to their entire mobility experience (nearly 10% thinks that it strongly increased).

A large number of studies have found strong positive relationships between mobility and networking (Davenport 2004; Canibano et al. 2008; Jonkers and Tijssen 2008; De Filippo et al. 2009; Joens 2009; Melkers and Kiopa 2010; Patricio 2010; Furukawa, Shirakawa et al. 2011; Ivancheva and Gourova 2011). Specifically, mobility is said to improve visibility, contacts, the amount and diversity of co-authorships, access to new international/global knowledge networks and communities of practice, etc. MORE2 shows in section 9.1.1 (Part 2, p177) that more than 50% of the R2, R3 and R4 mobile researchers currently working in the EU think that their national contacts/network improved thanks to their entire mobility experience (nearly 10% thinks that it strongly increased), 20% perceive that it did not change and 25% thinks that it decreased. Furthermore, as discussed earlier, more than 50% perceive that their number of co-authored publications increased as a result of the entire mobility experience.

Melkers & Kiopa (2010)¹¹⁸ studied survey responses from 1,598 scientists working in Research I universities across six disciplines in the USA, and found that non-U.S. citizens with a permanent or temporary U.S. resident visa are more likely to have close international collaborative relationships than native-born U.S. citizens or naturalized U.S. citizens. They also found that U.S. academic faculty mobilize different collaborative resources from international partners, versus their domestic collaborators. MORE2 shows in section 0 (Part 2, p182) that those only mobile in the EU regard their mobility effects more favourably for networking than their counterparts who are only mobile outside the EU, but less favourably than those mobile both in and outside EU.

Mobility is also widely believed to be positively associated with better access to research funding (Canibano et al. 2008; Van Bouwel et al. (2011); Ivancheva and Gourova 2011). Cañibano et al. (2008)¹¹⁹ studied a random sample of CVs from researchers applying to the Spanish Ramon y Cajal program and found that "most internationally mobile researchers seem to have better access to international

¹¹⁶ Van Bouwel, L., E. Lykogianni, et al. (2011). Mobility of European researchers to the US: student mobility vs. researcher mobility. Science and Technology Indicators Conference 2011 on Actors and networks in European Science. 7-9 September. E. N. o. I. Designers. Rome.

¹¹⁷ Sandstrom, U. (2009). "Combining curriculum vitae and bibliometric analysis: mobility, gender and research performance." *Research Evaluation* 18(2): 135-142.

¹¹⁸ Melkers, J. and A. Kiopa (2010). "The Social Capital of Global Ties in Science: The Added Value of International Collaboration." *Review of Policy Research* 27(4): 389-414.

¹¹⁹ Cañibano C., F. Javier Otamendi and F. Solís (2011): International temporary mobility of researchers: cross-discipline study. *Scientometrics*, 89, 653-675.

funding sources and networks, which does not, however, imply that they are the most quantitatively productive as far as publications and patents are concerned". MORE2 contradicts this claim somewhat, as it shows in section 9.1.1 (Part 2, p177) that only 40% of the R2, R3 and R4 mobile researchers currently working in the EU think that their ability to obtain international research funding improved thanks to their entire mobility experience, while a similar share think that it actually decreased, and 20% think that it did not change. However, a larger proportion of respondents stated that it strongly increased, as compared to those who think that it strongly decreased (8% versus 4%).

3.7 Flows of mobility of researchers and attractiveness

Traditionally, English-speaking countries are very attractive to foreign researchers. This has been attributed to the level of international recruitment and diversity of the workforce. Ackers (2008)¹²⁰ states that as the "melting pot for different nationalities to get together - it draws from a global market - that's the wealth of the UK". Universities in the USA are particularly attractive because of their flexible and open career structure. The tough but transparent and fair career structure provided by the US tenure track system, which lays out a clear path for career advancement, is especially attractive for talented young researchers¹²¹. In European countries the rather rigid and lengthy career structure based on hierarchy and seniority are often seen as a less motivating factor. The internal structure of research systems (hierarchical organisation, recruitment policies and procedures, qualification requisites, formal and informal networks) is country specific, influencing researchers' career trajectories¹²².

All the factors mentioned above constitute a dynamic whole and any combination of them could affect a researcher's decision as to whether to leave and where to go. There will always be a combination of motives and perceptions to consider. MORE2 support this claim. As stated in section 10 (Part 2, p186), "to measure the attractiveness of the EU as research environment is a complex matter. Both surveys are only refer to the topic indirectly and are thus to be interpreted with care. Nevertheless, a number of interesting indications and insights can be derived from the interest or intention to return to or move to the EU, for example, or the experienced effects or reasons for moving to different regions etc. However, only being able to distinguish the EU from non-EU destinations does not allow for important nuances. The non-EU destinations in particular are a collection of highly distinct destinations in all kinds of ways. It would be necessary to isolate e.g. the USA as destination from other non-EU countries in order to provide more detailed insights."

Several studies (e.g. Mahroum 2000¹²³; Szelenyi et al 2007¹²⁴; Delicado 2010¹²⁵) have indicated that PhD training is by far the main exit route for researchers in

¹²⁰ Ackers, L. (2008). Internationalisation, mobility and metrics: A new form of indirect discrimination? *Minerva*, 46, 411-435.

¹²¹ Thorn, K., Holm-Nielsen, L.B., (2006). International Mobility of Researchers and Scientists: Policy Options for Turning a Drain into a Gain, UNU World Institute for Development Economics Research (UNU-WIDER), Research paper series 2006/83.

¹²² Enders, J. & E. de Weert (2004) Science, training and Career: Changing Modes of Knowledge Production and Labour Markets. *Higher Education Policy*, 17: 135-52.

¹²³ Mahroum, S. (2000). Highly skilled globetrotters: Mapping the international migration of human capital. *R&D Management*, 30(1), 23-31.

¹²⁴ Szelenyi, K. (2007) Students without borders? Migratory decision-making among international graduate students in the US. In; M.P. Smith & A. Favell (eds.) *The human face of global mobility*, New Brunswick: Transaction Publishers, 181-209.

¹²⁵ Delicado, A. (2010) Going abroad to do Science: Mobility trends and motivations of Portuguese researchers. *Science Studies*, Vol. 23. no.2, 36-59.

several European countries. MORE2 shows in section 6.2.1 (Part 2, p152) that, after completing their undergraduate studies (e.g., such as a bachelors or masters degree), researchers in Greece, Switzerland, Italy, Ireland and the Netherlands are more likely (20% or more) to move to another country to obtain a PhD. This share is lowest in a number of East European countries, Belgium, Portugal, Finland and France (8% or less). Around 18% of doctoral candidates and recent PhD holders move to another country during their PhD for a limited period (3 months or more). Comparison over countries shows that shares of >3 month mobility during a PhD ranges from just over 10% in Luxembourg to more than 55% in Italy. After Italy, only Denmark and Spain have a PhD mobility rate higher than 40%.

Several European countries have developed repatriation programmes aiming to motivate researchers and scientists to return to their home country, mainly through financial incentives and employment opportunities.^{126;127} Regarding motivational factors to return to one's home country, the assumption holds that after a period of being abroad, researchers will return when social and economic conditions at home are perceived to be sufficiently favourable.

At the ERA Conference 2012 it was pointed out that facilitating factors concern the opportunity and security to engage in large-scale ambitious research projects and to award large-scale multipurpose grants which provide the stability and freedom that scientists need to conduct quality research. This also facilitates the establishment of networks and research environments where scientists collaborate¹²⁸. This is quite different to many procedures, where researchers have to apply for several relatively small grants to cover different cost categories. Another facilitating factor is the portability of research grants when researchers go abroad and are allowed to use the grant of their home institution.

According to MORE2, and as shown in section 0 (Part 2, p127), of the mobile researchers who currently work in the EU, 11% returned at least once to their country of citizenship and 11% to their country of most recent highest education. The highest shares of this latter type of 'return' mobility are observed in Ireland (39% according to citizenship and 25% according to highest education) and Denmark (28% and 30%). Of the researchers who obtained their highest education in the Netherlands, 22% returns at least once in their post-doctoral career while only 11% of mobile Dutch citizens return. A similar proportion is observed in France, Estonia, Switzerland, Belgium and Norway.

23% of the (non-representative) sample of EU researchers who are currently mobile outside the EU were considering moving back to the EU in the coming 12 months. Of this 23%, around 4 in 5 had taken concrete steps for 'return' mobility.

As section 6.1.1 (Part 2, p149) shows, of the total number of EU researchers who were mobile to the US for more than three months during post-doctoral career stages and subsequently returned to the EU and currently work as researcher in the EU: 11% are Greek, 11% are Italian and 10% are German citizens. After the German and Irish, Spanish and Italian citizens often return to their country of origin.

¹²⁶ Thorn, K., Holm-Nielsen, L.B., (2006). International Mobility of Researchers and Scientists: Policy Options for Turning a Drain into a Gain, UNU World Institute for Development Economics Research (UNU-WIDER), Research paper series 2006/83.

¹²⁷ Ma, Wanhua (2011) Contributions of Foreign Experts to Chinese Academic Development: A case study of Peking University. Center for International Higher Education, Peking University.

¹²⁸ Thorn, K., Holm-Nielsen, L.B., (2006). International Mobility of Researchers and Scientists: Policy Options for Turning a Drain into a Gain, UNU World Institute for Development Economics Research (UNU-WIDER), Research paper series 2006/83.

4 POLICY IMPLICATIONS

The findings and conclusions from the MORE2 project show that there is an extensive set of in-depth information to support evidence-based policy. In the following section we outline the most important findings with respect to the potential policy implications of the key findings.

1. Move towards a common and widely set of definitions of 'mobility'

This study, which is a follow-up to the MORE1 study (<http://www.researchersmobility.eu/>), has led to an enormous wealth of (new) data and insights on mobility patterns and flows, motives and effects, working conditions and remuneration. It has been confirmed that mobility is not a homogenous concept but, rather, has many sides depending on the conventions and definitions used. It is the same lack of globally accepted conventions that makes comparison with MORE1, but also other studies on mobility, difficult, if not impossible. As a result, longitudinal monitoring of policy effects in this important area is difficult as well.

Looking to the future, it seems advisable that a common and widely set of definitions of 'mobility' are reached in order to increase comparability and to monitor evolutions and longitudinal effects of policy. A good place to introduce such a set of definitions can be sought among or linked with existing initiatives such as the Frascati manual (OECD), the UOE definition of student mobility (Eurostat, UIS-UNESCO and OECD), the EC DG EAC learning mobility concepts or the ESF paper on concepts of mobility¹²⁹.

2. Continuation of efforts to create awareness for gender issues

Concerning the composition of the overall researcher population in Europe but also abroad, we see that there are more male than female researchers. At the same time, there are more men than women particularly in the higher career stages of the researcher profession, and female researchers are also less satisfied with the opportunities offered for advancement than their male colleagues.

The efforts at national and EU level to create awareness about these issues, and stimulating and facilitating 'more women at the top' with equal wage conditions need to be continued in order to increase the number of female researchers in higher career stages and remove the barriers to their mobility.

3. Intensifying tailored policy towards early stage researchers

The characteristics of researchers in the various career stages (R1-R4) differ. Researchers find stable positions at the later career stages (R3 to R4). Post-doc researchers (R2) who form an important pool of future researchers, feel particularly less satisfied with their current opportunities for advancement and growth. At the same time, doctoral candidates are in a precarious contractual situation, as many of them work on a fixed-term contract or do not have a contract at all.

This all suggests that a more 'tailored' policy towards the specific groups of early stage researchers in order to increase job security and attractiveness of pursuing a research career further may have the greatest effect in future and might even be important in order to create the conditions for early stage research to grow.

¹²⁹ European Science Foundation (2013). New Concepts of Researcher Mobility – A comprehensive approach including combined/part-time positions. ESF Science Policy Briefing, 49, April 2013.

4. Encourage exposure to industry and transferable skills training

It is a commonly accepted fact that today's doctoral candidates are not only trained for academic careers but will increasingly build a career in non-academic research-intensive environments throughout society. An important success factor in finding a job outside academia is to be able to adapt to another environment, possess the right skills, and receive the right training for this setting. Essential skills such as people management, intellectual property rights and entrepreneurship remain less common forms of structured training. When looking at intersectoral mobility (>3 months) during the PhD, only 23% of researchers have had a non-academic research experience (in public, non-for-profit or private industry); a subgroup of only 4% have experience with private industry.

More attention should go to these types of skill development during the PhD process and continuous professional development. 'Transferable' skills and experience building outside academia are, for example, embedded in the existing 'Principles for Innovative Doctoral Training'. Further emphasis on the interface with the labour market will increasingly prepare researchers for a research career outside academia.

5. Observations on salary, funding and wage setting autonomy

The MORE1 study, where EU-US mobility was studied in more detail, already showed that Europe might have a salary disadvantage compared to the US, for example. In this study, this is confirmed again and more detailed evidence is gathered. On average, over all career stages, non-EU countries pay 9-14 pp higher salaries than European countries (PPP adjusted).

While wages are lower on average, at the same time wage setting flexibility/autonomy is also rather low in many EU27 countries (particularly in universities), due to the fact that wage levels are often set at national level. This double 'wage' disadvantage makes it thus difficult for Europe to compete for the best researchers on the international stage. On the other hand, caution is needed when generalising across Europe because there are important country differences. The analysis shows that innovation leader countries have more autonomy at the institute level and that salary increases are granted more for performance (versus seniority or other) than in other countries.

From the perspective of international competition for leading talent, Member States have a major role to play with respect to funding and wage setting autonomy.

6. Observations on the attractiveness of the EU research environment

There is general satisfaction with the academic aspects of the research profession in Europe. Moreover, 93% of non-EU researchers who have worked in Europe would recommend that other colleagues work in Europe; about 90% of non-EU researchers who have never worked in the EU are interested in coming to Europe. Non-EU researchers who have been mobile to the EU also experience very positive effects from their move(s). These observations show that the European research environment has left a positive impression on the researchers who have experienced it and that there is potential to attract researchers (back) to Europe.

7. Guidance, support and funding for return mobility and collaboration with researchers abroad

Most EU researchers currently working outside Europe still have strong ties with Europe (91%). 23.4% considered moving back to Europe and 18.4% have taken concrete steps. These are some of the problems they face in

moving back: they find it difficult to find a suitable research position, keep their salary and/or obtain funding and find a job for their spouse.

Advertising of positions, guidance, close support and mobilisation of funding are essential to facilitate the return mobility to Europe for those interested. Alleviating barriers for their return should be made a priority. Both European and national/regional levels play a role here. On the other hand, the collaboration between researchers who have been abroad for a long period with researchers in their home country or the rest of Europe can also be encouraged in order to maintain these ties and to increase this type of international collaboration for the benefit of innovation and quality in research.

8. Mobility paradox: positive effects versus decrease in job opportunities

The majority of the >3 months internationally mobile researchers feel that mobility has had positive effects on several aspects of their career as a researcher. The output effects (quality of output, citation impact, patents, number of co-authored publications) are indicated to have increased the most as a result of their mobility experience. Acquiring new skills and network building are also important effects.

On the other hand, there is still a significant minority for whom these aspects have decreased. One would expect that mobile researchers become more 'attractive', but paradoxically enough, job options in academia as well as progression in remuneration and reputation have tended to decrease for more researchers rather than having increased.

Is this a new 'mobility paradox' that perhaps relates to the fact that mobility is becoming more 'common' and 'easier', or as a result of the fact that non-mobile researchers 'stay around' and build up a career track together with the associated remuneration? One plausible explanation of the negative perception of the effects of mobility by this subgroup could be that they were 'forced' into mobility due to lack of positions or career opportunities. In this case, the researcher may benefit less from the international research environment and collaboration than others who 'choose' their destination for the benefit of their career.

This paradox triggers new research questions. Specifically, observations on issues such as recognition, career progression, access to attractive / stable positions – are very interesting angles for future research to shed light on the dynamics and causes thereof.

5 TOPICS FOR FUTURE RESEARCH

Even though the set-up of the MORE2 project was to tackle a broad set of topics related to researchers, their careers and working conditions and their moves to other countries, continents and sectors, a number of interesting topics are not – or only to a limited extent – touched upon. These are our recommendations for further research:

- The role of peers on recruitment and research careers
- The effects of promotion procedures on research careers
- The functioning of national labour markets for researchers, and their effects on career paths
- Network characteristics^{130;131}, including the percentage of times a researcher works in collaborative projects; the size of her network (i.e. number of partners); the diversity of her networks (i.e. percentage of partners from a sector different from her own); and her degree of cosmopolitanism (i.e. percentage of partners from a third country)
- Differences in career paths and working conditions by citizenship status (i.e. local versus foreign born researchers)
- Disciplinary mobility (i.e. percentage of those who changed discipline or field after mobility)
- The mobility paradox and the dynamics of potential 'forced' mobility

¹³⁰ Bozeman, B. and E. Corley (2004). "Scientists' collaboration strategies: implications for scientific and technical human capital." *Research Policy* 33(4): 599-616.

¹³¹ Bozeman, B., J. S. Dietz, et al. (2001). "Scientific and technical human capital: an alternative model for research evaluation." *International Journal of Technology Management* 22(7-8): 716-740.

LIST OF FIGURES

Figure 1: Conceptual framework for the synthesis of the MORE2 data	49
Figure 2: Overview of the work packages and their interrelation	50
Figure 3: Interrelation of the work packages with the conceptual framework ...	51
Figure 4: Researchers (FTE) as a share of active population ¹ in 2010 ² and growth rate of such share from 2005 to 2010 in EU27 Member States ³	67
Figure 5: Number of researchers (FTE) in EU27, China, US and Japan, 2000-2010 (in thousands)	68
Figure 6: Number of researchers (FTE) as a share of the active population in EU27, China, US and Japan, 2000-2010	68
Figure 7: Share of female researchers in 2000 and 2010 ¹ in EU27 Member States (HC)	69
Figure 8: Difference in type of contract for recent employment per current career stage (EU27).....	76
Figure 9: Type of contract per gender (EU27)	77
Figure 10: Teaching activities per current career stage (EU27)	80
Figure 11: Type of contract per current career stage (EU27)	82
Figure 12: Share of positions offering tenure track by career stage (% of all positions named ²⁵)	82
Figure 13: Employment relationship per current career stage (EU27)	83
Figure 14: Difference in employment relationship for recent employment per current career stage (EU27).....	84
Figure 15: Implementation of structured PhD training programs	85
Figure 16: Share of researchers receiving structured training during PhD per country of PhD	86
Figure 17: Modules of structured training during PhD (EU27)	87
Figure 18: Modules of structured training during PhD per country of PhD	88
Figure 19: Type of contract per country of current employment.....	90
Figure 20: Employment relationship per country of current employment.....	92
Figure 21: Type of position per country of current employment (EU27).....	92
Figure 22: Teaching activities per country of current employment.....	93
Figure 23: Degree of satisfaction with different aspects of the current academic position (EU27)	96
Figure 24: Remuneration of university researchers – selected indicators by country groups.....	102
Figure 25: Determinants of wages and pay increases (by region - % of positive answers)	103
Figure 26: Correlation of the variable job choice with the job characteristics, ESR compared with LSR	112

Figure 27: Mobility motives for intersectoral mobility and for long term international mobility (EU27)	117
Figure 28: Differences in gender for international >3 month mobility in post-PhD career stages per country	126
Figure 29: Number of scholars from EU27 Member States employed in US as a percentage of total researchers employed in the Member State in 2009.....	128
Figure 30: Number of EU27 HRSTO employed in selected foreign countries	129
Figure 31: Estimated stock of EU27 born researchers in the US in three different simulation scenarios.....	132
Figure 32: Estimated stock of EU27 born researchers working in 5 non-EU countries (US, AUS, NZL, CAN and MEX) in three different simulation scenarios in 2000 and 2011.....	133
Figure 33: Return mobility to country of citizenship or country of highest education	138
Figure 34: Links maintained with the home country	139
Figure 35: Comparison of <3 month and >3 month international mobility rates in post-PhD career stages per field of science (EU27).....	140
Figure 36: International >3 month mobility in post-PhD career stages per <3 month mobility profile (EU27)	145
Figure 37: International <3 month mobility in post-PhD career stages per >3 month mobility profile (EU27)	146
Figure 38: International PhD degree mobility of R1 and R2 researchers per country of PhD (destination)	149
Figure 39: International PhD degree mobility of R1 and R2 researchers per country of citizenship and previous highest education (departure) ..	152
Figure 40: International mobility for a limited period during PhD of R1-R2 researchers per country of PhD	153
Figure 41: Importance of motives for international PhD degree mobility (EU27)	156
Figure 42: Importance of motives for >3 month international mobility during PhD (EU27)	157
Figure 43: Importance of motives for the last >3 month EU move of the respondent in post-PhD career (EU27)	158
Figure 44: Motives for mobility of non-EU researchers	159
Figure 45: Motives of EU researchers for moving abroad.....	160
Figure 46: Distribution of individual post-PhD career mobility steps over motives mentioned as main motive for this specific step (EU27).....	161
Figure 47: Motives of EU researchers for moving abroad by citizenship	164
Figure 48: Motives for EU mobility of non-EU researchers by citizenship.....	164
Figure 49: Motives for mobile non-EU researchers who have never been to the EU for mobility towards non-EU countries by citizenship	165
Figure 50: Importance of barriers to non-PhD-mobility (PhD degree and during PhD) (EU27)	167

Figure 51: Importance of barriers to last move in post-PhD career mobility (EU27)	168
Figure 52: Importance of barriers as reasons for international non-mobility in post-PhD career (EU27)	169
Figure 53: Difficulties faced by non-EU researchers when moving to the EU	170
Figure 54: Effects of the entire mobility experience on the researcher’s career (EU27)	178
Figure 55: Effects of EU mobility experience for non-EU researchers.....	179
Figure 56: Effects of the entire mobility experience on the researcher’s career when at least one change in employer (EU27).....	180
Figure 57: Effects of the entire mobility experience on the researcher’s career per destination region	183
Figure 58: Return potential prospects of EU researchers abroad.....	187
Figure 59: Comparing effects of mobility of non-EU researchers towards EU versus non-EU countries.....	191
Figure 60: Comparing factors important for EU researchers to move abroad with their previous EU experience change title	192

LIST OF TABLES

Table 1:	Scope, topics and information collection method per work package...	52
Table 2:	Data, analysis method and results per work package	55
Table 3:	Overview definitions of mobility.....	62
Table 4:	Overlap between countries of reference in the MORE2 HEI sample (EU27+6)	62
Table 5:	Number of researchers in EU27 Member States by sector of activity as a share of total researchers employed, 2010 (FTE)	70
Table 6:	The estimated population of the survey: researchers working in EU higher education institutions (2009)	72
Table 7:	Age range of first permanent position by career stage with stable working conditions.....	79
Table 8:	Career stage with own research agenda by career stage with stable working conditions.....	79
Table 9:	Satisfaction with recruitment process at home research institution (EU27)	95
Table 10:	Degree of satisfaction with different aspects of the current academic position per current career stage (EU27)	97
Table 11:	Fields of negotiation with exceptional candidates (by region and research capacity - % positive answers).....	105
Table 12:	Gross annual salaries and PhD stipends of university researchers as percentage of the best paying country within career stages. A country comparison	110
Table 13:	Comparison of different international mobility types and definitions per country.....	123
Table 14:	European-born US research doctorate recipients and those with definite commitments for research position in the US by EU27 country of birth ¹	128
Table 15:	EU27 Member States born US research doctorate recipients with definite commitments for research position in US after graduation, by country of birth ¹ , 1962-2011	131
Table 16:	Non-EU researchers in the EU27 by field of science.....	135
Table 17:	Non-EU researchers in the EU27 by career stage	135
Table 18:	Share of non-EU doctorate candidates by country (%)	136
Table 19:	Share of non-EU doctorate holders by country (%)	137
Table 20:	Intersectoral mobility per country and destination sector.....	143
Table 21:	Main destination countries for >3 month post-PhD mobility (EU27 citizens)	150
Table 22:	Difference in barriers to mobility by country of citizenship	173
Table 23:	Barriers of mobility towards non-EU countries by mobile non-EU researchers who have never been to the EU by citizenship	174

Table 24: Perceived barriers to EU mobility by mobile non-EU researchers who have never been to the EU by citizenship.....	174
Table 25: Perceived barriers of non-EU researchers to EU mobility by citizenship	175
Table 26: Mobility effects of non-EU mobility by country of citizenship.....	184
Table 27: Effects of mobility towards non-EU countries by mobile non-EU researchers who have never been to the EU by citizenship	185
Table 28: Comparison appreciation of the non-EU and EU research systems ..	189
Table 29: Motives for EU mobility of non-EU researchers by citizenship	191